

Syllabus

INSTRUCTOR: _____

E-MAIL: _____

OFFICE: _____

PHONE: _____

OFFICE HOURS: _____

COURSE WEBSITE: <http://homepages.wmich.edu/~hpetcovic/geos2900.html>

COURSE DESCRIPTION

“This laboratory-Based course is a continuation of GEOG 1900 and is specifically designed for prospective elementary teachers. The objectives of the course are to aid students in developing meaningful and functional understanding of key earth science concepts and their interrelations; to provide students with open-ended problems solving environments that facilitate insight in the nature of science as an intellectual activity; to explore alternated conceptions of scientific phenomena; to help students develop more positive attitudes about science and increase their confidence in their ability to do science.” (WMU Undergraduate Course Catalog)

COURSE RATIONALE

Under state accreditation guidelines, elementary education programs are required to prepare future elementary teachers to teach science and mathematics at the K-8 level. The science and mathematics program for students enrolled in the elementary education or special education curriculum at WMU includes six science and two math content courses. GEOS 2900 is one of these content courses. It has been specifically designed to prepare future teachers (you!) to teach earth science at the K-8 level with reference to state and national benchmarks for scientific literacy. Methods regarding how to teach science in the K-8 classroom are taught in a separate course, ED 4010 Teaching Elementary School Science.

What is Earth System Science?

Together, GEOG 1900 and GEOS 2900 will engage you in learning key concepts and principles of Earth System Science. What do we mean by the “Earth System?” Our planet can be thought of as having four basic components – the land surface and interior of the Earth (geosphere), water and ice (hydrosphere), air (atmosphere), and living creatures (biosphere). In order to understand how the earth works, we need to understand not only the processes that occur in each of these components, but how these components interact with each other. Additionally, we must consider the place of the earth in the solar system and universe, and how the earth and its inhabitants have changed through time. In short, Earth System Science considers our planet as a collection of systems through which matter and energy continuously cycle.

GEOG 1900 provides an introduction to earth system science, addressing aspects of the sun-earth-moon system, the processes that occur in the earth’s atmosphere and hydrosphere, how these processes create the earth’s weather and climate, and how humans interact with weather and climate systems. GEOS 2900 continues this exploration of earth system science, considering processes in the earth’s interior, materials that make up the earth, how the earth has changed through time, processes that occur at the earth’s surface, and how humans interact with the earth system. In addition to learning key principles of earth system science, you will also be expected to consider alternate conceptions that learners hold and how these conceptions impact teaching and learning.

Together, GEOG 1900 and GEOS 2900 have been designed to meet benchmarks indicated in Strand V of the Michigan Curriculum Framework (Earth and Space Sciences). GEOS 2900 addresses benchmarks in the areas of Standard V.1 (Geosphere), Standard V.2 (Hydrosphere), and Standard V.4 (Solar System, Galaxy, and Universe). GEOG 1900 addresses benchmarks in the areas of Standard V.2, Standard V.3 (Atmosphere and Weather), and Standard V.4. Additionally, students will reflect upon elements of Strand 1 (Construct New Scientific and Personal Knowledge) and Strand II (Reflecting on Scientific Knowledge) in many of the activities. The course website includes links to current state and national standards, and to the Michigan Test for Teacher Certification in Elementary Science.

The Inquiry Approach

In the inquiry approach to learning, you will engage in numerous hands-on activities, where you will 'discover' the principles and concepts of earth science. You will then use these concepts to understand and explain much of the phenomena that you observe in Michigan and around the world. Work through each activity carefully and use the questions to help guide your thinking as you determine what is happening. Once you understand the processes involved, you can begin to synthesize the ideas into a general statement which summarizes the principles and concepts. The next stage is to apply the information to explain new situations or data. An important part of this learning process is discussion. You and other students will exchange ideas and suggestions, with the intent of gaining a better understanding of earth science.

Science is not a list of facts and principles to learn, it is a way of looking at the world and asking questions. (F. James Rutherford)

Sometimes, teachers and students are apprehensive about getting into science. They may have not had much formal training in science. They worry about doing activities and experiments "correctly". But activities may not always work out as planned. That's okay! Practicing scientists experience failure far more often than success, and sometimes learn more from ideas or experiments that fail. In this course, there is usually more than one way to do a given activity and often there is more than one possible result. The activities in this course will guide you towards the scientifically accepted ideas and concepts, but also allow you to learn about how science is done.

ACKNOWLEDGEMENTS

The initial development of this earth science course was part of a significant three-year grant from the U.S. Department of Education FIPSE (award # P116B51275) to science education faculty at Western Michigan University, designed to fund the creation and implementation of a complete science curriculum for elementary teachers based on the principle of learning science through inquiry. The first earth science course in this curriculum was taught in the winter of 1998.

This course represents the cumulative efforts of many individuals over the past eight years. Ron Chase of the Department of Geosciences and Joe Stoltman of the Department of Geography developed the initial activities included in this course pack. Diana Casey, Department of Geography, Muskegon Community College, served as a consultant. Project Earth Science: Meteorology, a publication by the National Science Teacher's Association, served as a foundation for some of the geology activities.

Review and revision of this course and course pack was undertaken in 2004-2005 by Heather Petcovic with the valuable assistance and advice of Beth Carpenter-Walsh. Conversations with Joe Stoltman, David Rudge, Lisa DeChano, Robert Ruhf, and Bill Cobern have significantly helped to improve this course. Debra Bryant has also contributed to improvements and additions to the course. Feedback from current and former students has also help to inform changes to the course, and it is hoped that input from current students will improve this experience for future students.

COURSE GOALS

Students will:

1. Understand why it is important for children to learn earth science;
2. Learn key concepts of earth science through the process of inquiry;
3. Be able to reflect upon the nature and practice of earth science as a process rather than a body of disconnected facts to be memorized;
4. Be better able to make decisions concerning what concepts in earth science are the most important for children to learn; and,
5. Reflect upon how they themselves learn earth science and the implications of these reflections for how it should be taught.

COURSE OUTCOMES

By the end of this course, students will:

- Be familiar with the Michigan Benchmarks for Science Literacy in the context of the Earth Science Strand V: Geosphere, Hydrosphere, Atmosphere, and Solar System and Universe (Goal 1);
- Be able to relate the study of earth science to contemporary, historical, technological, and societal issues (Goal 1);
- Be familiar with key concepts, developments, and reasoning strategies used in earth science such that they are able to solve problems in open-ended, inquiry environments using materials, maps, data collection tools, models and computer simulations, other class activities and discussions, and background readings (Goals 2 and 3);
- Be able to describe fundamental aspects of the nature of science and scientific inquiry within the discipline of earth science (e.g. role of observation and inference, empirical basis, role of creativity, validity of claims, multiple methods, among others) (Goal 3);
- Be able to locate and evaluate lesson plans and other curricular materials in the earth sciences using both traditional (i.e., books, journal articles) and web-based resources (Goal 4).
- Become familiar with common misconceptions both adults and children have in the earth sciences through a research investigation and interviews with children (Goals 4 and 5).

STUDENT RESPONSIBILITIES

As a student in this course, it is your responsibility to:

1. Come to class on time, every time, ready to learn. This means completing all assignments on time and bringing all required materials to each class meeting.
2. Actively participate in class activities and discussions. Remember you are responsible for your own learning in this course.

3. Actively promote an environment of learning, fairness, and respect for everyone in the classroom.
4. Be familiar with all policies and procedures for the course, particularly policies for academic honesty.
5. Do your best work. Grades in this course are earned – a poor performance will result in a poor grade, and good work will result in a good grade.

INSTRUCTOR RESPONSIBILITIES

As the instructor for this course, it is my responsibility to:

1. Ensure that the classroom learning environment is one of openness, fairness, and respect for all.
2. Judge your work as honestly and fairly as possible. I will try to grade and return work within one week of when I receive it.
3. Challenge you to do your best in this course. I will not provide easy answers, but I will support and guide your efforts during the learning process.
4. Be available for consultation (during office hours or by appointment) if you need help with class material or if you have a problem or concern.

POLICIES AND PROCEDURES

Attendance and participation

Please know that attendance and participation are required in this course – it is impossible to earn a good grade without regular attendance and effort. Generally, the only excusable absences in this class will be health-related or those due to serious family emergencies. It is YOUR responsibility to inform instructors in advance if an absence is required.

In the event that you miss class, it is YOUR responsibility to get class notes, assignments and handouts. There will be no make-ups on in-class activities.

Additionally, no make-ups for in-class writings or exams will be given without an extremely valid and documented reason. If you miss an in-class writing or exam, contact your instructor as soon as possible. If class is canceled and an exam is scheduled, the exam will be given the following class meeting. The final exam will be given during the university scheduled time.

Please arrive promptly at the beginning of class, or a few minutes early. If you are late, please do not disrupt the class with your arrival.

A large portion of what you learn in this class will be from interactions within your group, or from discussions with the whole class. During discussions, please listen carefully to the ideas of others and try to understand what they are saying. Show respect for others' ideas, even though you might disagree. Everyone is expected to participate in discussions, although not on every question. Your instructor may weigh your classroom participation and effort in the determination of final grades.

Classroom procedures

No food or drinks in the classroom. Much of the equipment and laboratory materials we use are expensive to replace. Also, we often work with rock samples, soil, and chemicals.

Please clean up your work area at the end of every class. Return all equipment and materials to the carts, and properly dispose of all waste. Many other classes use this room and we need to work together to keep it clean.

Please silence cell phones and pagers during class.

Computers are provided for your use in the classroom. You are also welcome to bring portable computers to class, although our wireless internet access is not good. Technology devices of ANY type (cell phones, PDA's, laptops) will NOT be allowed during in-class writing or exams, expect when explicitly indicated on the exam.

Required materials and late work policy

For this course you will need to bring to each meeting:

- The course pack "How the Earth Works: An Experimental Approach"
- A spiral bound notebook OR binder with loose-leaf paper for your notes

To access and complete the homework assignments you will need a computer with:

- An internet connection (preferably broadband, dial-up will be very slow)
- An updated browser (Internet Explorer 6, Mozilla, or Firefox)
- Your BroncoNet ID and password
- Adobe Acrobat Reader or other software that reads PDF files
- Java Runtime Environment 5.0 Update 6

All written work is expected to be neat and thorough, with complete sentences, proper spelling, and correct grammar and punctuation. Unless otherwise indicated, please type all work using 12-point font, double line spacing, and 1-inch margins. Work that does not meet these requirements will be returned ungraded.

Late work will not be accepted beyond one class session after the due date. A 20% penalty will be assessed against the maximum possible points for any late assignment. Assignments are due on the date specified regardless of whether or not you are in class. If you miss class on the day an assignment is due, email the assignment to your instructor to avoid the late penalty.

No "extra-credit" projects, reports etc., are possible in this course. Please do not ask!

Students with special needs

Students who require special accommodations in this course are asked to inform the instructor as soon as possible. I will make every effort to meet your requests.

Academic Honesty

You are responsible for making yourself aware of and understanding the policies and procedures in the Undergraduate Catalog that pertain to Academic Honesty (pp. 274-276). These policies include cheating, fabrication, falsification and forgery, multiple submission, plagiarism, complicity and computer misuse.

If there is reason to believe you have been involved in academic dishonesty, you will be referred to the Office of Student Conduct. You will be given the opportunity to review the charge(s). If you believe you are not responsible, you will have the opportunity for a hearing.

You should consult with your instructor if you are uncertain about an issue of academic honesty prior to the submission of an assignment or test.

Students often misunderstand what plagiarism is; therefore please make sure you understand what plagiarism is and how to avoid it. If you are unsure, I strongly recommend you visit <http://www.indiana.edu/~wts/pamphlets/plagiarism.shtml>. All material taken from print, web, or other sources should be properly cited (author, date, source). Unless your instructor tells you otherwise, all work for this course should be written in your own words.

For security purposes grades will not be emailed to individual students. Grades can be tracked using the WebCT Vista Gradebook.

SAFETY

Laboratory safety is very important. In this course we will follow very strict safety procedures, similar to those you will be using in your own classrooms. It is important that you adhere to safety procedures at all times. Make sure that you look for and follow safety notes during experimentation.

- Observe all manufacturer safety precautions in handling chemicals. Wash hands thoroughly after leaving the laboratory.
- Observe all safety precautions with heating devices/lamps, and handle all heated materials with care.
- Use liquid soap and/or water when inserting thermometers through narrow openings.
- Be sure electric cords are coiled away from any sinks or pans filled with water.
- Cleanup all water spills with paper towel or a mop.
- Dispose of broken glassware in appropriate containers.
- Dispose of solid waste in appropriate containers, not in the sink.
- Report all accidents, spills, and injuries, no matter how small, to your instructor at once.
- Completely follow all directions given by your instructor.

In the event of a fire or fire alarm, gather your personal belongings and exit the classroom, then exit the building through the double doors to the right. Wait outside on the south side of Wood Hall with your classmates and instructor. Do not attempt to re-enter the building until your instructor indicates that it is safe to do so.

In the event of a tornado warning announcement, gather your personal belongings and follow your instructor to the tornado shelter.

GRADES

Grades will be earned and determined by the following:

Assignment	Grade Proportion
In-Class Activities (group)	25%
Homework Assignments (individual)	15%
Group Investigation and Presentation	10%
Exam 1	15%
Exam 2	15%
Final Exam (cumulative)	20%

Percentage	Grade
100 - 93	A
92 - 88	BA
87 - 82	B
81 - 76	CB
75 - 70	C
69 - 65	DC
64 - 60	D
59 - and below	E

Your lowest grade on a single in-class activity OR homework assignment will be dropped.
Grades for the group investigation and exams are not eligible to be dropped.

All exams must be returned to the instructor at the end of the class period in which they are returned to students.

Your instructor may choose to raise or lower your final grade by one percentage point based on your class participation and effort.

Any questions regarding your final grade need to be addressed within 1 month of the end of the semester. All unclaimed student materials will be retained by the instructor for 1 year after grades have been assigned, then destroyed.

Course Schedule

Week	Tuesday	Thursday
1/8	Introduction/Solar System	Earth Structure (1.1.1)/Tectonics (1.1.2)
1/15	Tectonics (1.1.2)	Plate Motion (1.1.3)
1/22	Earthquakes (1.2.1)	Volcanoes (1.2.2)
1/29	Minerals (1.3.1)	Rock Cycle (1.3.2)
2/5	Igneous & Metamorphic Rocks, Part 1 (1.3.3)	Igneous & Metamorphic Rocks, Parts 2-4 (1.3.3)
2/12	Sedimentary Rocks, Part 1 (1.3.4)	Sedimentary Rocks, Parts 2-4 (1.3.4)
2/19	Exam 1	Soil (2.1.1)
2/26	Wind, Water, & Sand (2.1.2)	Beach Systems (2.1.3)
3/5	SPRING BREAK	SPRING BREAK
3/12	Glaciers (2.2.1)	River Systems (2.2.2)
3/19	Groundwater, Parts 1-2 (2.2.3)	Field Trip*
3/26	Groundwater, Part 3 (2.2.3)	Exam 2
4/2	Fossils (3.1.1 and 3.1.2)	Relative Age Dating (3.2.1)
4/9	Absolute Age Dating (3.2.2)	Earth History (3.3.1)
4/16	Group Presentations	Group Presentations
4/23	Final Exam	

*Date of field trip subject to change due to weather.

IMPORTANT DATES:

Project proposal due: January 25

Exam 1: February 20

Research paper and preliminary lesson plan due: March 1

Exam 2: March 29

Group project presentations: April 17 and 19

Final research paper, lesson plan, and handout due on the day of the presentation

Final Exam:

10 am section: Friday, April 27, 8:00-10:00 am

1 pm section: Friday, April 27, 10:15 am-12:15 pm

Assignments

In-Class Assignments

Most of our work will be completed in class. Each class activity will generally begin with a class discussion of the topic to be investigated. In order to be prepared for the class discussion, you are expected to:

1. Read through the assigned activity PRIOR to coming to class.
2. Complete the “Before you begin” questions for each assigned activity. These questions will be used to generate discussion of the day’s investigation. These questions are intended to draw upon your ideas or prior knowledge of the subject.

For each in-class activity, the instructor will announce which Outcome questions are to be turned in to be graded. Please type your responses to the outcome questions on the classroom computers. Use 12 point font, 1-inch margins, and double spacing. Attach sketches, tables, or other data collected during the activity as required. Assignments that do not meet these requirements will be returned ungraded. Print out and turn in one set of outcome questions for your group. In-class assignments will receive a group grade.

In-class assignments are worth 20 points each. Grading is based on the completeness and accuracy of the answer; be careful to answer all parts of each question and to support your answer with data from the assignment.

Homework Assignments

Read and Reflect

Each in-class activity in the course pack ends with a “Read and Reflect” assignment. The main purpose of these assignments is to support the in-class learning by reinforcing key concepts discussed in class through a brief reading assignment and targeted questions. Read and Reflect assignments also may introduce additional material not covered in class. Questions on exams will draw from this material, in addition to the in-class material.

Read and Reflect assignments are accessed through the course WebCT Vista portal. Reflection questions are also provided in the course pack at the end of each section. To access the assignments:

1. Log onto the GoWMU webpage (<https://gowmu.wmich.edu/cp/home/displaylogin>) with your BroncoNet ID and password. If you do not have an ID and password, or if you are experiencing problems, contact the WMU Help Desk.
2. Scroll down to the WebCT box and click on “WebCT Vista.”
3. Click on “Earth Science For EI Ed II.” This will automatically open the WebCT Vista interface.
4. Readings can be accessed through the “Course Content” or the “Learning Modules” tabs. Reflection questions can be accessed through the “Learning Modules” or “Assessment” tabs. Threaded discussions can be accessed through the “Learning Modules” or “Discussion” tabs.

The WMU OIT Center recommends that you use a computer with a broadband connection to access the WebCT Vista interface. Computer software requirements, tips for connecting and running WebCT Vista, and troubleshooting information are provided in the Supplemental

Materials section of the course pack. WebCT Vista help for students is available at <http://www.wmich.edu/vista/students/index.html>, or from the Help Desk.

Reflection assignments must be completed through WebCT Vista (in Vista these are called “assessments”). Each reading and reflection assessment will become available at the end of our regular class meeting time. You will have until 8 am on the day of the next class meeting to complete the assessment. Your instructor will then review and grade the assessments, and any problems will be discussed that day in class.

In the event that you experience technical problems while accessing the readings or completing the reflection assessments (for example, unable to log on, dropped connection), you may complete the reflection questions on paper. A copy of each reading assignment is available in the Commons Area. Complete the questions in your course pack and turn these in at the start of class with no late penalty. Assignments will not be accepted more than 1 class period late, except in the event of an excused absence. Occasional technical difficulties are to be expected, but if you have chronic technical problems please consult with your instructor.

Reflection assessments will be worth 10 points each. Grading will consider the accuracy and thoroughness of your response.

Some of the reflection questions will ask you about what you have learned from the readings. Other questions will draw on what you have learned in class, or on your own ideas. These questions should reflect individual effort; you may share ideas with others in the class, but your responses should be entirely in your own words. Copying the readings or other sources for your answer is unacceptable and will be considered plagiarism. No credit will be given for plagiarized responses, and repeated offenses will be reported as an incident of academic dishonesty.

Threaded Discussions

On-line discussions are part of the Read and Reflect assignments. There are 10 discussion questions associated with different topics. These questions ask you to share your ideas and opinions with the class. Your instructor will monitor the discussions.

You will earn up to 10 points towards your homework grade by participating in the threaded discussions. You will be awarded 2 points for making a substantive contribution to the discussion. Your comment should be directed at the question, as well as a response to what other students have said. This means that in order to earn credit, you need to make a remark that shows thoughtful reflection about the question. Comments such as “yeah,” “right on,” or “I agree” will not earn credit. Repeating another person’s comment will also not earn credit.

Discussion threads are to be used only for answering the posed questions. Please be respectful of other people’s opinions when participating in the discussions. Comments that are irrelevant to the topic under discussion will be removed by your instructor. Misuse of the discussion tool, or disrespectful behavior toward others in the class will not be tolerated, and your access to the discussion tool will be blocked by your instructor.

Misconceptions Group Investigation and Presentation

A growing body of educational research demonstrates that the ideas children (and adults) already hold have a tremendous impact on learning. Many of these ideas are based on everyday experience, but they might not be “correct” according to accepted scientific ideas. This becomes a problem in the classroom – when you begin to teach a new concept, it is very likely that children already have ideas about that concept. How do you find out what ideas children already hold? How do you take these alternate ideas into account when planning your teaching? How do you change children’s alternate conceptions so that they are scientifically “correct?” This investigation will explore the answers to these questions.

In this project, you will:

- Select a topic in earth science that is commonly taught in the elementary grades.
- Research, using Web and library sources, what ideas children hold about this topic
- Talk to a child or group of children to find out what ideas they hold and the reasons for their prior ideas.
- Demonstrate a mature (adult) understanding of this topic.
- Design a lesson plan that (1) demonstrates an awareness of alternate conceptions children commonly hold about your chosen topic, (2) encourages learners to change their misconceptions, and (3) evaluates whether your lesson has been successful in changing students’ ideas.
- Present the findings of your research and a demonstration of your lesson plan to the class.
- Evaluate your peer’s presentations and your partner’s contribution to the project.

Choosing a Topic and Getting Started

Work in groups of 2 for this assignment. With your partner, sign up for a presentation time slot through the WebCT Vista portal.

All work associated with this project is to be typed using 1-inch margins, 12 point font, and double line spacing. Work that does not meet these requirements will be returned ungraded.

Start your research by going to the class website or the WebCT Vista site. Follow some of the links to earth science misconceptions among children and adults. A general Web search for "earth science misconceptions" is also recommended (or try "geology," "weather," "space," or other specific topics instead of "earth science"). Instead of “misconceptions,” also try “alternate conceptions” or “preconceptions.” In addition to websites, look for information in journal, book, and magazine articles. The WMU education library is a wonderful source of information; be sure to spend some time there. *Science Scope* is a magazine for elementary science teachers put out by NSTA and often has useful articles about teaching and children’s ideas. The *Journal of Geoscience Education* often publishes research related to misconceptions in teaching.

In addition to library research, you will talk to a child or group of children to gain an understanding of their ideas about your chosen topic. Each group is expected to talk to at least 1 child. Be sure to talk to a child who is close to the grade level for which you plan to develop your lesson. This does not have to be a long or formal interview – simply talk to the child or children to draw out what ideas they have about your topic, and where these ideas come from.

Components of the Project:

Proposal: A paragraph describing the topic of your investigation, the specific misconception you are targeting, and the grade level(s) your lesson is targeted towards. Also include your preliminary list of references. You must have at least five references, only three of which may be from Web sources (you may cite your interview with a child or children as a reference). Your instructor will review these and make comments or suggestions.

Preliminary Research Paper and Lesson Plan: A complete draft of your research paper and lesson plan (typed, double-spaced). The research paper should be a summary of your research findings. It should consist of 1 to 2 pages describing the web and library research you have found related to the misconception, and the results of the interview(s) you conducted. The research findings should also demonstrate an adult-level understanding of the topic or concept you have chosen. Be sure that you cite the source of all materials.

The lesson plan will be 4-6 pages (double-spaced, typed). Both the preliminary and final versions of your lesson plan should include the following information:

3. **Title** -- meaningful and interesting.
4. **Overview of lesson** -- summary of what is to be done during the lesson.
5. **Rationale** – connect the lesson plan to the curriculum
 - a. Specific misconception that is being addressed by the lesson.
 - b. Why students should learn this material.
 - c. Grade level.
 - d. When it is to be taught as part of which unit.
 - e. Grade-level appropriate national standard(s) addressed by the lesson (see course website for more information about state and national standards).
 - f. Grade-level appropriate Michigan benchmark(s) or content standard(s) being addressed by the lesson
6. **Materials** -- needed by student and teacher (specify).
7. **Learning Outcomes** – what students will know or be able to do by the end of the lesson. These should be specific and clearly related to the misconception.
8. **Opening the lesson** -- how you will introduce the lesson. Think of an interesting and innovative way to capture the students' attention and imagination. How will you find out what ideas and potential misconceptions students already hold about this topic? Be sure to find out student ideas prior to introducing vocabulary or concepts.
9. **Developing the lesson** -- use an inquiry approach. How will you encourage your students to discover the scientific concepts for themselves? Describe activities of differing paces that keep the students' attention and address learning objectives. How will you change the misconception you identified?
10. **Closing the lesson** -- devise an innovative way to summarize concepts and skills learned in the lesson.
11. **Extending the lesson** -- homework or enrichment to be done outside of the classroom that reinforces important concepts.
12. **Assessment** – describe how you will evaluate whether the students have achieved the learning outcomes. Was the lesson effective in promoting a scientifically correct understanding of the content? Use a problem solving application of the concepts and skills taught in the lesson, NOT a test or quiz.
13. **References** – note all of the sources you used in developing the lesson.
14. **Additional materials (if needed)** – worksheets or handouts for the students, examples of songs, journals, poems, etc. Any supplemental materials that enhance your lesson. These are considered “additional” material and will not be counted in the 4-6 page limit.

Again, your instructor will review the preliminary drafts of the research paper and lesson plan, and make comments and/or suggestions for improvement.

Final Presentation: You will have 20 minutes to present your research and lesson plan to the class. Presentations should make use of visual aids (PowerPoint slides, overheads, posters, etc.). Both members of the group are expected to contribute equally to the presentation. You may borrow or use any materials normally found in the GEOS 2900 classroom for your demonstration.

Your final presentation should include the following information:

1. **Introduction:** (estimated 1-2 minutes) What is the misconception your group is investigating? (Include both the topic and the grade level you are addressing.) What is a “correct” scientific understanding of this concept? Why is it important that students learn this material and that you challenge and try to change this misconception in your teaching?
2. **Research Findings:** (3-5 minutes) What studies have been done related to this misconception? What have these studies found? Include references to these studies. Also discuss the findings of your interview(s) with a child or children.
3. **Lesson Plan:** (12-15 minutes) Give an overview of the lesson plan to the class. Describe the entire lesson, and model at least part of the lesson to the class (“pretend” we are your future students, and have the class participate in part of the lesson). You will likely only be able to present part of the lesson, so decide which part you wish to demonstrate. Be sure to include how you would evaluate whether your teaching has effectively changed your students’ ideas.
4. **Conclusions:** (1-2 minutes) What have you learned from this investigation? How will this information help you to become a better teacher?

Along with the presentation, prepare a 1-2 page **handout** for the class that describes the main points of your lesson. In your handout include the following information:

1. **Title** of the lesson and **Authors** (your names)
2. **Overview** that summarizes the topic, misconception, and grade level; also describes what is to be done during the lesson.
3. **Benchmarks** addressed by the lesson (national and Michigan)
4. **Materials** needed by student and teacher (specify).
5. **Description of the lesson** that includes learning outcomes, how the lesson develops, and homework and assessment associated with the lesson.
6. **References** used in developing the lesson.

Final Research Paper and Lesson Plan: On the day of your presentation, the final versions of your misconceptions research paper and lesson plan are due. Use the same format as you did for the preliminary research paper and lesson plan (detailed above). Include your graded proposal and preliminary research paper and lesson plan when you turn in the final version. Your instructor will be looking to see that you followed through on suggestions for improvement.

Evaluation: In addition to presenting your own research, you will evaluate three presentations given by your peers. Use the scoring rubric provided (next pages). Each evaluation is worth 5 points graded on the quality of feedback you provide to other groups. You also will evaluate your partner’s contribution to the project.

Grading

Presentations will be graded on how well they meet the criteria specified in the scoring rubrics (next pages). Points are allocated as follows:

1. Proposal (5 points)
2. Preliminary research paper and lesson plan (10 points)
3. Final research paper and lesson plan (40 points)
4. Presentation and class handout (40 points)
5. Evaluation of three presentations (15 points)
6. Your partner's evaluation of your contribution to the project (5 points)

Your presentation grade will be 50% your instructor's score, and 50% the average of your peers' scores. Peer scores and comments will be shared with the presenters.

Only your instructor will see the evaluation of your partner's contribution to the project. This score will be reported as part of the project total grade.

SCORING RUBRIC: PROPOSAL

Names of Group Members: _____

Title of Project: _____

				Points Earned:	Comments:
Proposal					
Topic is appropriate to earth science and grade level selected, and specific misconception is identified (3 points)	Specific misconception is identified, but topic is not appropriate to grade level, or is not earth science (2 points)	Topic and grade level are appropriate, but specific misconception is not identified (1 point)	Topic is inappropriate and no misconception is specified (0 points)		
Five references (min. 2 non-web) are indicated (2 points)	Three to four references, or insufficient non-web resources indicated (1 point)	Two or fewer references are indicated (0 points)			
TOTAL (out of 5)					

SCORING RUBRIC: PRELIMINARY LESSON PLAN AND RESEARCH FINDINGS

Names of Group Members: _____

Title of Project: _____

				Points Earned:	Comments:
Preliminary misconceptions report					
Research findings related to the misconception from at least one source are discussed (2 points)	Research findings do not address children's ideas about the topic (1 point)	Summary of research findings is missing (0 points)			
At least one child was interviewed about his/her ideas on the chosen topic, and results are discussed and compared to research findings (3 points)	At least one child was interviewed about his/her ideas on the chosen topic and results are discussed, but the child's ideas are not compared to other research findings (2 points)	The results of the interview are mentioned but not discussed (1 point)	No child was interviewed (0 points)		
Preliminary lesson plan					
Lesson directly addresses the misconception and explores children's alternate ideas (3 points)	Lesson directly addresses the misconception but does not allow children to explore their ideas (2 points)	Lesson is related to the misconception but does not directly confront it (1 point)	Lesson is not appropriate to address the misconception (0 points)		
All required information is present in adequate detail to understand the lesson (2 points)	Required lesson plan information is missing or incomplete (1 point)	Significant information about the lesson plan is missing (0 points)			
TOTAL (out of 10)					

SCORING RUBRIC: FINAL MISCONCEPTION REPORT AND WRITTEN LESSON PLAN

Names of Group Members: _____

Title of Project: _____

				Points Earned:	Comments:
Final Misconception Report					
One or more studies describing children's ideas about the topic are described (3 points)	One or more studies are mentioned but findings are not described (2 points)	Misconception is discussed but not linked to a specific research study (1 point)	No studies are described or mentioned (0 points)		
Studies are cited so that it is obvious which information came from which study (2 points)	Studies are not clearly cited (1 point)	Studies are not cited (0 points)			
At least one child was interviewed about his/her ideas on the chosen topic, and results are discussed and compared to research findings (3 points)	At least one child was interviewed about his/her ideas on the chosen topic and results are discussed, but the child's ideas are not compared to other research findings (2 points)	The results of the interview are mentioned but not discussed (1 point)	No child was interviewed (0 points)		
Demonstrates a correct, adult-level understanding of the topic (3 points)	Understanding of the topic has minor errors or omissions (2 points)	Understanding of the topic is incomplete or not adult-level (1 point)	Understanding of the topic is incorrect (0 points)		
Final Lesson Plan					
Overview summarizes what is to be done in the lesson (2 points)	Overview lacks sufficient detail to know what is to be done in the lesson (1 point)	No overview (0 points)			
Rationale connects the lesson to the curriculum and to state benchmarks (2 points)	Rationale is incomplete or state benchmarks are inappropriate for the lesson (1 point)	Rationale is missing (0 points)			
Learning outcomes include specific knowledge and/or skills students will acquire (2 points)	Learning outcomes are too broad, or are not appropriate to the topic selected (1 point)	Learning outcomes are missing (0 points)			

Lesson solicits student ideas about the topic prior to instruction (3 points)	Lesson introduces facts or vocabulary prior to engaging students in the activity (2 points)	Lesson opening is inappropriate to find out student misconception (1 point)	Lesson makes no attempt to find out student ideas prior to instruction (0 points)		
Activity uses hands-on, inquiry strategy to allow students to explore and form their own ideas (3 points)	Activity uses a hands-on strategy, but students do not explore their own ideas or solutions (2 points)	Activity uses lecture or other teacher-directed methods of instruction (1 point)	Insufficient information provided to determine how the lesson is taught (0 points)		
Activity is described in adequate detail to understand how it is to be conducted (2 points)	Insufficient detail is provided to understand how lesson proceeds (1 point)	No detail about the activity is provided (0 points)			
Extension is appropriate to the activity (2 points)	Extension does not add value to the activity (1 point)	No extension provided (0 points)			
Assessment evaluates learning outcomes and is linked to the misconception (3 points)	Assessment evaluates learning outcomes but is not consistent with the misconception (2 points)	Assessment is not an example of application of student knowledge (1 point)	Assessment is not appropriate to determine learning outcomes (0 points)		
At least five references (min 2 non-web) are cited in the research and development of the lesson (3 points)	A reference list is provided but no indication is given of how the references were used in the research or development of the lesson (2 points)	Reference list is inappropriate or incomplete, or lacks non-web sources (1 point)	Reference list is missing (0 points)		
Lesson plan is well organized and easy to follow (2 points)	Lesson plan is difficult for the reader to follow (1 point)	Lesson plan is disorganized or missing required information (0 points)			
Class Handout					
Handout is well-organized and clearly conveys the main points of the lesson (2 points)	Handout is disorganized or difficult to follow (1 point)	No handout (0 points)			
All required information is present in adequate detail to understand the lesson (3 points)	Required information is missing or incomplete (2 points)	Significant information is missing (1 point)	No handout (0 points)		
TOTAL (out of 40)					

SCORING RUBRIC: MISCONCEPTIONS GROUP PRESENTATIONS

Title of Presentation: _____ Start time: _____

Names of Presenters: _____ End time: _____

Directions: Use the rubric below to assign points for each category. Briefly explain your assignments in the “comments” column.

				Points Earned:	Comments:
Introduction					
Grade level and topic are specified (2 points)	Grade level or topic specified, not both (1 point)	Grade level and topic are not specified (0 points)			
Misconception children have about the topic is clearly explained (2 points)	Misconception is too general or not appropriate to the topic (1 point)	Misconception is not specified (0 points)			
Demonstrates a correct, adult-level understanding of the topic (3 points)	Understanding of the topic has minor errors or omissions (2 points)	Understanding of the topic is incomplete or not adult-level (1 point)	Understanding of the topic is incorrect (0 points)		
Discusses the importance of the misconception and why it is important for children to learn about this topic (3 points)	Discusses the importance of the misconception, or why children should learn about this topic, but not both (2 points)	Briefly mentions the importance of the misconception in teaching or why children should learn about this topic (1 point)	Does not discuss the importance of the misconception, or why children should learn this topic (0 points)		
Related work*					
One or more studies describing children’s ideas about the topic are described in detail (3 points)	One or more studies are mentioned but findings are not described (2 points)	Misconception is discussed but not linked to a specific research study (1 point)	No studies are described or mentioned (0 points)		
Results of interviews with a child or children are presented and discussed (2 points)	Results of interviews are mentioned briefly but not discussed (1 point)	No children were interviewed about the misconception (0 points)			
Lesson Plan					
Lesson directly addresses the misconception and explores children’s alternate ideas (3 points)	Lesson directly addresses the misconception but does not allow children to explore their ideas (2 points)	Lesson is related to the misconception but does not directly confront it (1 point)	Lesson is not appropriate to address the misconception (0 points)		
Lesson is interesting and engaging for students (2 points)	Lesson is moderately interesting and engaging (1 point)	Lesson does not engage students (0 points)			

Entire lesson is described and a portion is modeled for the class (3 points)	Part of the lesson is modeled, but description of the lesson is incomplete (2 points)	Part of the lesson is modeled but entire lesson is not described (1 point)	Lesson is not described or modeled (0 points)		
Demonstration of lesson uses appropriate teaching methods for topic and grade selected (2 points)	Teaching methods are appropriate to the topic or grade, but not to both (1 point)	Teaching methods are inappropriate for the topic and grade selected (0 points)			
Conclusion					
Main points of the research and lesson plan are summarized (3 points)	Summary does not reinforce main ideas of the presentation (2 points)	Summary is brief and does not address the main ideas (1 point)	No summary (0 points)		
Summary addresses how the research informs future teaching (2 points)	Summary is not related to future teaching (1 point)	No mention of how the research can inform teaching (0 points)			
Presentation quality					
Presentation makes good use of the allotted time (2 points)	Presentation is about 5 minutes too long or too short (1 point)	Presentation is more than 5 minutes too long or too short (0 points)			
Both group members contribute equally to the presentation (2 points)	Group members do not contribute equally to the presentation (1 point)	One group member does not participate (0 points)			
Visual aids are well prepared and add to the quality of the presentation (3 points)	Visual aids are used but have mistakes or incorrect information (2 points)	Visual aids detract from the quality of the presentation (1 point)	No visual aids are used (0 points)		
Presentation is well organized and easy to follow (3 points)	Presentation is well organized but has minor mistakes or missing information (2 points)	Presentation is poorly organized or has significant missing information (1 point)	Audience is unable to follow the presentation (0 points)		
TOTAL (out of 40)					

*Some topics have little to no research available. See your instructor in advance if this is the case for the topic you have chosen.

SCORING RUBRIC: PEER EVALUATION OF PRESENTATIONS

Name of Student Evaluator: _____

Evaluation #1 Name:				Points Earned:	Comments:
Points assigned are appropriate to the quality of the work (2 points)	Points assigned are inconsistent with the quality of the work (1 point)	Points assigned are inappropriate to the quality of the work (0 points)			
High quality comments and feedback are provided to presenters, and explanations are consistent with points assigned (3 points)	Comments and feedback are provided to presenters, but explanations are not consistent with points assigned (2 points)	Only generic feedback such as "good job" is provided (1 point)	No feedback is provided to presenters (0 points)		

Evaluation #2 Name:				Points Earned:	Comments:
Points assigned are appropriate to the quality of the work (2 points)	Points assigned are inconsistent with the quality of the work (1 point)	Points assigned are inappropriate to the quality of the work (0 points)			
High quality comments and feedback are provided to presenters, and explanations are consistent with points assigned (3 points)	Comments and feedback are provided to presenters, but explanations are not consistent with points assigned (2 points)	Only generic feedback such as "good job" is provided (1 point)	No feedback is provided to presenters (0 points)		

Evaluation #3 Name:				Points Earned:	Comments:
Points assigned are appropriate to the quality of the work (2 points)	Points assigned are inconsistent with the quality of the work (1 point)	Points assigned are inappropriate to the quality of the work (0 points)			
High quality comments and feedback are provided to presenters, and explanations are consistent with points assigned (3 points)	Comments and feedback are provided to presenters, but explanations are not consistent with points assigned (2 points)	Only generic feedback such as "good job" is provided (1 point)	No feedback is provided to presenters (0 points)		

Total (out of 15):

SCORING RUBRIC: PARTNER EVALUATION

Evaluate your partner on his/her contribution to the group misconceptions project.

Your name: _____

Your partner's name: _____

Number of points assigned to your partner (circle): 1 2 3 4 5

In the space below, explain why you assigned this many points to your partner.