

Sul Ross State University
Science Education 3308:001, H01, H02, H03, H04, VMC, VAN
Foundations of Science Education I Syllabus-Fall 2022
Lecture M W 6:00-7:15 WSB 101, 321, MC, VH, EP B112, UV B114C, DR 107

Instructors:

Biology

Dr. Chris M. Ritzi
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Geology

Ms. Jesse M. Kelsch, MS
Warnock Science Building - 316
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MW 3-5, T 10:30-12, or by appt.

Class Website: <http://sulross.blackboard.com>

Text: No physical textbook is required. Supplemental content and material will be available online from the following open-source resources.

[CK-12 Earth Science for Middle School | CK-12 Foundation \(ck12.org\)](#)

[CK-12 Life Science for Middle School | CK-12 Foundation \(ck12.org\)](#)

[CK-12 Physical Science for Middle School | CK-12 Foundation \(ck12.org\)](#)

Course Description: This is the first in a series of two courses offered to education students, in which students will learn and explore the teaching of required science content outlined in the TEA science competencies related to Life Science and Earth Science, toward their future roles as elementary and middle school science teachers. Topics covered will include the following TEA science competencies: History & Nature of Science; Impact of Science; Structure & Function of Earth Systems; Cycles in Earth Systems; Energy in Weather & Climate; Structure & Function of Living Things; Reproduction & the Mechanisms of Heredity; Relationship between Organisms & the Environment; Energy Transformations & Conservation of Matter; Impact of Science on Personal & Societal Decisions; and Students as Learners & Science Instruction.

Inquiry and investigation are promoted in this class such that preservice teachers may do the same in their future science classrooms. The class emphasizes problem-solving as a pedagogical tool and explores assessment types and lesson plans appropriate to varied science content.

Student Learning Outcomes

The graduating education student graduating with a BS in Education should be able to:

1. Students will demonstrate effective lesson planning.
2. Students will demonstrate written and oral proficiency through a variety of instructional strategies.
3. Students will demonstrate effective evaluative processes for assessing student learning

Course Learning Objectives:

- 1) Students will be able to distinguish science from pseudoscience and skeptically evaluate claims based on strength of evidence.
- 2) Students will describe the organization and functioning of living things, including the human body.
- 3) Students will refine personal teaching philosophy through studying theories and methodologies of elementary instruction and science pedagogy.
- 4) Students will demonstrate understanding of basic Biological principles such as ecology, evolution, taxonomy, and genetics.
- 5) Students will demonstrate understanding of basic Geological principles such as minerals, weather and climate, cycles, and processes (weathering and plate tectonics).

Marketable Skills:

1. Students have the ability to teach diverse learners in an inclusive learning environment.
2. Students have the ability to assess student learning.
3. Students have the ability to critically think and creatively adapt instructional strategies to an instructional setting.
4. Students have the ability to construct a classroom management plan.
5. Student have the ability to effectively use technology to communicate

Grading: Your grade will be assigned based on the percentage of points you get out of a total possible 1000 points. (400 pts biology, 400 points geology, 200 pts final exams). The first half of the course will be based on the biology and life sciences content material, or the geology-based material, depending on which section you are enrolled in. The second half of the course content and grades will be based on the other subject matter. For each of the two separate portions of the course, grades will be based on the development of short question assessments for teaching competencies 6a, 6b, 6c & 6d (4-25pts each), online quizzes (4-25pts), and the development of two lesson plans and recorded delivery of those content-based lesson (2-100 pts) for teaching competencies 5a, 5b, 5c, 5e, 5f, 5g, & 5h. The final exam will be comprehensive across all topics.

Tests: There will be a variety of graded assignments through the course, from discussion boards to concept sketches to lesson plans to presentations. The final exam is set to be a 200 point comprehensive exam over both topic fields. If you miss an assignment or graded activity and have a legitimate excuse, contact your current instructor within 24 hours of the due date and we will arrange a make-up or late submission. If you do not contact us within 24 hours, you will receive a zero on that exam.

Attendance: Students missing 20% of lectures (6 lectures) OR labs (3 labs) may be dropped from the class per the SRSU catalog. Any student dropped for excessive absences will receive an F for the course grade. Please notify your instructor BEFORE missing class for authorized activities, death in the family, or illness. Assignments missed for any reason must be made up within one week of the originally scheduled date.

REGARDLESS OF WHY AN ABSENCE OCCURS, YOU MAY BE GIVEN AN F FOR THE COURSE GRADE IF YOU ACCUMULATE SIX ABSENCES.

If you are feeling ill, have a fever of 100 F, or am exhibiting any symptoms of COVID infection, please stay home and self-quarantine until you are either tested and cleared, or have been symptom free for over 10 days.

Lecture courtesy: The general rules of classroom etiquette are below.

- 1) Please do not talk to others in class while the instructor is lecturing. If you have a question, ASK THE INSTRUCTOR! That's what we are here for.
- 2) No eating, chewing, dipping, etc.
- 3) Please turn cell phones to silent while in class. They are disruptive to the entire class, and detract from learning.
- 4) For remote connections, please attend class as professionally as one would do in person (ie. Wearing proper clothes, not being disruptive or disrespectful to your peers, etc.)

TENTATIVE LECTURE OUTLINE

<u>DATE(S)*</u>	<u>LECTURE TOPIC</u>	<u>READING</u>	<u>COMPETENCIES</u>
<i>*FOR DIFFERENT SECTIONS</i>			
Aug 22, Oct 12	BIOLOGY day 1: Introduction and the Scientific Method	1.1, 1.3, 1.4, 1.5	1f, 2b,2d,2e, 4a, 4b,4h
Aug 24, Oct 17	Chemistry and Organic Molecules	2.1,2.2,2.3	8d
Aug 29, Oct 19	Cell Structures and Membranes	2.4, 2.5, 2.6, 2.7,2.8, 2.9, 2.10, 2.11, 2.12	11a, 11d
Aug 31, Oct 24	Energy via Photosynthesis & Cellular Respiration	2.13, 2.14, 2.15, 2.16, 2.17, 2.18	8f, 10b, 10c
Sep 5	Labor Day – No class		
Sept 7, Oct 26	Genetics	3.1, 3.2, 3.3, 3.5, 3.10	12a, 12b, 12c, 12d, 12e
Sept 12, Oct 31	Evolution via Natural Selection	4.1, 4.3, 4.4, 4.5, 4.6	5d, 13a, 13b, 13c
Sept 14, Nov 2	Evolution continued	4.7, 4.8, 4.9, 4.10, 4.11, 4.12	5d, 13a, 13b, 13c
Sept 19, Nov 7	Speciation and Taxonomy	5.1, 5.2, 5.6, 6.1, 6.7, 7.1, 7.4, 9.1, 10.1, 10.2	11b, 11f
Sept 21, Nov 9	Ecology	12.1, 12.2	14f, 14g
Sept 26, Nov 14	Population Ecology	12.3, 12.4, 12.5, 12.6	3c, 3d, 3f, 14e
Sept 28, Nov 16	Species Interactions	12.7, 12.8, 12.9	14d
Oct 3, Nov 21	Community Ecology and Trophic Levels	12.10, 12.11, 12.16, 12.17, 12.18, 12.19	11c, 14b, 14c
Oct 5, Nov 28	Succession and Change	12.20, 12.29, 12.20, 12.31	4d, 4f
Oct 10, Nov 30	Biomes	12.12, 12.13, 12.14, 12.15	14a, 14b, 14g

Oct 12, Aug 22	GEOLOGY day 1: Introduction and the Earth moon sun system	3.2, 3.4, 3.5, 3.7, 3.8, 3.11	18b, 6c
Oct 17, Aug 24	Weather & climate	12.1-12.5, 10.13, 10.15-10.17; 10.1-10.6; 11.1, 11.5-11.8, 11.14-11.6	17a-c, 17e, 15c
Oct 19, Aug 29	The role science plays in global challenges	10.14, 12.15-12.18	16d, 15d, 3f, 2j
Oct 24, Aug 31	The inorganic carbon cycle	12.14, 20.1	16c, 8f, 10a, 1f
Oct 26, Sep 7	Bloom's taxonomy for eliciting critical thinking		5f
Oct 31, Sep 12	Earth's water cycle	8.1-8.3, 10.9-10.12, 20.3;	16b, 17d
Nov 2, Sep 14	Surface and ground water	8.4-8.5, 8.8-8.14	15b, 15a
Nov 7, Sep 19	Constructive and deconstructive processes: Plate tectonics and weathering	5.7-5.15, 5.17; 13.1-13.4	15a
Nov 9, Sep 21	Scientific evidence for plate tectonics; how patterns can yield predictions	5.1-5.6	4b
Nov 14, Sep 26	Models in Earth science	1.9	4h
Nov 16, Sep 28	Earth materials	4.1-4.4	4a
Nov 21, Oct 3	How rocks, minerals, and soils form	4.5-4.6	16a
Nov 23	Thanksgiving Holidays – No Class Nov 23-25		
Nov 28, Oct 5	Properties and uses of Earth materials; Use of natural resources	20.5-20.8, 20.10-20.15, 21.1-21.5; 20.4, 8.15-8.17, 21.6-21.10; 8.18-8.19; 13.9-13.10	16e, 3e, 3d
Nov 30, Oct 10	Solar system and the universe	22.1, 22.11; 22.5-22.8, 22.12	18a, 18c
Dec 2 or 6 6:00 pm	Final exam for MW 6:00		

Note – This outline is subject to change for reasons of course interest, time constraint, or instructor whim. Assignments will be administered on the dates given, unless material relevant for a given assignment has not been covered as yet. Under such cases, a due date may be moved a class period or two to aid in the clarity and understanding of the material.

SRSU Distance Education Statement: Students enrolled in distance education courses have equal access to the university's academic support services, such as library resources, online databases, and instructional technology support. For more information about accessing these resources, visit the SRSU website. Students should correspond using Sul Ross email accounts and submit online assignments through Blackboard, which requires secure login. Students enrolled in distance education courses at Sul Ross are expected to adhere to all policies pertaining to academic honesty and appropriate student conduct, as described in the student handbook. Students in web-based courses must maintain appropriate equipment and software, according to the needs and requirements of the course, as outlined on the SRSU website. Directions for filing a student complaint are located in the student handbook.

SRSU Disability Services: Sul Ross State University (SRSU) is committed to equal access in compliance with Americans with Disabilities Act of 1973. It is SRSU policy to provide reasonable accommodations to students with documented disabilities. It is the student's responsibility to initiate a

request each semester for each class. Students seeking accessibility/accommodations services must contact Rebecca Greathouse Wren, LPC-S, SRSU's Accessibility Services Coordinator at 432-837-8203 (please leave a message and we'll get back to you as soon as we can during working hours), or email rebecca.wren@sulross.edu. Our office is located on the first floor of Ferguson Hall (Suite 112), and our mailing address is P.O. Box C-122, Sul Ross State University, Alpine, Texas, 79832.

Libraries: The Bryan Wildenthal Memorial Library in Alpine.

Offers FREE resources and services to the entire SRSU community. Access and borrow books, articles, and more by visiting the library's website, library.sulross.edu. Off-campus access requires logging in with your LoboID and password. Librarians are a tremendous resource for your coursework and can be reached in person, by email (srsulibrary@sulross.edu), or phone (432-837-8123).

Academic Integrity: Students in this class are expected to demonstrate scholarly behavior and academic honesty in the use of intellectual property. A scholar is expected to be punctual, prepared, and focused; meaningful and pertinent participation is appreciated. Examples of academic dishonesty include but are not limited to: Turning in work as original that was used in whole or part for another course and/or professor; turning in another person's work as one's own; copying from professional works or internet sites without citation; collaborating on a course assignment, examination, or quiz when collaboration is forbidden.

Classroom Climate of Respect: Importantly, this class will foster free expression, critical investigation, and the open discussion of ideas. This means that all of us must help create and sustain an atmosphere of tolerance, civility, and respect for the viewpoints of others. Similarly, we must all learn how to probe, oppose and disagree without resorting to tactics of intimidation, harassment, or personal attack. No one is entitled to harass, belittle, or discriminate against another on the basis of race, religion, ethnicity, age, gender, national origin, or sexual preference. Still we will not be silenced by the difficulty of fruitfully discussing politically sensitive issues.

Diversity Statement: We aim to create a learning environment for our students that supports a diversity of thoughts, perspectives and experiences, and honors your identities (including race, gender, class, sexuality, religion, ability, socioeconomic class, age, nationality, etc.). We also understand that the crisis of COVID, economic disparity, and health concerns, or even unexpected life events could impact the conditions necessary for you to succeed. Our commitment is to be there for you and help you meet the learning objectives of this course. We do this to demonstrate our commitment to you and to the mission of Sul Ross State University to create an inclusive environment and care for the whole student as part of the Sul Ross Familia. If you feel like your performance in the class is being impacted by your experiences outside of class, please don't hesitate to come and talk with one of us. We want to be a resource for you.

Texas Teaching Competencies covered in this course:

001 Lab Processes, equipment, safety

F. Understand how to gather, organize, display and communicate data in a variety of ways (e.g., charts, tables, graphs, diagrams, written reports, oral presentations).

002 History and nature of science, role of inquiry

B. Focus inquiry-based instruction on questions and issues relevant to students and use strategies to assist students with generating, refining and focusing scientific questions and hypotheses.

- D. Know how to guide students in making systematic observations and measurements and posing questions to guide investigations.
- E. Know how to promote the use of critical-thinking skills, logical reasoning and scientific problem solving to reach conclusions based on evidence.
- J. Understand the roles that logical reasoning, verifiable evidence, prediction and peer review play in the process of generating and evaluating scientific knowledge.

003 Impact of Science on personal and social decisions

- C. Apply scientific principles and processes to analyze factors that influence personal choices concerning fitness and health, including physiological and psychological effects and risks associated with the use of substances and substance abuse.
- D. Understand concepts, characteristics and issues related to changes in populations and human population growth.
- E. Identify and understand the types and uses of natural resources and the effects of human consumption on the renewal and depletion of resources.
- F. Understand the role science and scientists can play in helping resolve personal, societal and global challenges.

004 Unifying Concepts and Processes

- A. Understand how a unifying, explanatory framework across the science disciplines is provided by the concepts and processes of systems, order and organization; evidence, models and explanation; change, constancy and measurements; and form and function.
- B. Demonstrate an understanding of how patterns in observations and data can be used to make explanations and predictions.
- D. Apply unifying concepts to explore similarities in a variety of natural phenomena.
- F. Understand how change and constancy occur in systems.
- H. Understand how models are used to represent the natural world and how to evaluate the strengths and limitations of a variety of scientific models (e.g., physical, conceptual, mathematical).

005 Students as Learners and Science Instruction

- A. Understand how developmental characteristics, prior knowledge and experience and students' attitudes influence science learning.
- B. Select and adapt science curricula, content, instructional materials, collaborations, vocabulary and activities to meet the levels of interest, knowledge and understanding as well as the abilities, experiences and needs of all students, including English-language learners.
- C. Understand how to use situations from students' daily lives to develop instructional materials that investigate how science can be used to make informed decisions.
- D. Understand common misconceptions in science and have effective ways to address those misconceptions.

- E. Understand developmentally appropriate design and implementation of hands-on learning experiences in science and select effective, appropriate instructional practices, activities, technologies and materials to promote students' scientific knowledge, skills and inquiry processes.
- F. Understand questioning strategies designed to elicit higher-level thinking and how to use them to move students from concrete to more abstract understanding.
- G. Understand the importance of planning activities that are inclusive and that accommodate the needs of all students.
- H. Understand how to sequence learning activities in a way that enables students to build on their prior knowledge and that challenges them to expand their understanding of science.

006 Science Assessment

- A. Understand the relationships between a science curriculum, assessment and instruction and base instruction on information gathered through assessment of students' strengths and needs.
- B. Understand the importance of monitoring and assessing students' understanding of science concepts and skills on an ongoing basis, including how to use formal and informal assessments of student performance and how to use products (e.g., projects, lab journals, rubrics, portfolios, student profiles, checklists) to evaluate students' understanding of and participation in the inquiry process.
- C. Select — or design — and administer a variety of appropriate assessments (e.g., performance assessment, self-assessment, formal/informal assessment, formative/summative assessment) to monitor students' understanding and progress and to plan for instruction.
- D. Understand the importance of communicating evaluation criteria and assessment results to students.

008 Physical and Chemical properties in matter, changes in matter

- D. Apply knowledge of physical and chemical properties (including atomic structure) of and changes in matter to processes and situations that occur in life and in earth and space science.
- F. Describe and explain the occurrence and importance of a variety of chemical reactions that occur in daily life (e.g., rusting, burning of fossil fuels, photo-synthesis, cell respiration, chemical batteries, digestion of food).

010 Energy Transformations and Conservation of energy and matter

- A. Describe sources of electrical energy and processes of energy transformation for human uses (e.g., fossil fuels, solar panels, hydroelectric plants).
- B. Apply knowledge of transfer of energy in a variety of situations (e.g., the production of heat, light, sound and magnetic effects by electrical energy; the process of photo-synthesis; weather processes; food webs; food and energy pyramids).
- C. Understand applications of energy transformations and the conservation of matter and energy in life and in earth and space science.

011 Structure and Function of Living Things

- A. Understand that living systems have different structures that perform different functions.
- B. Understand and describe stages in the life cycles of common plants and animals (including animals that experience complete and incomplete metamorphosis).
- C. Understand that organisms have basic needs.
- D. Analyze how structure complements function in cells, tissues, organs, organ systems and organisms.
- F. Understand the relationship between characteristics, structures, and functions and corresponding taxonomic classifications.

012 Reproduction and the Mechanics of Heredity

- A. Describe the processes by which plants and animals reproduce and explain how hereditary information is passed from one generation to the next.
- B. Compare and contrast inherited traits and learned characteristics.
- C. Understand the organization of hereditary material and how an inherited trait can be determined by one or many genes and how more than one trait can be influenced by a single gene.
- D. Distinguish between dominant and recessive traits and predict the probable outcomes of genetic combinations.
- E. Evaluate the influence of environmental and genetic factors on the traits of an organism.

013 Adaptations and Evolution

- A. Demonstrate knowledge of adaptive characteristics and explain how adaptations influence the survival of populations or species.
- B. Describe how populations and species change through time.
- C. Describe processes that enable traits to change through time, including selective breeding, mutation and other natural occurrences.

014 Relationships between Organisms and the Environment

- A. Understand that organisms respond to internal or external stimuli and analyze the role of internal and external stimuli in the behavior of organisms.
- B. Understand relationships between organisms and the environment and describe ways that living organisms depend on each other and on the environment to meet their basic needs.
- C. Identify organisms, populations or species with similar needs and analyze how they compete with one another for resources.
- D. Analyze the interrelationships and interdependence among producers, consumers and decomposers in an ecosystem (e.g., food webs, food chains, competition, predation).
- E. Identify factors that influence the size and growth of populations in an ecosystem.
- F. Analyze adaptive characteristics that result in a population's or species' unique niche in an ecosystem.

G. Know how populations and species modify and affect ecosystems.

015 Structure and Function of Earth Systems

- A. Understand the structure of Earth and analyze constructive and destructive processes (including plate tectonics, weathering and erosion) that produce geologic change, including how these processes have affected Earth history.
- B. Understand the form and function of surface water and groundwater.
- C. Apply knowledge of the composition and structure of the atmosphere and its properties.
- D. Apply knowledge of how human activity and natural processes, both gradual and catastrophic, can alter Earth systems.

016 Cycles in Earth Systems

- A. Understand the rock cycle and how rocks, minerals and soils are formed, and their respective properties.
- B. Understand the water cycle and its relationship to weather processes.
- C. Understand the nutrient (e.g., carbon, nitrogen) cycle and its relationship to Earth systems.
- D. Apply knowledge of how human and natural processes affect Earth systems.
- E. Understand and describe the properties and uses of Earth materials (e.g., rocks, soils, water, atmospheric gases).

017 Energy in Weather and Climate

- A. Understand the elements of weather (e.g., humidity, wind speed and direction, air pressure, temperature) and the tools used for measurement.
- B. Compare and contrast weather and climate.
- C. Analyze weather charts and data to make weather predictions.
- D. Apply knowledge of how transfers of energy between Earth systems affect weather and climate.
- E. Analyze how Earth's position, orientation, and surface features affect weather and climate.

018 Solar System and the Universe

- A. Understand the properties and characteristics of objects in the sky.
- B. Apply knowledge of the Earth–Moon–Sun system and the interactions among them (e.g., day and night, seasons, lunar phases, eclipses).
- C. Identify properties of the components of the solar system.

