This course supports the assessment for Elementary Science Methods. The course covers 10 competencies and represents 3 competency units.

Introduction

Overview
In this course, you will learn to utilize concepts, tools, and structures of science education in the design of engaging learning experiences for elementary students. Part of this process includes creating integrative and challenging lesson plans, which provide opportunities for students to initiate investigations around problems or issues that interest them. You will learn how to design lesson plans and learning tasks that are appropriate for students of varying needs, characteristics, and abilities, with instructional strategies aligned to state and national standards.

Getting Started
Welcome to Elementary Science Methods! This course is designed to teach you the appropriate pedagogy for science educators. You will demonstrate your competency of this subject by completing a performance assessment. When you have completed these materials, you will gain the knowledge and skills to guide your students toward a better understanding of science.

Watch the following welcome video for an introduction to this course:

Note: To download this video, right-click the following link and choose "Save as...": download video.

Teaching Dispositions Statement
Please review the Statement of Teaching Dispositions.

Course Instructor Assistance

Book a call: mathsciencemethods.youcanbook.me

Email: mathsciencemethods@wgu.edu

Call: Extensions are listed in "Contact a Course Instructor" on the top right sidebar of this course.

Preparing for Success

The information in this section is provided to detail the resources available for you to use as you complete this course.

VitalSource E-Texts
The following textbook is available to you as an e-text within this course. You will be directly linked to the specific readings required within the activities that follow.

- Peters, J. M., & Stout, D. L. (2011). *Science in elementary education: Methods, concepts, and inquiries* (11th ed.). Boston, MA: Allyn & Bacon. ISBN: 9780135031506.

Teachscape
Teachscape video links are found throughout this course. They provide an opportunity to watch science in real elementary classrooms. No enrollment is necessary for this resource.

Setting Up Your Learning Journal
Throughout this course, you will be presented with questions and prompts that will help you engage deeply in the content. Please set up a journal system to record notes and reflections.

Competencies and Objectives

- **Competency 671.1.1: Processes of Science**
  The graduate integrates appropriate science concepts, skills, and processes in the development of science education for elementary students.

Objectives

- Identify the science content, processes, and skills that should be taught in the elementary classroom.
- Describe how elementary science utilizes scientific process skills to develop students' knowledge of scientific ideas.
- Explain science as practice in terms of elementary science education.
- Describe the interrelationship between inquiry skills and the science process.
- Explain the 5E learning model and its implication on the elementary science classroom.
- Recommend strategies students can use to formulate and test hypotheses.
- Design an instructional segment that integrates multiple science process skills.
- Explain the difference between various observation methods utilized in elementary science education.
- Identify appropriate activities to facilitate the process of observation of natural phenomena for elementary students.
- Select activities that support students' ability to employ the instruments, systems of measurement, and materials of science appropriately.
- Recommend strategies for helping students discover similarities and differences between objects or events.
- Recommend a strategy that supports the development of students' ability to formulate reasonable explanations about an observation.
- Recommend ways students can record the results of observations or investigations for a given learning activity or event.
- Recommend strategies to facilitate student predictions of the outcome to an event based on observation and prior knowledge.
- Design a science learning activity that encourages students to classify ideas or objects into groups based on various properties.
- Design a science learning activity that teaches students to measure quantities such as distance, volume, mass or time, using instruments.

- **Competency 671.1.2: Inquiry**
  The graduate integrates effective instructional approaches to support science inquiry in the development of science education for elementary students.

Objectives

- Explain why curiosity, honesty, openness, and skepticism are valued in science.
- Describe appropriate uses of expository methods of science instruction.
- Describe the relationship of inquiry to science education.
- Analyze the correlation between constructivism and science inquiry.
- Recommend strategies for incorporating free discovery methods for a given science theme.
- Evaluate how a given activity facilitates students' ability to modify or affirm scientific ideas according to accumulated evidence.
- Design a science learning activity based on the concepts that real problems have more than one solution and decisions to accept one solution over another are made on the basis of many issues.

- **Competency 671.1.3: Science Learning Environment**
  The graduate integrates developmentally appropriate strategies and approaches that support science literacy into the planning of science learning environments.

Objectives

- Recognize teacher attitudes and dispositions that support a science-rich learning environment for a given age of elementary students.
- Describe characteristics of meaningful, relevant, engaging science instruction.
- Explain the qualities of an age-appropriate science classroom environment or setting that is safe, flexible, and supportive of science inquiry.
- Select equipment and materials needed to equip a basic science-rich environment for a given age of elementary students.
- Select strategies for creating a classroom science environment that is responsive to students' interests, needs, and characteristics.
- Determine the benefits, necessary precautions, and procedures for including plants and animals in an elementary classroom.
- Recognize the importance of teacher modeling and student demonstration of effective laboratory safety procedures.
- Recognize guidelines for proper handling and disposal of substances and organisms typically used in an elementary science class.
- Identify various published guidelines for the proper use of animals, equipment, and chemicals in the classroom.
- Select appropriate precautions for specific laboratory and field activities.
- Identify possible ways students can interact with nature in given situations.
- Analyze a given situation for adherence to recognized safety guidelines.
- Determine a plan for connecting students with nature within the context of an elementary science program.

- **Competency 671.1.4: Instructional Strategies in Elementary Science Education**
  The graduate plans science instruction that supports the development of scientific knowledge, inquiry, and reasoning in elementary students.

Objectives

- Identify common misconceptions in science.
- Recognize the importance of making connections to prior learning and to other disciplines in the design, revision, and implementation of elementary science instruction.
- Select equipment and resources that provide rich support for scientific learning for a given topic.
- Provide a script for modeling academic language for a specified science instructional segment.
- Select science instructional activities based on students' prior knowledge and experience, interests, and skills.
- Select instructional strategies for teaching a particular science concept or skill.
- Determine suitability of the specified science curricula and teaching materials for a given group of students.
- Recommend strategies for implementing collaborative learning, project-based learning, and discovery-based learning in support of science curriculum.
- Recommend strategies for helping students use relationships studied in the classroom to explain phenomena observed outside the classroom.
- Recommend strategies to help students develop and test hypotheses or generalizations.
- Evaluate a lesson's effectiveness in engaging students in the broad vision of science.
- Design a learning activity to promote in-depth conceptual understanding of basic natural phenomena.
- Design a learning activity that supports discourse among students about scientific ideas.
- Design a laboratory-based lesson that makes use of specified materials or tools of inquiry for learning science.

- **Competency 671.1.5: Science for Students with Diverse Learning Needs**
  The graduate plans instruction in science education that provides equitable opportunities for all children.

Objectives

- Recognize how cultural factors play a role in students' science learning and participation.
- Apply principles of differentiated instruction to a science instructional activity to meet the needs of students with a variety of learning needs.
- Recommend strategies to align science instruction with students' personal knowledge, backgrounds, and interests.
- Recommend strategies for responding to student diversity that encourage all students to participate fully in science learning.
- Recommend culturally responsive strategies for engaging reluctant students in science learning.

- Recommend strategies for engaging and motivating gifted and talented learners in science learning.
- Recommend strategies for providing effective language models, communication strategies, and resources to facilitate understanding of science subject matter for individuals with exceptional learning needs who are English language learners.
- Plan a lesson that integrates multiple strategies for engaging exceptional learners in science education.

- **Competency 671.1.6: Assessment in Elementary Science Education**
  The graduate evaluates assessment information to inform instructional decision making and support science education for all students.

Objectives

- Recognize formal and informal strategies for assessing students' science learning.
- Explain how to use assessment to assure that students are learning specified content in the science curriculum.
- Match appropriate formative and summative assessment strategies to given science learning objectives.
- Use assessment data to design and refine science instructional plans.
- Select a developmentally appropriate method of assessing students' knowledge of science concepts for a situation.
- Analyze a provided assessment for alignment to science learning objectives.
- Recommend assessment strategies that include student participation and self-assessment in science learning.
- Recommend a plan for differentiating science learning based on given assessment data.
- Evaluate the suitability of multiple strategies, including listening to and understanding the ways students think about science, to assess students' knowledge in a given situation.

- **Competency 671.1.7: Science and Technology**
  The graduate selects appropriate technology tools that support science instruction and learning for elementary students.

Objectives

- Recognize how the internet can be used as a resource for collecting data for a given instructional science segment.
- Identify appropriate uses of digital technology to communicate ideas about science.
- Compare the benefits and applications of hands-on versus virtual science investigations.
- Propose a set of guidelines to assure digital safety in science learning.
- Select instructional strategies to support research and media skills within the science curriculum.
- Recommend strategies to facilitate students' use of digital technology to think, ask

questions, and communicate about science.
- Recommend criteria for reviewing science applications for use in the classroom.
- Develop a lesson that uses technology to build understanding of science concepts.
- Adapt a given science learning experience to incorporate digital tools and resources.

- **Competency 671.1.8: Science Standards, Goals, and Outcomes**
  The graduate evaluates the alignment of science standards, learning outcomes, benchmarks, and objectives in the development of science education for elementary students.

Objectives

- Recognize key components of national science standards.
- Identify sources of state and federal standards and benchmarks for science curriculum.
- Apply National Science in Education Standards (NSES) to a specific learning outcome.
- Evaluate a lesson plan for alignment to professional, state, and institutional standards relating to science education.

- **Competency 671.1.9: Integrating Curriculum**
  The graduate creates interdisciplinary learning experiences that effectively incorporate the concepts and modes of scientific inquiry.

Objectives

- Recognize strategies for integrating science across the curriculum.
- Recognize ways in which science and mathematics are interrelated.
- Identify useful strategies that promote science learning through reading, writing, discourse, and research.
- Select strategies that promote thinking skills in relation to science content.
- Analyze the effectiveness of activities designed to model and support the use of academic language within given science content instruction.
- Develop an instructional plan that incorporates concepts from the arts, language, culture, geography, history, sociology, and/or anthropology into science curriculum.

- **Competency 671.1.10: Science and Community**
  The graduate uses a variety of strategies to extend science learning and exploration beyond the classroom.

Objectives

- Recognize the importance of relating science to everyday life for students.
- Recognize strategies to extend science learning beyond the classroom.
- Recommend strategies for recognizing science in everyday life.

- Evaluate a science learning activity for relevance to student issues and concerns.

Processes of Science

As you teach science, you will integrate science concepts, skills, and processes in science education for elementary-age students.

Understanding Science as a Practice

The goal of science programs are to teach students scientific concepts, processes, and practices to best foster development of the scientific literacy necessary for interacting in complex societies. This topic introduces the reason and need for science education, and covers key inquiry concepts such as asking questions, developing and using models, planning and carrying out investigations, and analyzing and interpreting data.

Watch: Inquiry and the 5E Model (5:47)

Note: To download this video, right-click the following link and choose "Save as...": download video.

Read: Scientific Inquiry in Chapter 1

Read the following pages in *Science in Elementary Education: Methods, Concepts, and Inquiries*:

- Pages 2–19 of Chapter 1 "Inquiring Minds in the Classroom"

In your journal, describe what science content and skills should be taught in the elementary classroom and how should that information be taught? Why is it recommended to no longer emphasize a "one-size-fits-all" specific operation procedure for conducting scientific investigations?

Watch: Discovering Science (3:58)

Note: To download this video, right-click the following link and choose "Save as...": download video.

Watch: Recognizing and Helping Students Develop Investigable Questions

View the following Teachscape videos, which can be found under the "Teaching Examples" section of Science as Inquiry: Investigating Erosion.

- Asking Their Own Questions
- Creating Explanations from Evidence

Give three examples of investigable questions. What strategies will you employ to help students develop investigable questions? How might you help students formulate and test hypotheses?

Read: Four Strands of Science

As you read the material listed below, in your journal, describe how each of the four strands of science encourages inquiry within the scientific process.

Read the following pages in *Science in Elementary Education: Methods, Concepts, and Inquiries*:

- Pages 91–100 (starting at "The Goals of Science as Practice") of Chapter 5 ("Inquiry and Science as Practice")

Watch: Conducting an Investigation

View the following Teachscape video, which can be found under the "Teaching Examples" section of Science as Inquiry: Investigating Erosion.

- Conducting an Investigation

Review the following case in Teachscape:

- Investigating the Properties of Minerals: The 5E's

In your journal, define "scientific inquiry," discuss its benefits, and indicate how the 5E Model supports the development of scientific process skills.

Integrating Science as a Practice

Engaging in scientific inquiry should be interdisciplinary, with learning tasks that help students make connections across the curriculum. Learning tasks can include activities, discussions, or other modes of participation that engage students to develop, practice, and apply skills and knowledge related to a specific learning goal. Learning tasks may be scaffolded to connect prior knowledge to new knowledge and often include formative assessment.

Inquiry-based learning tasks enable students to develop skills for thinking critically and independently, making observations, weighing alternatives, and drawing conclusions for problems that involve evidence, numbers, patterns, logical arguments, and uncertainties. This topic introduces the need for scientific processes that are integrated with other academic content to create a holistic approach to scientific practices. This inquiry-based, interdisciplinary approach will help the cognitive development of your students as they shift from concrete operational thinking to more abstract thinking.

Watch: Practicing Process Skills (5:21)

Note: To download this video, right-click the following link and choose "Save as...": download video.

Identify: Science Process Skills

In your journal, identify and define the science process skills of observing, classifying,

measuring, communicating, inferring, predicting, and experimenting, which are listed on the following pages of *Science in Elementary Education: Methods, Concepts, and Inquiries*:

- Pages 93–110 of Chapter 5 ("Inquiry and Science as Practice")

Complete the following table:

- Scientific Skills

Identify: Observational Recording Systems

In your learning journal, identify and record which observational methods would be most appropriate for making observations about the following topics:

1. rocks
2. local plants
3. weather

Watch: Using Journals in the Science Classroom

View the following Teachscape video, which can be found under the "Teaching Examples" section of Science as Inquiry: Investigating Erosion.

- Use of Journals in the Science Classroom

Science journals are one tool that can be used to record the results of observations or investigations. What other tools can students use to record the results of their investigations?

Watch: Scientific Investigation (7:38)

Note: To download this video, right-click the following link and choose "Save as...": download video.

Explain: Student Predictions

As you read the material listed below, complete the following:

- In your journal, explain how the lesson "Sink or Float?" facilitates student predictions of outcomes based upon prior knowledge, prior academic learning, and observation.

Watch: Teaching Accuracy and Error

Note: To download this video, right-click the following link and choose "Save as...": download video.

What strategies will you use to teach students about systems of measurement, accuracy and error in data collection?

Systems of Measurement (9:16)

What strategies will you use to teach students about systems of measurement, accuracy, and error in data collection?

Note: To download this video, right-click the following link and choose "Save as...": download video.

Inquiry

A variety of effective instructional approaches can be used to teach scientific inquiry in elementary classrooms.

Science Inquiry

Scientific inquiry helps students learn the scientific foundation for discovering and evaluating information. As students engage in inquiry, they develop meaningful questions and become informed on issues that affect the world they live in. Scientific inquiry guides students toward answering the age-old question, "Why?" This topic provides ideas and information for the exploration of instructional approaches that support scientific inquiry.

Watch: The Inquiry Method: An Introduction for New Teachers (11:38)

Note: To download this video, right-click the following link and choose "Save as...": download video.

Explain: Importance of Scientific Thinking

If you have not already done so, please review the following chapter in *Science in Elementary Education: Methods, Concepts, and Inquiries*:

- Chapter 1 ("Inquiring Minds in the Classroom")

As you review the chapter listed above, in your journal, provide an example that demonstrates each of the following terms, and explain why each concept is important in the science classroom:

- curiosity
- honesty
- openness
- skepticism

Watch: Discovering Science (3:58)

Note: To download this video, right-click the following link and choose "Save as...": download video.

Identify: Teaching Methods

Approaches for teaching science range from expository (teacher-directed instruction in which teachers impart knowledge— to discovery (student-centered instruction that allows students to explore science on their own).

Read page 55 "Direct Instruction Teaching Tip" in Chapter 3 ("Planning for Inquiry"). In your learning journal, identify the differences between expository and discovery teaching methods and when each are appropriate.

Watch: Guiding Students in Inquiry (3:54)

Note: To download this video, right-click the following link and choose "Save as...": download video.

Analyze: Constructive Inquiry

As you complete the material listed below, using the "Willie the Hamster" vignette on page 27 as an example, analyze the relationship between constructivism and science inquiry in your journal.

Read: Discovering Science Through Inquiry

Read the following pages in Science in Elementary Education: Methods, Concepts, and Inquiries:

- Pages 24–34 (starting at "Inquiry and Children") of Chapter 2 ("Discovering Science though Inquiry")

In your learning journal, summarize the Constructivist learning theory and identify how it supports learning in the science classroom.

Watch: Social Learning

View the following Teachscape video, which can be found under the "Teaching Examples" section of Science as Inquiry: Investigating Erosion.

- Working in Teams

What are the desired results of this lesson? How can social learning help achieve the desired results? Record your findings in your journal.

Watch: Engaging the Students in Inquiry

View the following Teachscape video, which can be found under the "Teaching Examples" section of Investigating Properties of Minerals: The 5 E's.

- Engaging the Students in Inquiry

What engagement strategies does the teacher in these videos use to engage students in scientific discussion? Record the engagement strategies you identify in your journal.

Read: "Focus on Inquiry"

Read the following pages in *Science in Elementary Education: Methods, Concepts, and Inquiries*:

- Pages 42–49 (starting at "Focus on Inquiry") of Chapter 3 ("Planning for Inquiry")

Describe three discovery methods for learning about weather that you could incorporate into a learning task or lesson. How do the 5Es pertain to good planning and preparing for inquiry lessons?

Watch: Creating Explanations from Evidence

View the following Teachscape video, which can be found under the "Teaching Examples" section of Science as Inquiry: Investigating Erosion.

- Creating Explanations from Evidence

What methods did the teacher employ to promote inquiry among the students? How does this activity facilitate students' ability to modify or affirm scientific ideas based on observed evidence? In your journal, record how you would extend this lesson to further extend scientific thinking among students?

Watch: Scientific Investigation (7:38)

Note: To download this video, right-click the following link and choose "Save as...": download video.

Science Learning Environment

When developing science instruction for elementary students, teachers should consider students' ages, interests, needs, and characteristics for adopting specific instructional strategies and for creating science-rich environments. It is important to develop a positive and supportive learning environment where students feel comfortable taking risks and sharing ideas. This type of learning environment encourages students to develop a good rapport with one another and with the teacher, for effective and productive accomplishment of learning tasks.

Safety

In order for students to be safe in science classrooms, teachers must develop rules for safety, teach the rules, and make sure that all students in their classrooms comply with safety procedures. Safety rules and procedures can be as simple as washing hands after handling animals to following specific procedures when working with chemicals. Teachers must make safety an integral part of every science inquiry lesson. This topic will help you to see the many different types of safety a teacher needs to be aware of when teaching science.

Watch: Safety in the Science Classroom (11:31)

- Safety in the Science Classroom

Search: Science Equipment

As you review the websites listed below, create a list of equipment and materials that you would need for conducting classroom inquiry lessons. What do you think constitutes basic equipment for a science-rich environment? Review the following websites:

- Home Science Tools
- Basic Laboratory Equipment Guide

Identify: Safety Equipment and Procedures

As you read the material listed below, create a list of basic equipment and procedures that you should have in your classroom to ensure student safety.

Review the following section in the following document:

- What protective equipment should be provided in elementary science environments for teacher and student use? (p. 9) of "Science and Safety: It's Elementary!"

Watch: Safety in the Science Classroom (12:28)

Note: To download this video, right-click the following link and choose "Save as...": download video.

Read: Safety Rules

As you read the material listed below, in your journal, list safety rules that will be applicable for the grade level you plan to teach.

Read the following document:

- "Safety in the Science Classroom"

Read: Safe Handling of Microorganisms

As you read the document listed below, identify three learning tasks you could incorporate into science instruction to promote classroom safety. Describe how you would model safe procedures.

Read the following document:

- "Tips for the Safer Handling of Microorganisms in the School Science Laboratory"

Internet Search: Safety in the Science Classroom

As you explore the web page listed below, select links for resources that will help you learn about each of the following topics. Then, create a document that summarizes safety procedures for each of these areas:

- safe handling of plants and animals
- proper handling of substances
- safety procedures for classroom laboratories
- key points of eye safety

Visit the following National Science Teachers Association's web page:

- Safety in the Science Classroom, Laboratory, or Field Sites

Connecting Students with Nature

Through inquiry, students can learn about the natural world. When students have opportunities to interact with nature, they make observations, collect data, examine evidence, and draw conclusions about the natural world. As part of the scientific process, they can also be taught to communicate their scientific thinking with others. This topic will provide ideas and examples for how to connect students with nature.

Design an Activity in Nature

As you read the material listed below, create a science learning task (lesson) that promotes student interaction with the natural world. Include learning objectives for your learning tasks. Save your lesson in your journal.

Read the following articles:

- "Providing Nature and Science Experiences for Young Children"
- "Activities Based on the National Science Education Standards"

Watch: Science in Daily Life (2:27)

Note: To download this video, right-click the following link and choose "Save as...": download video.

Read: Safety Issues

As you read the material listed below, consider the following question:

- If you were to take your students to a nature preserve, what procedures would you implement to ensure student safety?

Review the following section in the following document:

What safety issues do I need to consider when planning and conducting field trips and field experiences? (p. 13) of Science and Safety: It's Elementary!

Evaluate: Nature of Science

As you complete the material listed below, in your journal, identify aspects of the lesson that

make the lesson meaningful, relevant, and engaging for students.

Review the following section from *Science in Elementary Education: Methods, Concepts, and Inquiries*:

- "Teaching Tip: The Nature of Science Activity" (p. 14) of Chapter 1 ("Inquiring Minds in the Classroom")

Read: Extending Beyond the Traditional Classroom

As you read the following pages of *Science in Elementary Education: Methods, Concepts and Inquiries*, consider how you might extend learning beyond the traditional classroom. Record your ideas in your learning journal.

- Pages 144–146, (starting at "Ms. Blackwelder's Class Trip") in Chapter 7 ("Inquiry Learning Opportunities")

Instructional Strategies in Elementary Science Education

As a science teacher, it is important that your instruction supports the development of students' scientific knowledge, inquiry, and reasoning skills. You will learn how to develop engaging learning tasks that help them to build on their preconceptions and prior academic knowledge so that students gain a deeper understanding of the learning objectives you are targeting in each lesson segment.

Instructional Strategies in Science

Effective science instruction includes hands-on experimentation and integration of content-area topics into science curriculum. There are many different strategies that can be used to develop students' curiosity in science, and this topic will help you explore ideas for providing effective, engaging, and interdisciplinary science instruction.

Plan Instruction: Misconceptions Part 1

The National Science Teachers Association has identified common misconceptions in science. See the list below:

- Common Misconceptions in Science

Using your textbook and Internet resources, complete the following table to plan instructional activities that address common misconceptions:

- Misconceptions in Science—Part 1

Watch: Integrating Content Strategies for Cross-Curricular Science (4:48)

Note: To download this video, right-click the following link and choose "Save as...": download video.

Watch: Promoting Scientific Discussion

View the following Teachscape video, which can be found under the "Teaching Examples" section of Science as Inquiry: Investigating Erosion.

- Using the Language of Science

What disposition and attitude did the teacher display during this lesson? What observations did you make about the learning environment in this classroom? How would you describe the rapport between the teacher and students? How did these factors influence student engagement and learning? Record your findings in your journal.

Read: Connecting Literacy and Science

As you read the article listed below, explain in your journal why integrating literacy instruction into science lessons supports learning. Create a list of specific strategies that integrate literacy instruction in science lessons. What planned supports can you provide for students who struggle with reading and writing tasks?

Read the following article:

- "Connecting Literacy and Science to Increase Achievement for English Language Learners"

Create: Scientific Resources

As you review the activities in the material listed below, list the following for each activity:

- science standard or benchmark
- material and equipment needed for the lesson
- Internet resources that provide supplemental material or resources
- instructional strategies for diverse learners

Review the following pages in *Science in Elementary Education: Methods, Concepts, and Inquiries*:

- Pages 181–191 (starting at "Light Energy and Color Benchmarks") of Inquiry Unit 1 ("Physical Science")

Apply: Activating Prior Knowledge

Select one of the learning activities from the Inquiry Unit listed below. For the activity you select, identify three ways that you can activate students' prior knowledge and prior academic learning to learn the new concept. Think about the personal assets (interests, knowledge, family background) that you can draw upon to support learning.

- Inquiry Unit 3 ("Earth and Space Science")

Designing Science Instruction

This topic explores lesson design and effective strategies for engaging student interest and motivation for learning science. As you read through the steps in designing instruction, remember that if you capture the students' interests and present a well-planned engaging lesson with visuals, you will pique their curiosity, and they will want to learn more about the complex world of science.

Watch: Inquiry and the 5E Model (5:47)

Note: To download this video, right-click the following link and choose "Save as...": download video.

Explain: Inquiry Teaching

As you complete the reading listed below, consider the limitations of lecturing and explain approaches to inquiry lessons that provide enduring understanding. Record your thoughts in your learning journal.

- Pages 42–56 (starting at "Focus on Inquiry") of Chapter 3 ("Planning for Inquiry")

Watch: Guiding Students in Inquiry (3:54)

Note: To download this video, right-click the following link and choose "Save as...": download video.

List: Information Transfer

As you read the material listed below, list two strategies that can be used in the classroom to connect classroom learning to phenomena outside the classroom. Think about how you can help students make interdisciplinary connections as they explore concepts addressed in other curriculum areas. Explain how these strategies will help students make the connection from the classroom to the real world.

Read the following pages in *Science in Elementary Education: Methods, Concepts, and Inquiries:*

- Pages 89–98 (starting at "Focus on Inquiry") of Chapter 5 ("Inquiry and Science as Practice")

Identify: Testing a Hypothesis

As you read the material listed below, reflect on the following:

- What scientific skills do students need to know as they learn about science as a practice? Define each skill in your journal.
- Can you identify two to three strategies that a student can use to develop and test hypotheses or generalizations, and that employ the scientific skills you listed above?

Read the following pages in *Science in Elementary Education: Methods, Concepts, and Inquiries:*

- Pages 99–113 of Chapter 5 ("Inquiry and Science as Practice")

Design: Conceptual Understanding and Discourse

As you read the material listed below, reflect on the following:

- How might you design a learning task to promote in-depth conceptual understanding of a natural phenomenon?
- What can you do to ensure that the learning task supports discourse among students about scientific ideas?
- What national or state science standards could you use to create a grade-level-appropriate learning task or lesson?
- How can you ensure that your learning task engages students in scientific practices through inquiry and that it is closely aligned to stated learning objectives?
- How would you describe the language functions that will be addressed in the learning task? Common language functions in science include: analyzing scientific data, interpreting diagrams or graphs, predicting from scientific inquiries, and justifying conclusions with scientific evidence.

Review the following chapter in *Science in Elementary Education: Methods, Concepts, and Inquiries*:

- Chapter 5 ("Inquiry and Science as Practice")

Watch: Tools for Science (2:47)

Note: To download this video, right-click the following link and choose "Save as...": download video.

Devise: Tools of inquiry

As you read the material listed below, reflect on the following:

- How might you design a laboratory-based learning task that makes use of specified materials or tools of inquiry for learning science?
- Can you define the central focus of the learning task? What important understandings and core concepts do you want students to develop?
- How will you ensure that your learning task is aligned to national or state science standards?
- How can you ensure the task or lesson segment will engage students in scientific practices though inquiry?

Science for Students with Diverse Learning Needs

As you plan classroom instruction, you should consider the instructional needs of all students in your classroom, including students with disabilities and students with diverse backgrounds.

Providing Equitable Opportunities in Science

Students come to the elementary classroom with distinctive backgrounds and diverse life

experiences that are assets to their own learning and to the overall learning environment in your classroom. Teachers are responsible for creating inclusive, accessible learning environments that support learning for all students. There are four types of assets:

- **Personal Assets:** Specific background information that students bring to the learning environment. Students bring interests, knowledge, everyday experiences, and family backgrounds that a teach can draw upon to support learning.
- **Cultural Assets:** Cultural backgrounds and practices that students bring to the learning environment, such as traditions, languages, world views, literature, and art that a teacher can draw upon to support learning.
- **Community Assets:** Common backgrounds and experiences that students bring from the community where they live, such as resources, local landmarks, community events and practices that a teacher can draw upon to support learning.
- **Developmental Assets:** Refers to specific background information about cognitive, physical, and social and emotional development that a teacher can draw upon to support student learning.

This topic will help you understand how to create an inclusive and responsive classrooms that draws upon your students' assets to engage them in learning.
Watch: Engaging All Learners (9:13)

Note: To download this video, right-click the following link and choose "Save as...": download video.
Summarize: Cultural Assets

As you read the material listed below, in your journal, summarize the instructional implications for addressing diversity and incorporating the cultural assets of your students to create a positive and productive learning environment in the classroom. Identify strategies for supporting student learning and engagement.

Read the following pages from *Science in Elementary Education: Methods, Concepts, and Inquiries*:

- Pages 116–120 (starting at "Focus on Inquiry") of Chapter 6 "Inquiry Experiences for All Children"

Identify: Instructional Modifications

As you read the material listed below, complete the following:

- List modifications you would make in the lesson plan for:
  - students from a diverse culture
  - English language learners
  - females
  - students with disabilities
  - gifted students

Review the following pages in *Science in Elementary Education: Methods, Concepts, and Inquiries*:

- Pages 121–129 (starting at "Science Talk") of Chapter 6 ("Inquiry Experiences for All Children")
- Pages 50–52 (starting at "Lesson Plan: Exploring a Mixture") of Chapter 3 ("Planning for Inquiry")

Assessment in Elementary Science Education

When used effectively, assessments can provide good information for gauging student learning and for making instructional decisions. Assessment is integral to effective instructional programs.

Assessment in Science Education

Assessments are part of effective instructional programs. When assessments align with instructional goals, they provide a means of tracking student progress toward goals, and they are essential tools for making instructional decisions. This topic will help you explore practices regarding science assessments.

Watch: Assessing Learning in Science (6:10)

Note: To download this video, right-click the following link and choose "Save as...": download video.

Define: Formal and Informal Assessment

As you review the material listed below, define informal assessment and formal assessment, and provide examples of each type of assessment in your learning journal.

Review the following pages in *Science in Elementary Education: Methods, Concepts, and Inquiries*:

- Pages 59–66 (starting at "Focus on Inquiry") of Chapter 4 ("Inquiry and Assessment")

Explain: Assessing Learning

As you read the material listed below, explain in a well-written paragraph how you, the teacher, will know when a student has learned a specific concept based on assessment. Describe the evaluation criteria or performance indicators that you will use to assess evidence of student learning. Include in your explanation how to verify that an assessment is aligned with a learning task or lesson. Describe how you might use a rubric to provide students with detailed feedback about their performance on an assessment.

Read the following pages in *Science in Elementary Education: Methods, Concepts, and Inquiries*:

- Pages 66–71 of Chapter 4 ("Inquiry and Assessment")

Create: Summative/Formative

After you read the material listed below, provide a summative and formative assessment strategy for the following learning objective:

- Students will explain how light from the sun is made up of a mixture of many different colors of light, even though they appear to the eye as white.
  Summative:
  Formative:

Read the following pages in *Science in Elementary Education: Methods, Concepts, and Inquiries*:

- Pages 73–85 of Chapter 4 ("Inquiry and Assessment")

Analyze: Assessment and Instructional Alignment

As you complete the material listed below, choose four learning tasks or lessons to evaluate. Determine how well the assessments align with the central focus or the instructional objectives and important understandings students should develop in each learning task. Identify whether the assessments are formal or informal, and formative or summative. Critique the evaluation criteria used to assess understanding.

Review lessons in the following section of *Science in Elementary Education: Methods, Concepts, and Inquiries*:

- Inquiry Unit 2 ("Life Science")

Interpret: Assessments

In the book *Every Child a Scientist: Achieving Scientific Literacy for All (*National Research Council, 1998), the authors make the following statement:

"To assess a student's level of understanding, teachers traditionally have used multiple choice and short-answer tests given at the end of a unit of study. But in a classroom where students carry out their own science investigations, these types of tests cannot possibly measure whether students have learned all that is expected of them" (page 17).

In light of this quote, and considering the material listed below, explain in your journal how student participation and self-assessment could be used to gather assessment data on science investigations.

Review the following pages in *Science in Elementary Education: Methods, Concepts, and Inquiries*:

- Pages 70–83 (starting at "Planning Learning Experiences and Instruction") of Chapter 4 ("Inquiry and Assessment")

Reference: National Research Council. (1998). *Every child a scientist: Achieving scientific*

literacy for all. Washington, DC: National Academy Press.

Science and Technology

Science and technology go hand in hand. Using technology in the classroom supports scientific inquiry.

Technology in Science Education

Elementary students generally enjoy exploring new technologies. In the science classroom, computer technology can be used for conducting inquiry and for helping students become scientifically literate. This topic explores how the use of technology can enhance learning and exploration.

Watch: Using Technology in Science Class (3:30)

Note: To download this video, right-click the following link and choose "Save as...": download video.

Recommend: Strategies

Consider the following scenario:

- Teachers participate in committees to improve curriculum throughout the school year. You have been asked to be a member of the technology committee for science content.

As you read the material listed below, recommend five strategies that could be used to facilitate students' use of digital technology to think, ask questions, and communicate about science.

Read the following pages in *Science in Elementary Education: Methods, Concepts, and Inquiries*:

- Pages 134–146 (starting at "Focus on Inquiry") of Chapter 7 ("Inquiry Learning Opportunities")

Compare: Virtual vs. Hands On

As you review the articles listed below, complete the following in your journal:

- Create a table in your notebook that has the following elements:
  - two rows: one for hands-on experiments; one for virtual experiments
  - two columns: one for benefits; one for applications
- Compare and contrast the hands-on and virtual experiments.
  - Identify the benefits and limitations of each approach.
  - In your analysis, include a paragraph that explains when these two types of experiments might complement each other.

Read the article below:

- "Can Virtual Labs Replace Hands-On?"

Create: Internet Use Guidelines

As you read the document and explore the website listed below, reflect on the following:

- What are some of the positive aspects for using the internet as a source for data collection?
- Consider how you would assure parents or guardians of students in your classroom that students will be able to safely use the Internet.
- Create a set of guidelines for use in your classroom and the computer lab to help ensure digital safety when students are working on the Internet during science classes.

Read the following document:

- Guidelines and Resources for Internet Safety in Schools

Science Standards, Goals, and Outcomes

Standards guide curriculum development at state and local levels. Classroom teachers should ensure that science instruction aligns to elementary standards and benchmarks.

Science Standards

Standards provide a framework for teaching science. There are national standards, core standards, and state standards that describe outcomes of science education. When planning science instruction, teachers should start with standards, and then plan learning tasks (lessons) and lesson segments (units) that align to specific standards. Alignment is critical for ensuring that students are prepared to meet standards. This topic describes how standards guide scientific inquiry.

Watch: Science Standards (4:34)

Note: To download this video, right-click the following link and choose "Save as...": download video.

Standards: National and State

It is important as a new teacher to be educated about the expectations in you field. As you read the material listed below, complete the following:

- Create a list of the key components of the national science standards.
- Identify the source of the state and federal standards and benchmarks for science.
- Locate and list the websites that contain your state science standards and the national science standards.

Read the following pages in *Science in Elementary Education: Methods, Concepts, and Inquiries*:

- Pages xiii–xvi of the preface
- Pages 57–58 (starting at "National Standards and Planning") of Chapter 3 ("Planning for

Inquiry")

Watch: Where Are My State Standards (1:38)

Note: To download this video, right-click the following link and choose "Save as...": download video.

Relate: Standards and Objectives

Access your state and national science standards. For each learning objective listed below, identify both a state and national standard that correlates with the learning objective.

- Students will explain why the Earth has seasons.
- Students will draw the eight phases of the moon in order of occurrence.
- Students will list the colors that make up sunlight.

Watch: Writing Lesson Objectives: A Silver Bullet (1:28)

Note: To download this video, right-click the following link and choose "Save as...": download video.

Evaluate: Alignment

As you review the lessons listed below, complete the following:

- Write the learning outcomes for each lesson.
- Access state and national standards and write the standards that correlate with each lesson.
- Explain whether the lesson outcomes are clearly aligned with both the state and national standards. How do you know they are aligned? What evidence is there in the objective and lesson plan to support alignment?

Review the lessons included on the following pages of *Science in Elementary Education: Methods, Concepts, and Inquiries*:

- Pages 357–359 (starting at "Molds and Fungi Inquiry") of Inquiry Unit 2 ("Life Sciences")

Integrating Curriculum

Scientific processes are utilized in many disciplines. Creating interdisciplinary learning experiences helps students understand how science connects to the real world.

Integrating Curriculum

Science curriculum explores the world and the very nature of knowledge. By integrating science with other content areas, students make connections between science and the world around them. This topic introduces interdisciplinary approaches that couple academic concepts with real-world learning tasks or lessons.

Watch: Strategies for Curricular Integration (4:43)

Note: To download this video, right-click the following link and choose "Save as...": download video.

Identify: Math and Science Strategies

As you read the material listed below, create a list of strategies for integrating math with science instruction.

Read the following pages in *Science in Elementary Education: Methods, Concepts, and Inquiries*:

- Pages 134–135 of Chapter 7 ("Inquiry Learning Opportunities")

Watch: Integrating Curriculum: Math and Science Connections (5:04)

Note: To download this video, right-click the following link and choose "Save as...": download video.

Recommend: Integration Strategies

Consider the following scenario:

- You are a member of the school curriculum committee representing science. You need to provide to the members of your committee a list of strategies that they can use in their classrooms to integrate science into other curriculum areas in grades K–6.

As you review the material listed below, create a list of integration strategies in your notebook, citing at least two strategies for integrating science into each of the following areas:

- mathematics
- reading
- writing
- discourse
- research
- thinking skills

Review the following pages in *Science in Elementary Education: Methods, Concepts, and Inquiries*:

- Pages 6–19 (starting at "Scientist Support of School-Based Scientific Inquiry") of Chapter 1 ("Inquiring Minds in the Classroom")
- Pages 134–162 of Chapter 7 ("Inquiry Learning Opportunities")
- Pages 93–133 of Chapter 5 ("Inquiry and Science as Practice")

Science and Community

When science extends beyond the classroom, it becomes relevant in students' lives. Creating science learning tasks or lessons that include everyday experiences and examples helps

students connect science to their lives.

Science in the Community

Science learning is not about memorizing content; instead, science education focuses on preparing students to be contributing members of society in terms of their ability to acquire knowledge and make informed decisions. This topic introduces the idea of understanding scientific explanations and applying that knowledge in new ways to explain scientific phenomena and solve real-world questions or problems.

Watch: Science in the Community: Connecting to Daily Life (2:27)

Note: To download this video, right-click the following link and choose "Save as...": download video.

Recall: Everyday Science

As you read the material listed below, consider the importance of relating science to everyday life for children. You can tap in to your students personal and community assets to see if they have family members or prior experiences that might enhance understandings and engage them in learning. In your journal, write an article for your local newspaper that explains to the community the importance of relating science to the everyday life for students. Explain the benefits to students, families, and communities.

Read the following pages in *Science in Elementary Education: Methods, Concepts, and Inquiries*:

- Pages 17–19 of Chapter 1 ("Inquiring Minds in the Classroom")
- Pages 147–156 of Chapter 7 ("Inquiry Learning Opportunities")
- Pages 165–172 of Chapter 8 ("Professional Development in Support of Inquiry")

Project in Elementary Science Methods

All the work you previously completed in preparation for the Elementary Science Methods objective assessment is relevant for completing the performance assessment for this course.

Elementary Science Methods Performance Assessment

Complete the following performance assessment in Taskstream:

- Elementary Science Methods:

Watch: Elementary Science: Writing Lesson Plans (9:57)

Note: To download this video, right-click the following link and choose "Save as...": download video.

For details about this performance assessment, see the "Assessment" tab in this course.

Please follow the guidelines outlined in the document below when writing lesson objectives.

- Guide to Writing Lesson Objectives

The following sample lesson plans will give you examples of how to complete lesson plans:

- Completed Expository Lesson Plan Sample
- Completed Discovery Lesson Plan Sample

Final Steps

Congratulations on completing the activities in this course! This course has prepared you to complete the assessments associated with this course. If you have not already been directed to complete the assessments, schedule and complete your assessments now.