Fall 16

EGE 311: Sciences In Primary Education Syllabus

EGE 311 is a course designed for the students in the Elementary Education program of Faculty of Education at TEDU. The purpose of the course is to introduce to the core concepts required in primary education science curriculum including physics, chemistry, and biology topics. The course is designed to scaffold the science content through critical thinking and student-centered applications as well as the characteristics of science, technology, scientific knowledge, and scientific method.

Syllabus

Course Number: EGE 311

Course Title: Sciences in Primary Education

Number of Credit Hours: 3

Required or Elective: Required

Term: Fall 2016

Meeting Day and Time:

Monday 14:00-16:00 &

Thursday 14:00-16:00

Location: D126

Course web site:

Professor/Instructor: Dr. Elif ADIBELLİ ŞAHİN
Office: D109
Office Hours: Thursday, 10:00-12:00; others by appointment
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Email Address: elif.sahin@tedu.edu.tr
Instructor web site: http://www.tedu.edu.tr/en/dr-elif-adibelli-sahin

Required texts:

- Bauer, Henry H. (1992). *Scientific literacy and the myth of the scientific method*. Urbana, IL: University of Illinois Press.
- Ford, Michael. (2008). Disciplinary authority and accountability in scientific practice and learning. *Science Education*, *92*(3), 404-423.
- McComas, W. F. (1998). The principal elements of the nature of science: Dispelling the myths of science. In W. F. McComas (Ed.) *Nature of science in science education: Rationales and strategies* (pp. 53-70). Dordrecht, Netherlands: Kluwer (Springer) Academic Publishers.
- Hewitt, Paul G. (2010). *Conceptual integrated science--explorations*. San Francisco, CA: Addison-Wesley.
    - Suggested Supplementary Readings;
        - "The Scientists: A History of Science Told Through the Lives of Its Greatest Inventors" by John Gribbin.
        - "How We Know: An Exploration of the Scientific Process" by Martin Goldstein and Inge F. Goldstein.
        - "The Borderlands of Science: Where Sense Meets Nonsense" by Michael Shermer

COURSE DESCRIPTION

EGE 311 is a course designed for the students in the Elementary Education program of Faculty of Education at TEDU. The purpose of the course is to introduce to the core concepts required in primary education science curriculum including physics, chemistry, and biology topics. The course is designed to scaffold the science content through critical thinking and student-centered applications as well as the characteristics of science, technology, scientific knowledge, and scientific method. The course focuses on practicing science and technology literacy as well as science-technology-society-environment relationships through inquiry based implementations. The teacher candidates are going to construct the relationship between science and other courses such as math and literacy in the curriculum. Throughout the inquiry based practices, scientific process skills and their applications are enhanced. This course will consist of lectures, discussions, readings, hands-on/ minds-on activities, demonstrations, group activities, writing reports, displays as well as lab assignments and exams.

RATIONALE

Turkish elementary schools require teachers to provide instruction in all curricular subjects. With the growing importance of science in our daily lives and the national thrust to improve the science literacy of all students, the teaching of elementary science has become a major focus. Therefore, this course will emphasize the science concepts included in the Turkish primary education curriculum 1-4. Those concepts covered in this course are; Science as Process, What are Claim and Evidence, Scientific Arguments, Electricity, Force and Motion, Substance, Light and Sound, Cell and Life, Discovering Our Bodies, and Earth and Time. EGE 311 course encourages teacher candidates to be questioning, reflective and critical thinkers about scientific concepts. The course is based on a disciplinary way of knowing and view of scientific knowledge that draws on the traditional disciplines of science and new scientific technology to enable students to investigate issues that are interesting and relevant in a modern world. This course provides opportunities for students to conduct science experiments and generate informed arguments about questions, claims, and evidences. This process enables them to make informed judgments and decisions about science concepts under investigations.

The course is grounded in the belief that science is, in essence, a practical activity. From this stems the view that conceptual understandings in science derive from a need to find solutions to real problems in the first instance. The inquiring scientist may then take these understandings and apply them in a new context often quite removed from their original field. This course seeks to reflect this creative element of science as inquiry. It should involve students in research that develops a variety of skills, including the use of appropriate technology, an array of diverse methods of investigation, and a sense of the practical application of the domain. It emphasizes formulating and testing hypotheses and the critical importance of evidence in forming conclusions. This course enables them to investigate science issues, in the context of the world around them, and encourages student collaboration and cooperation with community members employed in scientific pursuits. It requires them to be creative, intellectually honest, to evaluate arguments with skepticism and to conduct their investigations in ways that are ethical, fair, and respectful of others.

COURSE OBJECTIVES

Students within this course will have an opportunity to conduct investigation in order to answer questions about the natural and technological world, using reflection and analysis to prepare a plan; to collect, process and interpret data; to communicate conclusions; and to evaluate their plan, procedures, and findings. The EGE 311 course is designed to facilitate the achievement of the following outcomes.

Upon successful completion of this course, a student will be able to:

- Plan scientific investigations to test ideas about the natural and technological world;
- Collect and record a variety of information relevant to their investigations;
- Translate and analyze information to find patterns and draw conclusions to extend their understanding;
- Reflect on an investigation, evaluate the process and generate further ideas;
- Identify the core concepts in biology, chemistry, and physics areas covered in primary school curriculum;
- Understand the philosophical tenets, assumptions, goals, and values that distinguish science from technology and from other ways of knowing the world;
- Value a willingness to work as a group in science related topics;
- Initiate an argument based on science related topics.

Course's theoretical and practical components include common inquiry based activities that require and foster following scientific process skills:

Classifying – arranging or distributing objects, events, or information representing objects or events in classes according to some methods or systems

Communicating – giving oral and written explanations or graphic representations of observations

Comparing and contrasting – identifying similarities and differences between or among objects, events, data, systems, etc.

Creating models – displaying information, using multisensory representations

Gathering and organizing data – collecting information about objects and events, which illustrate a specific situation

Generalizing – drawing general conclusions from particulars

Identifying variables – recognizing the characteristics of objects or factors in events that are constant or change under different conditions

Inferring – drawing a conclusion based on prior experiences

Interpreting data – analyzing data that have been obtained and organized by determining apparent patterns or relationships in the data

Making decisions – identifying alternatives and choosing a course of action from among the alternatives after basing the judgment for the selection on justifiable reasons

Manipulating materials – handling or treating materials and equipment safely, skillfully, and effectively

Measuring – making quantitative observations by comparing to a conventional or nonconventional standard

Observing – becoming aware of an object or event by using any of the senses (or extensions of the senses) to identify properties

Predicting – making a forecast of future events or conditions expected to exist

Students' expectations throughout the course:

Working Effectively – contributing to the work of a brainstorming group, laboratory partnership, cooperative learning group, or project team; planning procedures; identifying and managing responsibilities of team members; and staying on task whether working alone or as part of a group

Gathering and Processing Information – accessing information from printed media, electronic databases, and community resources; using the information to develop a definition of the problem and to research possible solutions

Generating and Analyzing Ideas – developing ideas for proposed solutions; investigating ideas; collecting data; and showing relationships and patterns in the data

Common Themes – observing examples of common unifying themes; applying them to the problem; and using them to better understand the dimensions of the problem

Realizing Ideas – constructing components or models; arriving at a solution; and evaluating the results

Presenting Results – using a variety of media to present the solution and to communicate the results

COURSE OUTLINE

Below is a *tentative* class schedule, subject to revision/adjustment as and if required. Additional readings may be assigned as we go.

Main Topic	Topic	Time	Documents
Nature of Science	Scientific Processes	1 week	Course Reading
	What are Claim and Evidence	1 week	Course Reading
	Scientific Arguments	1 week	Course Reading
Physical Science	Force and Motion	2 week	Course Reading
	Substance	1 week	Course Reading
	Electricity	2 week	Course Reading
	Light and Sound	2 week	Course Reading
Biological Science	Cell and Life	1 week	Course Reading
	Discovering Our Bodies	1 week	Course Reading
Earth and Space Science	Earth and Time	1 week	Course Reading

Week 1: Scientific Processes

Required Readings:

- McComas, W. F. (1998). The principal elements of the nature of science: Dispelling the myths of science. In W. F. McComas (Ed.) *Nature of science in science education: Rationales and strategies* (pp. 53-70). Dordrecht, Netherlands: Kluwer (Springer) Academic Publishers.
- Bauer, Henry H. (1992). *Scientific literacy and the myth of the scientific method*. Urbana, IL: University of Illinois Press.

Week 2: Science As Inquiry - What are Claim and Evidence

Required Readings:

- Ford, Michael. (2008). Disciplinary authority and accountability in scientific practice and learning. *Science Education*, *92*(3), 404-423.
- Bauer, Henry H. (1992). *Scientific literacy and the myth of the scientific method*. Urbana, IL: University of Illinois Press.

Week 3: Scientific Arguments

Required Reading:

- Ford, Michael. (2008). Disciplinary authority and accountability in scientific practice and learning. *Science Education*, *92*(3), 404-423.
- Bauer, Henry H. (1992). *Scientific literacy and the myth of the scientific method*. Urbana, IL: University of Illinois Press.

Week 4: Force and Motion I

Required Reading:

- Hewitt, Paul G. (2007). *Conceptual integrated science* (1st ed.). San Francisco, CA: Pearson/Addison Wesley.
- Hewitt, Paul G. (2010). *Conceptual integrated science--explorations*. San Francisco, CA: Addison-Wesley.

Week 5: Force and Motion II

Required Reading:

- Hewitt, Paul G. (2007). *Conceptual integrated science* (1st ed.). San Francisco, CA: Pearson/Addison Wesley.
- Hewitt, Paul G. (2010). *Conceptual integrated science--explorations*. San Francisco, CA: Addison-Wesley.

Week 6: Substance

Required Reading:

- Hewitt, Paul G. (2007). *Conceptual integrated science* (1st ed.). San Francisco, CA: Pearson/Addison Wesley.
- Hewitt, Paul G. (2010). *Conceptual integrated science--explorations*. San Francisco, CA: Addison-Wesley.

Week 7: Electricity I

Required Reading:

- Hewitt, Paul G. (2007). *Conceptual integrated science* (1st ed.). San Francisco, CA: Pearson/Addison Wesley.
- Hewitt, Paul G. (2010). *Conceptual integrated science--explorations*. San Francisco, CA: Addison-Wesley.

Week 8: Electricity II

Required Reading:

- Hewitt, Paul G. (2007). *Conceptual integrated science* (1st ed.). San Francisco, CA: Pearson/Addison Wesley.
- Hewitt, Paul G. (2010). *Conceptual integrated science--explorations*. San Francisco, CA: Addison-Wesley.

Week 9: Light and Sound I

Required Reading:

- Hewitt, Paul G. (2007). *Conceptual integrated science* (1st ed.). San Francisco, CA: Pearson/Addison Wesley.
- Hewitt, Paul G. (2010). *Conceptual integrated science--explorations*. San Francisco, CA: Addison-Wesley.

Week 10: Light and Sound II

Required Reading:

- Hewitt, Paul G. (2007). *Conceptual integrated science* (1st ed.). San Francisco, CA: Pearson/Addison Wesley.
- Hewitt, Paul G. (2010). *Conceptual integrated science--explorations*. San Francisco, CA: Addison-Wesley.

Week 11: Cell and Life

Required Reading:

- Hewitt, Paul G. (2007). *Conceptual integrated science* (1st ed.). San Francisco, CA: Pearson/Addison Wesley.
- Hewitt, Paul G. (2010). *Conceptual integrated science--explorations*. San Francisco, CA: Addison-Wesley.

Week 12: Discovering Our Bodies

Required Reading:

- Hewitt, Paul G. (2007). *Conceptual integrated science* (1st ed.). San Francisco, CA: Pearson/Addison Wesley.
- Hewitt, Paul G. (2010). *Conceptual integrated science--explorations*. San Francisco, CA: Addison-Wesley.

Week 13: Earth and Time

Required Reading:

- Hewitt, Paul G. (2007). *Conceptual integrated science* (1st ed.). San Francisco, CA: Pearson/Addison Wesley.
- Hewitt, Paul G. (2010). *Conceptual integrated science--explorations*. San Francisco, CA: Addison-Wesley.

GENERAL COURSE GUIDELINES

Class Schedule, Attendance, and Late Submission: Class meets at scheduled times. Your participation is critical to your on-going development as a teacher. Treat this class as if it were a part of your job, please be here! It is your responsibility to sign attendance sheet each class session. You should notify me, preferably in advance, if you know you will be absent or tardy from class. Although your grade initially will be determined by the results of the assignments below, it can be reduced for excessive absences or tardies as follows.

Absences:

- 0-2 absences – no change to your grade
- > 2 absences – each absence will result in the reduction of your grade by 5%
- ≥ 9 absences – Fail

Three tardies and/or early departures = one absence, and counts as part of those above.

Notification about absences or tardies does not imply excusal. You are responsible for turning in assignments at the beginning of class on the day they are due. Assignments that are late will automatically receive a *10 percent* grade reduction (one full grade lower).

Grading: Your final grade will be determined from the course activities and projects. Students' performance will be evaluated using letter grades (A - F).

GRADING SCALE		
Grade	Grade Points	Percentage Scores
AA	4.00	90 – 100
BA	3.50	85 – 89
BB	3.00	80 – 84
CB	2.50	75 – 79
CC	2.00	70 – 74
DC	1.50	60 – 69
DD	1.00	50 – 59
F	0.00	0 – 49
FX	0.00	–
P	–	–

Academic Integrity: Academic integrity requires that all academic work be wholly the product of an identified individual or individuals. Collaboration is only acceptable when it is explicitly acknowledged. Ethical conduct is the obligation of every member of the TED University community, and breaches of academic integrity constitute serious offenses. Since a lack of integrity hinders the student's academic development, it cannot be tolerated under any circumstances. Violations include but are not limited to: cheating, fabrication, plagiarism, and denying others access to information or material. See TEDU Catalog for further clarification and information on grievance procedures.

COURSE ASSIGNMENTS, EXPECTATIONS AND GRADING PROCEDURES

Grading Structure		Percentage
1	Nature of Science Questionnaires	%10
2	Concept Mappings	%20
3	Weekly Lab Reports	%25
4	Writing to Learn Activity	%10
5	Midterm Exam	%15
6	Final Exam	%15
7	Class Participation	%5
	10% per week penalty for late work.	

ASSIGNMENTS

1. Nature of Science Questionnaire

Because an understanding of nature of science is part of science subject, it is important for science teacher candidates to examine and refine their thoughts about the definition of science and the characteristics of scientific knowledge. Thus, in this assignment you will be asked to complete a nature of science questionnaire at the beginning of the course and then revise it at the end of the course.

2. Concept Mapping Activity

Because science is conceptual subject, it is important for learners to have tools for developing concepts. Concept mapping is a valuable tool in determining a student's current cognitive status, and for helping students' concepts to mature. In this assignment, you will create a concept map that illustrates a concept taught at the elementary level in science. You will work with model concept maps in class and in your text.

Your concept map illustrates visually the topics that relate to a broad science concept. The illustration shows details about the relationships among the topics. Choose a main concept from the list here, and organize topics below. Rank topics from general to more specific. Connect topics with links that describe their relationship. The concept map may be turned in on paper or electronically using Word, Inspiration, PowerPoint, Visio or Cmap.

<u>Elementary science concepts:</u>

Physical Science:

Matter—properties, measurement, states, chemical reactions, elements

Motion—force, machines, gravity, speed, sound

Energy—light, heat, electricity, magnetism, transfer of energy

Life Science:

Characteristics of organisms—classification, environments, structures, cells, disease

Life cycles—heredity, reproduction, genetics, adaptations, evolution, extinction

Environments—food webs, resources, change, energy sources, populations

Earth and Space Science:

Earth—land, landforms, water, sky, change, geologic history, climate

Sky—solar system, motion, gravity, solar energy, weather

Concept Map Rubric:

Value	0	1	2
Concepts	Incomplete, illogical	Complete, logical	Complete, logical, appropriate connections
Creativity	Not evident	Exhibited	
Presentation	Errors of spelling and language	Largely free of errors of spelling and language	Easily read, free of errors of language and spelling

3. Weekly Lab Reports

Your Argument Based Inquiry Lab Report Template is given with Appendix A in this syllabus. Although you are asked to work in groups, you are required to hand in individual reports at the following week of the activity conducted. You need to make sure that all sections of the report are completed properly. It is strongly suggested to keep a copy of the report for your own records and exam preparation purposes. More details and discussion about the evaluation criteria and rubric will be provided during the course.

4. Writing to Learn Activities

You will be asked to write about the science topics in a variety of writing formats including posters, letters, and poems to the different audiences. At the end of the each main topic you will be provided a writing activity guide about details. You will have a 1-week time to prepare your writing assignments and hand-in. Your writing assignments will be evaluated with the following rubric.

Writing to Learn Assignment Evaluation Rubric:

Adapted From: Spandel, Vicki. (2001). Creating writers: through 6-trait writing assessment and instruction (3rd ed.). New York, NY: Long

	6 Exemplary	5 Strong	4 Proficient	3 Developing	2 Emerging	1 Beginning
Ideas & Content *main theme* *supporting details*	• Exceptionally clear, focused, engaging with relevant, strong supporting detail	• Clear, focused, interesting ideas with appropriate detail	• Evident main idea with some support which may be general or limited	• Main idea may be cloudy because supporting detail is too general or even off-topic	• Purpose and main idea may be unclear and cluttered by irrelevant detail	• Lacks central idea; development is minimal or non-existent
Organization *structure* *introduction* *conclusion*	• Effectively organized in logical and creative manner • Creative and engaging intro and conclusion	• Strong order and structure • Inviting intro and satisfying closure	•Organization is appropriate, but conventional • Attempt at introduction and conclusion	• Attempts at organization; may be a "list" of events • Beginning and ending not developed	• Lack of structure; disorganized and hard to follow • Missing or weak intro and conclusion	• Lack of coherence; confusing • No identifiable introduction or conclusion
Voice *personality* *sense of audience*	• Expressive, engaging, sincere • Strong sense of audience • Shows emotion: humor, honesty, suspense or life	•Appropriate to audience and purpose • Writer behind the words comes through	• Evident commitment to topic •Inconsistent or dull personality	• Voice may be inappropriate or non-existent • Writing may seem mechanical	• Writing tends to be flat or stiff • Little or no hint of writer behind words	• Writing is lifeless • No hint of the writer
Word Choice *precision* *effectiveness* *imagery*	• Precise, carefully chosen • Strong, fresh, vivid images	•Descriptive, broad range of words • Word choice energizes writing	• Language is functional and appropriate •Descriptions may be overdone at times	• Words may be correct but mundane • No attempt at deliberate choice	• Monotonous, often repetitious, sometimes inappropriate	• Limited range of words • Some vocabulary misused
Sentence Fluency *rhythm,* *flow* *variety*	• High degree of craftsmanship • Effective variation in sentence patterns	• Easy flow and rhythm • Good variety in length and structure	• Generally in control • Lack variety in length and structure	• Some awkward constructions • Many similar patterns and beginnings	• Often choppy • Monotonous sentence patterns • Frequent run-on sentences	• Difficult to follow or read aloud • Disjointed, confusing, rambling
Conventions *age appropriate,* *spelling,* *caps,* *punctuation,* *grammar*	•Exceptionally strong control of standard conventions of writing	• _Strong control of conventions; errors are few and minor	• _Control of most writing conventions; occasional errors with high risks	• Limited control of conventions; frequent errors do not interfere with understanding	• Frequent significant errors may impede readability	• Numerous errors distract the reader and make the text difficult to read

Appendix A: Argument Based Inquiry Lab Report Template

EGE 311- Student Template for Argument-Based Inquiry

Name_____

My Question is: 	**My beginning understanding is:**

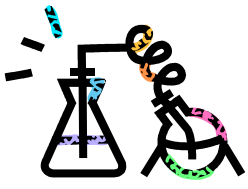
The other possible models discussed in my class are:

Model 1:

Model 2:

Model 3:

This is what I did to test which model answers my question best:



This is what I found when I tested (data):

My claim is:

My evidence is:

How do my ideas compare with others?

***Notes from my classmates……..**

Reading framework

Notes from outside experts: (informational text, internet, encyclopedia, etc.)

Source 1: **Author: _____** **Title: _____** **_____**	**Source 2:** **Author: _____** **Title: _____** **_____**	**Source 3:** **Author: _____** **Title: _____** **_____**
Information: **(What I knew from the source?)**	**Information:**	**Information:**
How do the information from source compare/contrast to my claim/evidence?		

What can I say about each model that was tested?

Model 1:

Model 2:

Model 3:

Reflections:

My ideas have changed because….	**My ideas haven't changed because……**