"If a child is to keep alive his inborn sense of wonder, he needs the companionship of at least one adult who can share it, rediscovering with him the joy, excitement and mystery of the world we live in."
Rachel Carson

UNIVERSITY OF TEXAS AT SAN ANTONIO
College of Education
Department of Interdisciplinary Learning and Teaching

IDS 2413
EARTH SYSTEMS SCIENCE
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DEPARTMENT OF INTERDISCIPLINARY LEARNING AND TEACHING
Mission: The mission of the Department of Interdisciplinary Learning and Teaching is to foster the intellectual and professional growth and integrity of students and faculty through critical reflection and dialogue, civic responsibility, and leadership.

Goals: The Department of Interdisciplinary Learning and Teaching will create a context that nurtures interdisciplinary learners who:

- Acquire and demonstrate content and discipline knowledge
- Demonstrate an awareness and acknowledgement of and engagement in research-based, reflective, culturally responsive practices
- Are producers, disseminators, and critical consumers of research
- Demonstrate an awareness and acknowledgment of and engagement in social justice and equitable practices
- Articulate their professional philosophy and demonstrate a strong professional identity

COURSE DESCRIPTION

Study of major concepts, principles, and theories in the fields of earth and life sciences and ways of scientific thinking that contribute to empirical and theoretical inquiries. Study of the origin of the planet and solar system with special emphasis on geologic time and plate tectonics and their influence on biological evolution. Topics may include but not be restricted to: atmospheric and oceanic circulation; climate changes; natural resources; biological evolution and distribution; bio-diversity including specialization and adaptation; interaction and interdependence; genetic continuity and reproduction; growth, development, and differentiation; energy, matter, and organization; maintenance of a dynamic equilibrium. **Prerequisite: Completion of core curriculum requirements, including college algebra or higher math.**

KNOWLEDGE BASE

The basis for this course is the *National Science Education Standards (NSES)* for science content. These standards are designed to guide the nation toward a scientifically literate society. Founded in exemplary practice and research, the Standards describe a vision of the scientifically literate person and present criteria for science education that will allow that vision to become reality. Teachers must have theoretical and practical knowledge and abilities about science, learning, and science teaching. General science competencies for EC-4 and 4-8 in Texas (TEKS *Standards*) are correlated to the NSES and will also be addressed in the course. Lecture topics**,** laboratory activities and assignments are chosen to enhance and model course topics and reflect an understanding of the *National Science Content Standards* and the *Texas Essential Knowledge and Skills* for elementary and middle school science curricula. The *National Science Education Standards* can be downloaded from http://books.nap.edu/html/nses/ . The *TEKS* can be found at http://www.tea.state.tx.us/teks/

COURSE OBJECTIVES

As caring, responsible and scientifically literate persons, students enrolled in this course will be able to:

1. exhibit a holistic understanding of Planet Earth, recognizing that it is a system comprised of changing and interacting subsystems;
2. demonstrate an aesthetic appreciation of, and respect for, the beauty and value of the Earth, its grand cycles and its life;
3. exhibit a holistic understanding of individual organisms, recognizing that each is a system comprised of changing and interacting subsystems, and that each is also a part of environmental processes;
4. demonstrate an awareness that humans are unique, that our activities may seriously impact Planet Earth, and that individually and collectively we have the responsibility to make informed decisions on issues affecting the future of our planet and its inhabitants;
5. demonstrate wise use of Earth's limited resources;
6. access, sort, interpret, analyze, evaluate and apply information from a wide variety of sources;
7. use current technologies as tools to access and process information;
8. demonstrate skills for engaging in individual and collaborative scientific and social endeavors;
9. demonstrate effective communication skills within the context of science;
10. show an understanding of the basic concepts and principles of science, and apply them to identify issues, solve problems, make decisions and understand the world;
11. participate in "hands on" and inquiry-based activities in classroom and field settings; and,
12. participate in classroom and outside experiences, assignments, and activities that promote the *National Science Education Standards* and the *TEKS*.

CONCEPTUAL FRAMEWORK

(Excerpts from Dr. Art's Guide to Planet Earth by Art Sussman)

Earth is Whole

“One of our civilization's major discoveries is that we live on a round planet. Today we are in the middle of a more awesome discovery about the nature of our home. Earth is not flat. Earth is not round. Earth is whole.”

"Earth is Whole" means that all the planet's physical features and living organisms are interconnected. They work together in important and meaningful ways. The clouds, oceans, mountains, volcanoes, plants, bacteria and animals are all functioning parts of Earth's Operating System.

Systems within Systems within Systems

“We use the word "system" when we want to describe something that is made up of different kinds of parts that join together to form an interconnected whole. Learning to think in terms of systems is very useful because we are surrounded by all sorts of systems. In fact, each of us is our own little system.”

The Earth System

*“In examining Earth as a whole, we use systems thinking to focus on **Earth's matter, Earth's energy and Earth's life**. In other words, we are going to examine from a systems point of view the stuff (matter) that exists on planet Earth, the energy that makes things happen on planet Earth, and the organisms that make our planet unique in the solar system.”*

METHODS OF INSTRUCTION

Class discussions and activities will be hands-on, inquiry-based activities, utilizing whole group discussions, cooperative learning groups, and some individual projects. Lecture experiences will be designed around the learning cycle format (exploration, concept formation, and expansion), emphasizing the science process skills in discussions and demonstrations. Video-tapes, case studies, field trips, guest speakers, small and large group discussions, and the Internet will be utilized to support class activities.

USE OF TECHNOLOGY

Technology is recognized as not only an important methodology to utilize in the classroom, but in today's classroom, a necessary tool. Therefore, various forms of technology as instructional tools will be modeled in this course. This will include, but not be limited to, video tapes, overhead projectors, WebCT, Internet resources, WebQuests, and computer software. The use of the computer will be **required** in the writing of all written work submitted for evaluation.

Communication will occur periodically individually and as a class using electronic sources. WebCT provides a rich source for communication and idea exchange. Weekly agendas, syllabus, course materials and readings, updates, and announcements are available on this site. Please visit the site ASAP to become familiar with its tools. It is **your** responsibility to monitor the site on a regular basis.

REQUIRED COURSE MATERIALS

1. The Blue Planet. 1999. Skinner, Porter, and Botkin. John Wiley & Sons, Inc. Available at UTSA bookstore.
2. WebCT: Schedules, updates, links to selected sites, lecture outline, and other information will be posted on the WebCT. WebCT is subject to frequent revisions/postings. **Check the WebCT on a regular basis**.

COURSE REQUIREMENTS

Students are expected to complete all of the following:

1. Science Resource File

The project will consist of selecting an Earth Systems Science topic, and designing a resource file with suitable experiments/activities for the topic, appropriately correlated to the EC-4 or 4-8 TEKS science standards. Students will work in groups consisting of three to four participants. Each participant will take an active role in the project. Each group will present their resource file at a "Share Fair." Choose your group carefully as these will be GROUP grades, not individual grades. Details and instructions for the project will be distributed in class and posted on WebCT.

2. Chapter Reviews

In preparation for each major section of the course's conceptual framework, students will be required to complete a short preview of chapter readings. These chapter preview questions are posted on WebCT.

3. *WebQuests*

The Internet is a treasure trove of Earth science data, illustrations and photos, maps, and movies. Use of the World Wide Web can enrich your study of the Earth system by providing such visual and written information as satellite images, accounts of the most recent volcanic disaster, animations of ocean currents, and videos of landslides, floods, and hurricanes. Each group will complete four guided, inquiry-based Internet exercises known as a WebQuest. These WebQuests are posted on WebCT.

4. *Case Study*

The case studies provided to you and the interactive website (www.wiley.com/college/blueplanet) will allow you to see and explore the interaction of people and their environment. Details about the case study are posted on WebCT. You will share your group's thoughts and ideas on your case study research during the scheduled final exam.

5. Midterm and Final Content Exams

Each chapter identified in the weekly schedule will be discussed in class and summary notes of each chapter will be posted on WebCT. You will have an opportunity to be involved in one or more activities that extend the chapter content material. Two times during the semester, at midterm and at the conclusion, you will be given a written assessment of the content material covered in the chapter readings and class activities.

6. *Attendance and Participation*

Attendance in class will directly affect your participation grade. You will receive 10 points for each day you attend full class. Arriving late or leaving class early of more than 30 minutes will be equivalent to an absence and you will not receive any points for attendance.

ASSESSMENT AND EVALUATION

1.	Science Resource File (group grade)	20
2.	Web quests (4x5) (group grade)	20
3.	Chapter previews (5x20) (individual grade)	10
4.	Case Study (group grade)	20
5.	Midterm content exam (individual grade)	10
6.	Final Exam (individual grade)	10
7.	Participation and attendance	10
	Total	**100**

GRADING

A	90-100 pts.
B	80-89
C	70-79
D	60-69

Semester Grade Assignments:
“D” Demonstrates an **inadequate** level of class, attention, participation, preparation and professionalism as judged by the instructor’s expectations. Submitted projects are at an inadequate level.
"C" Demonstrates an **average** level of class attendance, attention, participation, preparation, and professionalism as judged by the instructor's expectations. Submitted projects are at an average level.
"B” Demonstrates a **high** level of class, attention, participation, preparation, and professionalism as judged by the instructor's expectations. Submitted projects must be at a high level.
"A” Demonstrates the **highest** level of class attendance, attention, participation, preparation, and professionalism as judged by the instructor's expectations. Submitted projects must be of the highest scholarly level.

ATTENDANCE POLICY
Class attendance and promptness is mandatory. The preservice teacher is preparing for a profession where attendance, promptness, and being well prepared and organized are vital. In addition, because this is a hands-on class, many instructional strategies will be demonstrated and lecture will be kept to a minimum. Learning by borrowing someone else’s class notes will be nearly impossible. It is therefore imperative that you be present, timely, and involved in all

aspects of the course. If students cannot make it to class, they are still responsible for the materials that they miss and the data log entry for that day. Attendance will be documented for each class period. It is the student's responsibility to sign in on the attendance sheet each class period.

Note: It is expected that for every hour spent in class, twice that amount of time should be spent outside of class on assignments, readings, and class preparation. If you find yourself unable to complete course requirements in a timely manner, refer to the university withdrawal policy and dates. Incomplete grades are infrequently given and are only given for dire emergencies. Becoming "overloaded" does not count as an emergency.

PROFESSIONALISM

An important part of this course is the growth students make toward becoming professional educators. Students are expected to submit work that represents their best effort. All assignments must conform to university policies governing academic dishonesty. All work submitted must be edited for grammar, spelling and correct sentence structure. Materials submitted in this class will be typed, double-spaced, single sided, 12 pt. font, and 1-inch margins). **The instructor reserves the right to deduct points from any assignment that does not conform to professional writing standards.**

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CLASS PARTICIPATION

An important requirement of this course is active participation in class lectures, experiments, and activities. It is expected that you will be prepared for each class period. Absences and inadequate preparation cannot be made up. **All assignments are due at beginning time of scheduled class. Late work will NOT be accepted.** Papers or projects that are late due to severe illness or personal emergency are accepted without deduction of points, but only when adequate documentation and approval of instructor are provided and MUST be completed no later than 7 days from due date. Papers or projects submitted more than 7 days after the due date will not be accepted, regardless if excused absence. **Late work will not be accepted for unexcused absences. Unexcused absences include those caused by traffic, babysitting problems, travel, advisor appointments, doctor's appointments, minor illnesses, car trouble, and others reasons not considered severe illnesses or emergencies.**

Throughout the semester you will be working in groups to complete assignments. While most of this group work will occur in the classroom, you may be required to work with your group outside of the lab time. It is your responsibility to work as an active group member. **If you do not actively work with your group members, you will have points deducted from your participation grade.** Students will complete a final evaluation of self and each group member and these evaluations will be used to determine class participation points.

UNIVERSITY POLICIES

The University expects every student to maintain a high standard of individual integrity for work done. Scholastic dishonesty is a serious offense, which includes, but is not limited to, cheating on a test or other class work, plagiarism (the appropriation of another's work and the unauthorized incorporation of that work in one's own work), and collusion (the unauthorized collaboration with another person in preparing college work offered for credit). In cases of

scholastic dishonesty, the faculty member responsible for the class may initiate disciplinary proceedings against the student. In this class all UTSA procedures will be followed and the necessary paperwork will be filed with the Office of Student life and the College of Education. The course instructor will recommend a penalty to the Office of Student Life, which may impose an additional university penalty.

ACCOMODATIONS FOR STUDENTS WITH SPECIAL NEEDS

If any member of this class feels that he/she has a disability and needs special accommodations of any nature whatsoever, the instructor will work with you and the Office of Disability Services to perform in this class. Students with disabilities must be registered with the Office of Disability Services located in MS 2.03.18 (Main Campus, 458-4157) or BV 1.302 (Downtown, 458-2838). Please advise the instructor of such disability and the desired accommodations at some point before or immediately after the first scheduled class period.

FLEXIBILITY CLAUSE

Flexibility is one key to learning. The instructor reserves the right to modify or change the assignments, sequence of assignments, or weight of assignments as necessary and as reflected by the needs of individuals or the group during the semester. This course outline represents a tentative listing of information and modifications may be assigned as necessary and appropriate. **If you are not in class, you may miss important information that directly affects your grade!**

"Must we always teach our children with books? Let them look at the mountains and the stars up above. Let them look at the beauty of the waters and the trees and flowers on earth. They will then begin to think, and to think is the beginning of a real education."

David Potis

SBEC SCIENCE STANDARDS
Grades EC-4 and 4-8

Standard VII. **The science teacher understands how science affects the daily lives of students and how science interacts with and influences personal and societal decisions.**

Teacher Knowledge: What Teachers Know
The beginning teacher knows and understands:
7.1k that human decisions about the use of science and technology are based on factors such as ethical standards, economics, and societal and personal needs;
7.2k scientific concepts and principles relating to personal and societal health, including the physiological and psychological effects and risks associated with the use of substances and substance abuse;
7.3k concepts related to changes in populations and to characteristics of human population growth;
7.4k types and uses of natural resources and the effects of human consumption on the renewal and depletion of resources;
7.5k the properties of natural ecosystems and how natural and human processes can influence changes in environments;
7.6k the principles of risk and benefit analysis and how it is used in the process of personal and societal decision making; and
7.7k the role science can play in helping resolve personal, societal, and global challenges.

Application: What Teachers Can Do
The beginning teacher is able to:
7.1s use situations from students' daily lives to develop instructional materials that investigate how science can be used to make informed decisions;
7.2s apply scientific principles and processes to analyze factors that influence personal choices concerning fitness and health;
7.3s analyze factors that affect the severity of disease and methods for preventing, controlling, or curing diseases and ailments;
7.4s analyze how factors such as population growth, resource use, population distribution, over consumption, technological capacity, poverty, and societal views can influence changes in environments;
7.5s apply scientific principles and the theory of probability to analyze the advantages, disadvantages, or alternatives to a given decision or course of action; and
7.6s demonstrate how science can be used to help make informed decisions about societal and global issues.

Standard IX. **The science teacher knows and understands the science content appropriate to teach the statewide curriculum (Texas Essential Knowledge and Skills [TEKS]) in life science.**

Teacher Knowledge: What Teachers Know

The beginning teacher knows and understands:

9.1k that living systems have different structures to perform different functions;
9.2k that organisms have basic needs;
9.3k that organisms respond to internal or external stimuli;
9.4k the relationship between organisms and the environment;
9.5k the life cycles of organisms; and
9.6k how populations or species evolve through time.
9.7k all content specified for teachers in grades EC–4;
9.8k the structure and function of living systems;
9.9k reproduction and the mechanisms of heredity;
9.10k adaptations of organisms and the theory of evolution;
9.11k regulatory mechanisms and behavior; and
9.12k the relationships between organisms and the environment.

Application: What Teachers Can Do

The beginning teacher is able to:

9.1s describe stages in the life cycle of common plants and animals;
9.2s identify characteristics of plants and animals;
9.3s identify adaptive characteristics and explain how adaptations influence the survival of populations or species;
9.4s describe the processes by which plants and animals reproduce and explain how hereditary information is passed from one generation to the next;
9.5s analyze the role of internal and external stimuli in the behavior of organisms;
9.6s compare and contrast inherited traits and learned characteristics;
9.7s describe ways living organisms depend on each other and their environment for basic needs;
9.7s describe ways living organisms depend on each other and their environment for basic needs;
9.8s analyze the characteristics of habitats within an ecosystem; and
9.9s identify organisms, populations, or species with similar needs and analyze how they compete with one another for resources.
9.10s apply all skills specified for teachers in grades EC–4, using content and contexts appropriate for grades 4–8;
9.11s analyze how structure complements function in cells, organs, organ systems, organisms, and populations;
9.12s identify human body systems and describe their functions;
9.13s distinguish between dominant and recessive traits and predict the probable outcomes of genetic combinations;
9.14s explain that every organism requires a set of instructions for specifying its traits;
9.15s describe how an inherited trait can be determined by one or by many genes and how more than one trait can be influenced by a single gene;
9.16s compare and contrast sexual and asexual reproduction;
9.17s compare traits in a population or species that enhance its survival and reproduction;

9.18s describe how populations and species change through time;
9.19s analyze responses in organisms that result from internal and external stimuli;
9.20s describe feedback mechanisms that allow organisms to maintain stable internal conditions;
9.21s identify the abiotic and biotic components of an ecosystem;
9.22s describe the interrelationships among producers, consumers, and decomposers in an ecosystem; and
9.23s analyze and describe adaptive characteristics that result in a population's or species' unique niche in an ecosystem.

Standard X. **The science teacher knows and understands the science content appropriate to teach the statewide curriculum (Texas Essential Knowledge and Skills [TEKS]) in Earth and space science.**

Teacher Knowledge: What Teachers Know
The beginning teacher knows and understands:
10.1k properties of Earth materials;
10.2k changes in Earth systems; and
10.3k characteristics of the Sun, moon, and stars.
10.4k all content specified for teachers in grades EC–4;
10.5k the structure and function of Earth systems;
10.6k cycles in Earth systems;
10.7k the role of energy in weather and climate;
10.8k characteristics of the solar system and the universe;
10.9k the history of Earth; and
10.10k the history of the universe

Application: What Teachers Can Do
The beginning teacher is able to:
10.1s describe properties and uses of rocks, soils, water, atmospheric gases, and other Earth materials;
10.2s describe characteristics of weather, tools for making weather measurements, and changes in weather;
10.3s describe forces and processes that change the surface of Earth (e.g., glaciers, earthquakes, weathering);
10.4s identify objects in the sky and describe their characteristics (e.g., Sun as Earth's major energy source, position of the planets in relation to the Sun); and
10.5s describe the basic characteristics of the Sun and other stars; analyze the consequence of the moon's orbit around Earth (e.g., phases of the moon) and Earth's orientation and movement around the Sun (e.g., day and night, the seasons).
10.6s apply all skills specified for teachers in grades EC–4, using content and contexts appropriate for grades 4–8;

10.7s analyze and describe characteristics of the geosphere, the hydrosphere, the atmosphere, and the biosphere;
10.8s analyze a variety of Earth cycles (e.g., rock cycle, water cycle, carbon cycle, nitrogen cycle);
10.9s analyze and describe how human activity and natural processes, both gradual and catastrophic, can alter Earth systems;
10.10s identify properties of and analyze interactions among the components of the solar system;
10.11s explain weather measurements and analyze weather processes;
10.12s analyze how the Earth's position, orientation, and surface features affect weather and climate; and
10.13s examine characteristics of the universe, such as distances, stars, and galaxies, and describe scientific theories of the origin of the universe.

Standard XI. **The science teacher knows unifying concepts and processes that are common to all sciences.**

Teacher Knowledge: What Teachers Know
The beginning teacher knows and understands:
11.1k how systems and subsystems can be used as a conceptual framework to organize and unify the common themes of science and technology;
11.2k how patterns in observations and data which explain natural phenomena allow predictions to be made;
11.3k how the concepts and processes listed below provide a unifying framework across the science disciplines:
- systems, order, and organization;
- evidence, models, and explanation;
- change, constancy, and measurements;
- evolution and equilibrium; and
- form and function;

11.4k properties and patterns of systems can be described in terms of space, time, energy, and matter;
11.5k how change and constancy occur in systems;
11.6k the complementary nature of form and function in a given system; and
11.7k 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).

Application: What Teachers Can Do
The beginning teacher is able to:
11.1s apply the systems model to identify and analyze common themes that occur in physical science, life science, and Earth and space science;
11.2s analyze a system (e.g., a cell, the ocean, an ideal gas) in terms of cycles, structure, and processes;

11.3s analyze the general features of systems (e.g., input, process, output, feedback);
11.4s analyze the interactions that occur between the components of a given system or subsystem;
11.5s analyze the interactions and interrelationships between various systems and subsystems; and
11.6s use the systems model to analyze the concepts of constancy (e.g., conservation of mass, energy, and momentum) and change (e.g., evolution).