

## Course Syllabus

### Title

Teaching Elementary Life Science

### Target Audience

This course is intended for pre-service and in-service teachers of life science in grades K-4.

### Prerequisites

To successfully participate and complete the assignments in this course, the learner must:

- Be familiar with taking an online course or have completed the PBS “Practice Learning Online with TeacherLine” course.
- Have some experience in grades K-12 classrooms.
- Have an interest in life, earth and space sciences.

### Course Description

This course focuses on three elements: content knowledge, inquiry and other teaching strategies, and use of multimedia and visualization tools in teaching and learning about elementary life science. Teaching Elementary Life Science is designed to enhance educators’ understanding and teaching of life science. This course begins with the principles of constructivist learning, inquiry, and exploration-based science. Throughout, the emphasis on content gives teachers a comprehensive understanding of life science to increase students’ understanding at the elementary level. Through the readings, videos, discussions, assignments, and other interactive experiences, learners in this course will have multiple opportunities to develop content knowledge about the characteristics of living things, plants as producers and animals as consumers, cells and organisms, heredity and adaptation, ecosystems, and humans and the environment. Learners will experience a rich multimedia, inquiry-based learning environment as their students ideally would in their own classrooms. The course provides effective teaching methodologies, strategies and tools that can be used when teaching life science concepts.

### Instructor/Facilitator

See instructor/facilitator sheet.

### Credits

To be determined by college or university.

### Course Goals

As a result of participating in this course learners will:

- Develop content knowledge about topics taught at the elementary level.
- Understand inquiry-based learning models.
- Explore a range of effective teaching methodologies and strategies.
- Draw on a media-rich learning environment that you can use with your students.
- Use classroom-practice videos to model ways of teaching beyond the textbook.
- Understand and utilize the scientific process.

### Outline of Content and Assignments

Learners in this course are expected to participate in discussions, complete assignments and a final project. Learners are also expected to keep a personal notebook (which is not assessed) to keep notes, complete exercises and record reflections about their learning experiences in this course.

### **Discussion Activities**

- **Essential Question** – Each session includes a discussion about an essential question and to teaching and learning issues related to this question. Learners post responses to questions posed in the course and respond to posts submitted by their colleagues.
- **Final Project Discussion** - There is also an ongoing discussion concerning final assignment preparation.

**Assignments and Final Course Project** - Learners are expected to submit assignments and a final project. Rubrics are provided for assessment of all assignments, and the course content includes assignment samples.

Assignments in this course include:

- **Questions: Compare Your Answer**  
Learner’s written responses to a question are compared to answers written by experts in the field.
- **Writing Assignments** - Short writing assignments (essays) are submitted to the facilitator.
- **Final Course Assignment: Curriculum Design Project**  
This assignment consists of developing three activities based on local standards and learners’ experiences with the content and methodology in the course. To complete the assignment learners will provide for each activity:
  - A thorough description of the activity.
  - The learning objective the activity serves.
  - A demonstration of their understanding of the content covered in the activity.
  - A list of materials and resources and a description of how they fit into the activity.
  - A description of how they would organize students in the classroom to ensure an optimal learning environment, and an explanation of why they chose this method.
  - A description of where the activity would fall in the course of a day’s lesson and an explanation of why this is the best place for it.
  - A detailed rationale explaining why they chose to create each activity.
  - A description of how students’ mastery of each objective will be assessed.

### **Required Readings**

- Session 1:
  - “On Scientific Method”
  - “Nature of Science (from ENSI)”
  - “The Nature of Science (from Project 2061)”
  - “Teaching for Conceptual Change: Confronting Children’s Experiences”
  - “View Science Learning From a Constructivist Perspective”
  - “The Fallacy of Induction in Science Teaching”
  - “National Science Education Standards”
- Session 2:
  - “Personal Plot Journals”
  - “Darwin’s Description of a Swarm of Locusts in Argentina”
  - “What is Life?”
  - “Characteristics of Life”
  - “Living/Animal Chart”
  - “Language in the Science Classroom”
  - “When is an Animal not an Animal”
- Session 3:
  - “Drift Seeds and Drift Fruit: Seeds That Ride The Ocean Current”
- Session 4:
  - “Food Chains”

- “Guidelines for Responsible Use of Animals in the Classroom”
- Session 5:
  - “A Unifying Concept: The History of Cell Theory”
  - “Stem Cell Debate”
  - “Children’s Understanding of Scale”
  - “Microscopic Explorations”
- Session 6:
  - “Excerpt from the Botany of Desire”
  - “NSTA Position Statement on Evolution”
  - “Dealing with Controversy”
- Session 7:
  - “What is fertilizer and why do plants need it”
  - “Complex Relations”
  - “Teaching About Ecosystems”
  - “Ecosystems”
- Session 8:
  - “Sea life is troubled by noise”
  - “Fish Creek”
  - “The Scale of Our Presence”
  - “The Ecosystem Sustained”
  - “What’s the State of Biodiversity”
  - “Alaska’s Cold Desert”
  - “Genetic Art”

### **SESSION 1: THE NATURE OF SCIENCE**

**Objectives** - After completing this session, learners will be able to:

- Describe how science and scientists follow processes of systematically making observations, asking questions, making predictions, taking measurements, collecting data, and coming to decisions based on evidence.
- Describe how scientific knowledge changes in the light of new evidence or interpretation of data.
- Identify ways to bring the scientific process into the classroom as a teaching and learning tool.

Using an inquiry-based approach, the session is divided into the following sections: Invitation, Exploration, Explanation, Application and Putting It into Practice. The **Essential Question** for this session is: ***What is science, and what do scientists do?***

Activities in this session delve into the introducing learners to the online learning environment and the process of thinking like a student again. Learners become aware of how they learn and understand science, make connections between learning and teaching, and begin to explore a constructivist model for teaching science.

Assignments in this session require learners to describe what they have learned about the nature of science and their image of an ideal life science lesson.

Discussions in this session focus on finding solutions for the essential question for this session.

Learners will record notes and reflections in their personal notebook about different concepts, methods, activities and ideas presented throughout the session.

### **SESSION 2: LIVING THINGS**

**Objectives** - After completing this session, learners will be able to:

- Identify criteria that distinguish between living and non-living things.
- State the basic needs of living things: animals need air, water, food, and shelter; plants need air, water, sunlight, and nutrients.
- Give examples of how animals and plants meet their needs through their adaptive structures and behaviors.
- Provide examples of how various animals and plants meet their needs in different environments.
- Use techniques for bringing students' prior knowledge and understanding to the surface.

Using an inquiry-based approach, the session is divided into the following sections: Invitation, Exploration, Explanation, Application and Putting It into Practice. The **Essential Question** for this session is: ***What distinguishes something that is living from something that is not?***

Activities in this session delve into an active, inquiry-based approach to the study of biology with a focus on how we learn to differentiate between living and nonliving things. This session is designed to build knowledge of natural environments, identify ways to help bring young students' prior knowledge to the surface, and teach students to distinguish between living and nonliving things.

Assignments in this session require learners to describe the characteristics of living things and a classification activity that they may implement with students.

Discussions in this session focus on finding solutions for the essential question for this session.

Learners will record notes and reflections in their personal notebook about different concepts, methods, activities and ideas presented throughout the session.

### **SESSION 3: PLANTS AS PRODUCERS**

**Objectives** - After completing this session, learners will be able to:

- Explain why plants are called producers -- living things that capture and use the sun's energy to create their structure.
- Identify the sources of the molecules that plants use to make their structures.
- Describe some of the structures and functions of specialized plant parts such as leaves, roots, flowers, and stems.
- Trace the predictable life cycles of plants through germination, growth, reproduction, and death.
- Use concept maps as a tool for surfacing and assessing understanding.

Using an inquiry-based approach, the session is divided into the following sections: Invitation, Exploration, Explanation, Application and Putting It into Practice. The Essential Question for this session is: ***How do the structures and functions of plants allow them to meet their needs?***

Activities in this session build on the previous two sessions' focus on scientific process and living things. Learners observe their ground plots to investigate the process of photosynthesis, plant and substances, and the life cycles of plants. They also learn how to use concept maps as a teaching tool to assess students' understanding.

Assignments in this session require learners to explain how plants are able to be producers and what they have learned about plant structure and function as they relate to the process of photosynthesis.

Discussions in this session focus on finding solutions for the essential question for this session.

Learners will record notes and reflections in their personal notebook about different concepts, methods, activities and ideas presented throughout the session.

#### **SESSION 4: ANIMALS AS CONSUMERS**

**Objectives** - After completing this session, learners will be able to:

- Explain why animals are called consumers -- organisms that must ingest food.
- Describe how plants and animals fit together into food chains.
- Identify different ways that animals meet their need for food describe some of the specialized structures, systems, and behaviors that help animals find and make use of food.
- Describe examples of how animals obtain nutrients in different ways throughout their life cycles.
- Identify how observation and investigation with live animals might enhance your classroom practice.

Using an inquiry-based approach, the session is divided into the following sections: Invitation, Exploration, Explanation, Application and Putting It into Practice. The **Essential Question** for this session is: ***How do the structures and functions of animals allow them to meet their needs?***

Activities in this session transition from the study of plants as living things to the study of animals as living things. Learners continue to explore their plots and learn how observing ecosystems and animal habits can translate into effective teaching strategies.

Assignments in this session require learners to select an animal and describe how it fits into a food chain and how its structures and behaviors help it survive in its environment. Learners also provide an explanation of how the structures and behaviors of a frog change throughout its life.

Discussions in this session focus on finding solutions for the essential question for this session.

Learners will record notes and reflections in their personal notebook about different concepts, methods, activities and ideas presented throughout the session.

#### **SESSION 5: CELLS AND ORGANISMS**

**Objectives** - After completing this session, learners will be able to:

- Observe that cells are three dimensional, made up of mostly water, and are the smallest form of life.
- Explain why cells are the basic building blocks of all organisms, both single-celled and multicellular.
- Provide examples of cell structures that perform the basic functions of organisms, such as intake of food and excretion of waste.
- Identify differences between plant and animal cells and explain how these differences in structure determine function.
- Identify how to use varied resources and tools for learning about phenomena that are otherwise difficult to observe.

Using an inquiry-based approach, the session is divided into the following sections: Invitation, Exploration, Explanation, Application and Putting It into Practice. The **Essential Question** for this session is: ***How do cells carry out the functions of life?***

Activities in this session delve into the basic building blocks of life. Learners define a cell, consider essential knowledge for elementary school teachers, and identify tools and resources for helping young students understand things that are difficult to observe.

Assignments in this session require learners to reference what they have learned about the structure and function of organelles and about cell specialization to describe how cells are the basic building blocks of all organisms. Learners also identify a classroom activity to prepare students to learn about cells and the particular tools or resources to be used during the lesson.

Discussions in this session focus on finding solutions for the essential question for this session.

Learners will record notes and reflections in their personal notebook about different concepts, methods, activities and ideas presented throughout the session.

### **SESSION 6: HEREDITY AND ADAPTATION**

**Objectives** - After completing this session, learners will be able to:

- Define variation, adaptation, and natural selection.
- Give examples of variation within a species and describe how such differences affect an individual's chances for survival.
- Describe why offspring are like their parents in some ways and different in others.
- Differentiate between characteristics that are inherited and those that result from environmental influences.
- Describe the process of natural selection.
- Develop activities for young children that will prepare them for future study of evolution.

Using an inquiry-based approach, the session is divided into the following sections: Invitation, Exploration, Explanation, Application and Putting It into Practice. The **Essential Question** for this session is: ***How does variation among individuals affect the survival of species?***

Activities in this session will delve into the study of variation, heredity, and adaptation as elements of how living things survive, with a focus on developing activities targeted toward young students.

Assignments in this session require learners to summarize their understanding of adaptation and how it happens and to match adaptation concepts with local teaching standards. Learners also begin working on their final assignment.

Discussions in this session focus on finding solutions for the essential question for this session.

Learners will record notes and reflections in their personal notebook about different concepts, methods, activities and ideas presented throughout the session.

### **SESSION 7: INTERACTIONS OF ORGANISMS**

**Objectives** - After completing this session, learners will be able to:

- Define an ecosystem as a community of animals and plants living together, as well as the physical features of the environment.
- Provide examples of how living things interact with each other via competition, cooperation, and predator-prey relationships.
- Construct a food chain that shows how energy efficiency decreases through the food chain and how all animals depend on the ability of plants to produce food from sunlight.
- Construct a food web that shows how life is interconnected through the many ways in which organisms in an ecosystem find food.
- Provide examples of how living things interact with nonliving things such as air, water, and sunlight.
- Provide examples of the effects of change in ecosystems, recognizing that all organisms cause changes in their environments and that these changes may be beneficial or detrimental to the organisms themselves and to other organisms.
- Use a range of effective questioning strategies.

Using an inquiry-based approach, the session is divided into the following sections: Invitation, Exploration, Explanation, Application and Putting It into Practice. The **Essential Question** for this session is: ***How do living things in an environment affect each other's chances for survival?***

Activities in this session use the knowledge acquired in previous sessions, with a focus on teaching strategies that help students understand the connections among living things and their environments—in particular, the relationship between food chains and energy sources, predator/prey relationships, food and ecosystems, and the interconnection between living and nonliving things.

Assignments in this session require learners to identify and describe three to four observed relationships among living things or between living and nonliving things and to recognize the impact of nonliving elements of an ecosystem on its inhabitants.

Discussions in this session focus on finding solutions for the essential question for this session.

Learners will record notes and reflections in their personal notebook about different concepts, methods, activities and ideas presented throughout the session.

### **SESSION 8: HUMANS AND THEIR ENVIRONMENTS**

**Objectives** - After completing this session, learners will be able to:

- Explain how humans depend on the natural environment for their survival.
- Provide examples of human-caused environmental changes that are either beneficial or detrimental to themselves and other organisms.
- Consider an environmental decision in terms of its consequences and benefits.
- Describe the impact of group discussion on learning and ways to promote group discussion in their teaching.

Using an inquiry-based approach, the session is divided into the following sections: Invitation, Exploration, Explanation, Application and Putting It into Practice. The **Essential Question** for this session is: ***How do humans affect their ecosystems?***

Activities in this session explore human beings as living things. Learners examine the complex relationship between humans and the environment and some of the benefits and tradeoffs of human-caused changes in the ecosystem.

Assignments in this session require learners to identify and detail the benefits and dangers of human-caused environmental change and to take and scientifically support a personal position relating to environmental change using session content and life experience. Learners also complete their final assignment.

Discussions in this session focus on finding solutions for the essential question for this session.

Learners will record notes and reflections in their personal notebook about different concepts, methods, activities and ideas presented throughout the session.

### **Schedule**

This course is scheduled to take approximately 45 hours to complete.

### **Requirements**

Learners are expected to:

- Complete all assignments.
- Participate and actively engage in discussions with fellow learners while contributing to the social construction of knowledge.
- Be self-directed and self-motivated.

- Ask for assistance when they need it.

Facilitators are expected to:

- Provide feedback to all learners.
- Participate in discussions to keep them moving forward.
- Provide assistance to learners who need it.

### **Technical Requirements**

- Word Processor
- Internet service provider
- E-mail
- Shockwave and Flash: <http://www.macromedia.com/downloads/>
- Acrobat Reader: <http://www.adobe.com/products/acrobat/readstep.html>
- QuickTime: <http://www.apple.com/quicktime/download/>

### **Standards of Academic Integrity**

As posted on PBS TeacherLine Web site at

[http://teacherline.pbs.org/teacherline/help/help\\_template3.cfm?subID=197](http://teacherline.pbs.org/teacherline/help/help_template3.cfm?subID=197)

### **Evaluation**

This course is evaluated on a letter grade basis, and graduate credit may be available. See the PBS TeacherLine Web site for details pertaining to specific graduate credit instructions.

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