Welcome to…

Investigative Science I (SCIE 201)
Earth: The Water Planet

This course is designed especially for you – the preservice elementary education major!

Syllabus, Fall 2006 **USP Natural Science**
Pasteur 121 **4 S.H. Laboratory**
MWF 1:00 - 2:50 PM

Course Web Site is on Desire2Learn: **https://winona.ims.mnscu.edu/**

Your Instructors:	**Email:**	**Phone:**	**Office:**
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Office Hours:

Jenn	3 – 4 pm Mondays, Wednesdays & Fridays 10 am – Noon Tuesdays & Thursdays And by appointment (or drop by)
Andy	See http://course1.winona.edu/aferstl And by appointment (or drop by)

Why Water?

We're certain that you already know a lot about water; one of our first goals is to help you learn to think about water in a new light – that is to say, to think about water from a scientific perspective. Your future students will also know a lot about water. We hope that you will learn strategies for helping them think about water from a scientific perspective.

Even though water is the theme of this course, it's not just about water. Sure, we'll explore the physical and chemical properties of the stuff, but we'll also take a look at how water interacts with other systems on this planet as well as why it is that Earth is so unique in our solar system (is it unique in the universe or just in our celestial neighborhood?).

This course is not likely to resemble any other course you take during your college careers (except for Investigative Science II and III). We're taking a novel approach to science by integrating all the natural science disciplines and blurring the boundaries between lectures and laboratories. Throughout the semester, your instructors will try to integrate concepts of biology, chemistry, geoscience, and physics to help you gain a unique perspective about water, science and teaching. One of our primary goals is to help build you "pedagogical content knowledge" – your knowledge of science and how to teach it appropriately to elementary students. Although we don't want to scare you off, you should be aware that this course will be demanding and challenging, both of your time and of your mind. Despite having a focus on how to teach science to elementary students, this is very definitely a 200-level college science course. The best elementary teachers are not just the folks who "love kids" – superior elementary teachers not only love kids, but also love helping them learn; and, in order for you to do that, it is critically important that you have a solid foundation.

There is no required text. But here are some examples of text that might be useful references:

- *Integrated Science,* (4th ed.) Tillery, B.W., Enger, E.D., Ross, F.C., 2003, McGraw-Hill Publishers, 861p.
- *Concepts and Inquiries in Elementary School Science* (4th ed.), Peters, J.M. and Gega, P.C., 2002, Merrill Prentice Hall, 428 p.
- *The Sciences: And Integrated Approach*, (4th ed.) Tefil & Hazen, John Wiley & Sons, Inc, © 2004
- *Conceptual Physical Science Explorations*, Hewitt, Suchocki, and Hewitt, Addison Wesley© 2003
- *Elementary Science Methods: A Constructivist Approach,* (4th ed.) Martin, Thomson & Wadsworth© 2006

Required Materials: Laptop; colored pencils; ruler; calculator; notebook or three-ring binder

Purpose of Class

The purpose of this class is to help you become familiar with the fundamentals of science in a manner that also prepares you to teach science in your future elementary classroom. It is important that elementary students be allowed and encouraged to explore their world and that teachers of students at this young age support their curiosity. Too many students come to college claiming to hate science. When pressed, many say that they had a miserable teacher in their K-12 years who didn't answer their questions, or who made them memorize a textbook. Science is so critically important to understanding our world, that we want the future teachers of our nation's children to be enthusiastic about science so that their future students will likewise be passionate about science.

One of the easiest ways to engage children in science is to help them understand the things in their everyday world. To that end, we will explore the science of water. Since water is central to life on our home planet, and because you can be pretty certain you'll find water in the school you'll teach in someday, we thought it pertinent to study water. The human body is roughly 75% water; the surface of planet Earth is roughly 75% water covered; water is critical to life, as well as to many of the processes that happen all around us on this planet. This course will help you understand some of those processes, and give you the tools you'll need to figure out the rest of them. Most importantly, this course will help you learn how to engage kids in exploring their world, by designing and conducting simple, cheap, and safe experiments that can be completed in any elementary classroom.

Teachers are scientists!

Everyday when teachers prepare lesson plans, they try to predict how their students will answer questions or react to an instruction. Then, while the lesson plan is put into action, the teacher will observe and try to understand if the lesson plan is working. But how will a teacher know if the lesson is working? How will they compare their results to their prediction? How will they modify the lesson plan for the next time to, hopefully, improve it? Teachers are some of the greatest social scientists of our time (even though they don't get paid for it). They perform experiments on kids every school day! So, one purpose of this class is to get you to think critically about what you are doing and why you are doing it.

Course Expectations

In order to achieve the goals for this course, it's important that everyone participating have a clear understanding of expectations. To that end, we've compiled an initial list of expectations, which we will discuss (and potentially modify) in class.

What we expect of you:

- That you will **attend** and **participate fully** in every class meeting and all field trips.
- That you will **make an honest effort** on all activities, assignments, and other course requirements.
- That you will **communicate** in advance to your instructors and your group members any time that you will be unable to participate in class meetings.
- That you will **listen respectfully** to your peers and treat all class members with respect (respect diverse opinions and talents).
- That you will **work hard** to connect course material to what you already know.
- That you will **ask questions to help further your understanding** (either when you don't understand something or when you need to understand something at a deeper level) – questions may be asked of yourself, your peers, and your instructors.
- That you will **come prepared for class each day**; this includes being prepared for lectures, labs, and/or group activities.
- *That you will move outside your "**comfort zone**". It is only then that true and significant learning can occur. If you are just learning facts and not really trying to restructure the way that you are organizing knowledge and thinking about "how you know what you know" then you are not really learning.*

What you should expect of us:

- We will be **available for questions** (through office hours, email, hallway contacts, and during class).
- We will be **enthusiastic** about course material.
- We will be **open to new suggestions and flexible in how we teach** – *thereby moving out of our comfort zone.*
- We will **come prepared** for class every day.
- We will **be respectful** of one another, all students and your ideas and suggestions.
- We will **model effective pedagogy and scientific process.**
- We will **grade you fairly** and without bias.

Disabilities

If you have a physical or cognitive disability that requires academic accommodation, please see us as soon as possible so that we can discuss how best to accommodate your needs. You are not required to disclose a disability, but we are unable to accommodate anything we are not aware of. You may also wish to speak with the staff of the Disability Resource Center (DRC) who may be able to provide assistance. The DRC is located in Howell 136, 457-2391. Their web address is http://www.winona.edu/disabilityservices

University Studies Compliance

This course qualifies as a University Studies course in the Natural Science with Laboratory category. If you successfully complete this course, you will have completed the laboratory requirement and 4 credits of Natural Science in the University Studies Program.

The purpose of the Natural Science requirement in the University Studies program is to provide students with the tools to understand and be able to apply the methods by which scientific inquiry increases our understanding of the natural world.

Courses that satisfy the Natural Science requirement must include requirements and learning activities that promote students' abilities to...

a. understand how scientists approach and solve problems in the natural sciences;
b. apply those methods to solve problems that arise in the natural sciences;
c. use inductive reasoning, mathematics, or statistics to solve problems in natural science;
d. engage in independent and collaborative learning;
e. identify, find, and use the tools of information science as it relates to natural science;
f. critically evaluate both source and content of scientific information; and
g. recognize and correct scientific misconceptions.

Courses that satisfy the laboratory requirement in the Natural Sciences will additionally provide students the opportunity to practice scientific inquiry through hands-on investigations and to analyze and report the results of those investigations.

Course activities described throughout the remainder of this syllabus will be coded to the above list of outcomes by the corresponding letter. These outcomes will be integrated throughout course content—each new topic will be presented in a manner in which the student will be able to understand and apply the methods by which scientists approach and solve problems in the natural sciences, using inductive reasoning or mathematics (outcomes a-c). Common scientific misconceptions will be identified at the start of each topic, and class material will be directed toward correcting those misconceptions (outcome g). You will be asked to work collaboratively on certain in-class and take-home activities and independently on other assignments (outcome d). In-class and homework assignments will require that you work with the internet, reference books, science education texts, and other sources to critically evaluate scientific information as it relates to the science of water (outcomes e, f). During the laboratory portion of the course, you will have the opportunity to engage in hands-on scientific investigation of natural phenomena, and you will be required to analyze and report the results of your investigations (laboratory outcome).

Skill goals:

At the end of this course, students will be able to:

- synthesize diverse information to draw reasonable scientific conclusions and to support those conclusions with evidence and scientific reasoning
- solve simple mathematical problems
- read, interpret and make graphs and diagrams
- design, implement, and *assess the effectiveness of* science activities for elementary school children

Content Goals:

At the end of this course, students will be able to:

- Make connections between the macroscopic and microscopic worlds.
- Construct a model illustrating how water impacts the Earth (what & where is water; how does water affect the Earth; how do things affect water).
- Design and construct a simple experiment that can be completed in an elementary classroom.

Grading:

Your grade in this class will be based on your performance in all class activities. We will provide more specific information and grading rubrics throughout the semester. You can expect that activities, projects, written reflections, concept maps, participation, and reports will each constitute a part of your grade.

Individual Projects (40%): will consist of both **long-term** and **short-term** activities in which you are asked to produce something that is your own individual work. Examples will include (but are not limited to) individual reflections, predictions for various experiments, and concept maps.

Group Projects (40%): will consist of both **long-term** and **short-term** activities in which you work in a group and the entire group produces something that is a result of the group's work. Examples will include (but are not limited to) field trip reports, concept maps, and group reflection pieces.

Participation (20%): will be graded in three ways. First, your participation will be evaluated by your peers as you work in your groups via the team contribution forms. Second, you will be asked to evaluate your participation in class a few times throughout the semester. Finally, the instructors are observing how you participate during the class, such as your interaction with your group as well as your participation during discussions in the larger class setting. The instructors will evaluate your participation once at the end of the semester, but will be watching throughout, so if you have a question as to how we think you are doing, just ask us.

Short-term activities* – take approximately a day to complete. Typically these activities will be graded out of 25 points, unless it is a completed/not completed activity in which case it will be given either 10 or 0 points.

Long-term activities* – take a week or longer to complete. Typically these activities will be graded out of 100 points.

* Instructors reserve the right to alter the total point value of an activity as they see fit.

The **final projects** that will demonstrate the highest level of mastery that you achieve in this course will include your group water concept map and an individual reflection of your personal experience in the class itself. More information about these projects will be given out early in the semester.

Final Exam: Wednesday, December 13th, 10:30 am.

(Tentative) Schedule (subject to change, especially topics later in the semester)

Week	Topic
1	Introductions What is Science?
	HOLIDAY – No class Sept 4th
2	What is Science? (cont.) Build Terrariums
3	What is Science? (cont.) Hydrologic Cycle
4	Hydrologic Cycle (cont.) Cave Systems
5	Preparation for Cave Trip Groundwater Contamination
	All-Day Cave Field Trip Sept 30th
6	Water Experiments
7	Water Experiments **HOLIDAY – No class Oct 13th**
8	Floating & Sinking Density, Mass & Weight
9	Start working on classroom visit Pressure
10	Gas Laws Classroom visit prep
11	Classroom visit prep
12	Classroom visits
13	Energy Phases of Matter
14	Temperature Energy Conservation
15	Philosophy of Science

Potential Topics that will be integrated throughout the course:

Science Itself
What is Science?
How is Science Done?
Investigative Science
The Philosophy of Science
Pseudo-science
Scientific Misconceptions

The Water Cycle
Surface Water
Groundwater
Atmospheric Water

The Physics of Water
Flow Characteristics
Density, Mass, and Volume
Water Pressure
Energy

The Chemistry of Water
Hardness
Salinity
pH & Alkalinity
Conductivity
Nitrates/Nitrites
Phosphates

Phases of Water
Gases, Liquids & Solids
Phase Changes

Environmental Issues
Water Pollution
Water Contamination
Water Treatment Mechanisms
The Water You Drink
Water Usage
Weather Patterns
The Greenhouse Effect

Water is Important for Life
Origin of Life on Earth
Photosynthesis
Microscopic Communities
Macroscopic Communities
Water and Life on Other Planets

Because this course is more fluid than most that you will take, we will cover the above topics, but we will be flexible in the order in which we do so (i.e. the schedule above is very likely to change throughout the semester). We will keep you well-informed of what topics we will be covering and any changes that we may make in class, through email, and on the class Desire to Learn site.