Official Course Syllabus  
College of Education  
Winona State University

**Department**: Education  
**Date of Revision**: Fall 2006

**Course Number**: EDUC 335  
**Course Title**: Teaching of Science and Environmental Studies in the Elementary School

**Number of Credits**: 3  
**Frequency of Offerings**: Each Semester

**Prerequisite(s)**: EDUC 303 or 304, EDUC 310 or 311; SCIE 201

**Grading**: Grade only

**Course applies to**: Early Childhood and Elementary Specialty Licenses

**Relation to Conceptual Framework**: We exist to prepare professionals to continuously improve student learning in twenty-first century schools. Through a continuum of clinical experiences and relevant and appropriate instructional methods, WSU graduates are prepared in a community of learners with developmentally appropriate content and pedagogical expertise, and professional dispositions to improve students’ learning by: (1) actively engaging in a culture of reflective practice and continuous improvement (2) demonstrating awareness of – and an ability to respond to – broader psychosocial and global contexts; and (3 advocating for students and their learning through leadership, collaboration, innovation, flexibility, and critical thinking. [Highlights reflect significant emphasis during this course.]

**Course Description**

1. **Catalog Description**

Study and guided application of current materials and methods designed for science and environmental education. Theoretical background and practical skills necessary for teaching both process and content curriculum are developed through individual and group work as well as field experiences.

2. **Statements of the Major Focus and Objectives of the Course**

**8710.3200 Teachers of Elementary Education With a Specialty**

**Subp. 3. Subject matter standards, elementary education**

A. A teacher of children in kindergarten through grade 6 and either preprimary children age three and above, young adolescents in grades 5 through 8, or a world language and culture in kindergarten through grade 8 must:
(1) understand and apply the research base for and the best practices of kindergarten, elementary, and preprimary or middle level education;

(5) understand how to integrate curriculum across subject areas in developmentally appropriate ways;

E. A teacher of children in kindergarten through grade 6 must demonstrate a fundamental knowledge of scientific perspectives, scientific connections, science in personal and social perspectives, the domains of science, and the methods and materials for teaching science and scientific inquiry. The teacher must:

(1) understand science as a human endeavor, the nature of scientific knowledge, and the historical perspective of science;

(2) know and apply the understandings and abilities of scientific inquiry including the ability to: (a) identify questions and concepts that can be explored through scientific inquiry; (b) compare the use of multiple types of inquiry for answering questions;

(3) know how to make connections across the domains of science, between science and technology, and between science and other school subjects;

(4) use scientific understandings and abilities when making decisions about personal & societal issues;

(8) know and apply pedagogy and classroom management in science and scientific inquiry including understanding: (a) content standards under chapter 3501 for recommendations regarding curriculum, instruction, assessment, professional development, and program development; (b) how to teach scientific inquiry in a developmentally appropriate manner; (c) common student misconceptions in science and developmentally appropriate strategies to elicit students' misconceptions and help them move to accepted scientific understandings.

8710.3300 Middle Level Licensure in Academic Specialty

Subp. 3. Subject matter standard.

A. A teacher of an academic specialty to middle level students understands the nature of early adolescence and the needs of young adolescents. The teacher must understand:

(1) the research base for and best practices of middle level education;

(2) the educational principles relevant to the physical, social, emotional, moral, and cognitive development of young adolescents;

b. A teacher of an academic specialty to middle level students understands the teaching of an academic specialty that integrates understanding of the academic specialty with the teacher’s understanding of pedagogy, students, learning, classroom management, and professional development. The teacher of an academic specialty to middle level students in grades 5 through 8 must:
(1) develop curriculum goals and purposes based on the central concepts of the academic specialty and know how to apply instructional strategies and materials that are appropriate for middle level students and are specific to the academic specialty;

(2) understand how to integrate curriculum across subject areas in developmentally appropriate ways;

3. Course Outline of the Major Topics and Subtopics
   I. Pedagogy
      A. Theory
         1. Multiple Intelligences
         2. Piaget
         3. Vygotsky
         4. Karplus & Thier – The Learning Cycle
         5. Historical foundations of school science
      B. Practice
         1. Standards
            a. Teaching
               i. NCES
               ii. MN Standards of Effective Practice
            b. Content
               i. Project 2061
               ii. NCES
               iii. Minnesota Academic Standards
         2. Lessons
            a. Guided inquiry
               i. What is guided inquiry?
               ii. 5E learning cycle
            b. Open inquiry
         3. Units
            a. Integrated
            b. Thematic
      4. Science and Invention Fairs
   II. Inquiry-based Curriculum
      A. SCIS
      B. Science In A Nutshell
      C. FOSS
   III. Assessment
      A. Authentic
      B. Formal
      C. Informal
   IV. Professionalism
      A. EdMinn
      B. NEA
      C. NSTA/MnSTA
   V. Legal Issues
A. Safety
B. Ethics

VI. Diversity
A. Project WET; Project Wild; Project Learning Tree; Food, Lands & Peoples
B. Learning styles

VII. Technology
A. Inspiration
B. PowerPoint
C. Excel

4. Basic Instructional Plan and Methods Utilized

1. Small group cooperative learning
2. Individual assignments
3. Discussion/lecture
4. Laboratorios
5. Computer assignments
6. Videotapes/case studies
7. Handouts
8. Readings
9. Field experiences as available

5. Course Requirements
1. Invention Fair project
2. Thematic/Integrated unit
3. Theory synthesis paper
4. Standards map and review
5. Midterm written exam
6. Attendance and participation

6. Textbook(s) or Alternatives
Minnesota Academic Standards in Science K-12 downloaded from the Minnesota Department of Education website (http://education.state.mn.us)


7. List of References and Bibliography


Council for Environmental Education. 2000. Project WET. Houston, TX: CEE.

Council for Environmental Education. 2000. Project WILD. Houston, TX: CEE.


Key Assignments and Evaluations

Theory Synthesis Paper (25 points)

Each student will develop a paper describing the interaction of the nature of scientific investigation, the purpose of science in the school curriculum, the cognitive development of the learner, and the inquiry-based science curriculum. Additionally, the student will create an Inspiration concept map of the four areas discussed in the narrative.

Paper mechanics: Font 12, Times New Roman or Arial only, standard margins, header with name and course number/section on each page, stapled at upper left corner (NO BINDERS). Cover sheet with Name, Course Number and Section, Date. Provide full citation of all references using APA style. If you don’t know this style, ask. What length? It is doubtful that this can be done well in less than 8 to 10 pages and it may take more than that. Inspiration map is extra.

Due date March 14.

Thematic/Integrated Unit (50 points)

Each group will create two lessons in life science, physical science, earth/space science, and history of science at one grade level for a total of 8 lessons on one specific theme.

The lessons should follow the 5E Learning Cycle. The unit will have the following divisions:
1) A cover sheet with the group names and EDUC 335 Section ___
2) Page two will list the theme plus the daily lesson names (a simple scope and sequence)
3) Pages three through X will be your lessons
4) The second to last page will be a list of cross-curricular integrations
5) The final page will be a discussion of differentiations for the unit

Create all data sheets, teacher guides, student guides, etc. Type, collate, and turn all the lessons in as a stapled or clipped packet. DO NOT PUT THEM IN ANY KIND OF BINDER! Electronic versions are OK – in Word please; send as an email attachment.

Each lesson is graded individually. The rubric is based on 30 possible points; 8 times 30 equals a total of 240 points.

WRITTEN LESSONS DUE DATE: All lessons need to be in no later than April 13 at the end of class.

- Resources:
  o Science and Children, Science Scope journals (WSU Library)
  o Books we have in class (my collection)
  o Books from the library or media center
- Clear internet sites with me first!

- Full lesson plans are available on the D2L site for reference. Two are guided inquiry lessons (Birds of a Feather, What Goes Up), one is open inquiry (Newspaper Towers) and the last is a combination guided/open inquiry lesson (Donner Party).

- The Learning Cycle lesson plan format is available on D2L under the heading “A Checklist for Preparing a Learning Cycle Lesson.” The assessment rubric for the lessons is also posted on D2L.

- **Plagiarism caution**
  While it is OK to get experiment/activity ideas from other sources, the lessons must be original. All “teacher talk” (for learning cycles this means the scaffolded questions/answers in the Explanation phase) must be yours; data sheets – yours; introduction material, literature readings, etc... YOURS!

**MN Standards Mapping Assignment (25 points)**
Each of you will be assigned to a specific strand of the MN science standards. You will create a group presentation of the content of that strand and present your information to the class.

Instructions:
1. Find your name on the group assignment list posted on D2L. Next to it is the grade you will use for the assignment. Get together with your group ASAP.
2. Download a copy of the science standards. They are posted on our D2L site or you can go to [http://education.state.mn.us](http://education.state.mn.us).
3. Analyze the standards and the benchmarks assigned to strand at each grade level (K-middle school). What do they cover? What prior knowledge is assumed at each grade level? What academic and physical skills are required at each grade level? How do your standards flow from grade to grade?
4. Present your analysis to the class on February 22.

You may organize your analysis in any way that makes sense to you. Cut/paste, print and highlight, perform a skit, interpretive dance, whatever works for your group.

A note: Environmental education is a specific portion of this course. However, the new MN standards incorporate the legislated environmental education topics so you will not see environmental education as a separate topic of discussion other than when we look at the MN DNR sponsored curricula of Project Wet, Project Wild, and Project Learning Tree.

**Midterm written exam (15 points)**
A written exam covering text reading assignments and class lecture notes will be given around the midterm of the semester. The exam is scheduled for March 2.
**Invention Fair Project (50 points)**
Elementary and middle schools have begun to offer the “invention fair” as an alternative to the traditional science fair. Invention design is supported by the national science standards and the Minnesota Academic Standards in Science (see reference list).

The process of setting up an invention design unit is similar to the steps needed for a successful science fair investigation. The invention design unit outline and evaluation rubric is taken directly from Kathleen Hammontree’s article in *Science Scope* (July 2005, p.18-23). It is a good basic format for your student’s to use when developing their inventions.

For EDUC 335 you will work with a small group to create an invention. You will follow the outline below just as your students would. The Invention Fair will take place during our finals time. Please note that various portions of the project are due throughout the semester – these due dates are listed on the outline form.

**Inventor’s Log**

Your inventor’s log is a diary and record of your inventive thinking and a guide for completing your invention project for science class. It should include everything that is related to your project. Fill in detailed information as you complete each step in your inventor’s log. Every time you work on your project or just think about your idea, record it in your journal. Write your observations, comments, thoughts, and any interesting information on the lines provided. The more effort you put into the log, the greater the reward you will get from it. Keeping up and finishing each step on time will make the invention project much easier.

**Step 1. Identify needs in your life. DUE ______________**
Conduct a survey. Interview everyone you can think of to identify what problems need solutions. Fill in this chart as you interview people.

<table>
<thead>
<tr>
<th>Questions</th>
<th>People interviewed</th>
</tr>
</thead>
<tbody>
<tr>
<td>What does not work as well as you would like it to work?</td>
<td>Yourself</td>
</tr>
<tr>
<td>What job(s) would you like to see solved?</td>
<td></td>
</tr>
<tr>
<td>What problem(s) would you like to see solved?</td>
<td></td>
</tr>
<tr>
<td>If you could invent something to make your life easier, what would you invent?</td>
<td></td>
</tr>
<tr>
<td>What is your most annoying problem at home?</td>
<td></td>
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<td>At school?</td>
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<td>At work?</td>
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<tr>
<td>At the airport?</td>
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</tr>
<tr>
<td>On the road?</td>
<td></td>
</tr>
</tbody>
</table>
At the supermarket?  
Elsewhere?

**Step 2. Brainstorm. DUE**
Look at your survey. What kind of invention, tool, game, device, or idea would be helpful to solve someone’s problem? Brainstorm and list ideas on this chart.

<table>
<thead>
<tr>
<th>For this problem</th>
<th>I could invent</th>
</tr>
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<tbody>
<tr>
<td></td>
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</table>

**Step 3. Research. DUE**
Learn about other people’s invention ideas and the invention process by conducting research in the library or on the web. Look for ideas that are applicable to your interests, but remember that you need a brand new, original idea. Some recommended materials and websites are included in the Resources section below. List all the books, magazines, and websites you consulted.

**Resources**

**Books**

**Videos**

**Websites**
Smithsonian’s Inventions at Play: [http://inventionatplay.org](http://inventionatplay.org)
United States Patent and Trademark Office Kids’ Pages:
http://www.uspto.gov/go/kids/index.html
Invent America competition: www.inventamerica.org/contest.cfm
National Inventors’ Hall of Fame: www.invent.org
Coolest inventions for kids: www.timeforkids.com/TFK/inventions
Enchanted Learning inventors index: www.enchantedlearning.com/inventors/indexa.shtml

Step 4. Record your invention idea and explain what inspired you. DUE___________
I will invent a(n)

What made you decide on this invention?

What do you expect will be the biggest challenge in creating your invention?

Step 5. Test your idea. DUE____________________
Use the flow chart below to “test” your idea to see if it is suitable for this project.

A. Is my idea practical?
No. Start over. Yes. Continue

B. Is it easy to make?
No. Start over. Yes. Continue

C. Is it safe?
No. Start over. Yes. Continue

D. Is it affordable?
No. Start over. Yes. Continue

E. Is my idea really new?
No. Start over. Yes. Continue

Step 6. Invention sketches and diagrams. DUE____________________
Draw a diagram of what you think your invention will look like. List all parts, sources for the
parts, and costs of materials used in the invention.

<table>
<thead>
<tr>
<th>Part</th>
<th>Source for part</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</table>
Step 7. Build a model of your invention. DUE____________________
List, in order, the steps for constructing your invention.

Step 8. Give your invention a name. DUE _________________

Step 9. Share your invention with the class. DUE _________________
My date to share is __12/14/06 (8am to 10am)__.  
All projects will be due the week of __12/14/06__.

Step 10. Reflect on being an inventor. DUE _________________
On a scale of 1 to 10 (1 means No, not at all, 10 means Yes, absolutely!):
I helped solve a problem ___
I learned about the steps to invent a new product ___
I have more ideas for inventions ___
I like inventing ___

Complete the sentences:
The best part of this project was ____________.
The most challenging thing about this project was ____________.
My favorite invention that I saw was the ____________ because ____________.
**Tentative Class Schedule for EDUC 335 Spring 2007***  
*T*opics will not change but dates may be changed as needed for pedagogical reasons.

<table>
<thead>
<tr>
<th>Day</th>
<th>Date</th>
<th>Topic</th>
<th>Assignment/Text Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>W</td>
<td>1/17</td>
<td>Nature of Science</td>
<td>Text Chapter 1</td>
</tr>
<tr>
<td>F</td>
<td>1/19</td>
<td>Nature of Science</td>
<td></td>
</tr>
<tr>
<td>W/F</td>
<td>1/24/26</td>
<td><strong>No class – Wolf Ridge trip</strong></td>
<td>Download MN standards Read Chapter 2</td>
</tr>
<tr>
<td>W</td>
<td>1/31</td>
<td>Standards - National and MN</td>
<td>Groups for standards</td>
</tr>
<tr>
<td></td>
<td></td>
<td>How to “map” standards</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>2/2</td>
<td>Standards presentations</td>
<td><strong>Turn in presentation summary</strong></td>
</tr>
<tr>
<td>W</td>
<td>2/7</td>
<td>Lab – <em>What Goes Up...</em></td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>2/9</td>
<td>Analyze <em>What Goes Up...</em></td>
<td>Begin Theory Base</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Begin Theory Base</td>
<td>Text Chapter 3</td>
</tr>
<tr>
<td>W</td>
<td>2/14</td>
<td>Case studies – 1st and 4th grade</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>2/16</td>
<td>Continue Theory Base</td>
<td>Assign Theory Synthesis Paper</td>
</tr>
<tr>
<td>W</td>
<td>2/21</td>
<td>5E Learning Cycle lesson format</td>
<td>Text Chapters 4, 5, 7 Assign Invention Fair/groups</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Invention Fair information</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>2/23</td>
<td>Types of Inquiry:</td>
<td>Text Chapter 4</td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>Newspaper Towers</em></td>
<td></td>
</tr>
<tr>
<td>W</td>
<td>2/28</td>
<td>Types of Inquiry:</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td><em>Mystery Powder</em></td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>3/2</td>
<td><strong>Midterm exam!</strong></td>
<td></td>
</tr>
<tr>
<td>W/F</td>
<td>3/7/9</td>
<td><strong>No class – Spring Break</strong></td>
<td></td>
</tr>
<tr>
<td>W</td>
<td>3/14</td>
<td>Thematic Integrated Units</td>
<td><strong>Theory Synthesis Paper due</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Assessment</td>
<td>Assign Units, Text Chapter 6</td>
</tr>
<tr>
<td>F</td>
<td>3/16</td>
<td>Integrated lessons</td>
<td>Text Chapter 8</td>
</tr>
<tr>
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<td>Lesson example: <em>Donner Party</em></td>
<td></td>
</tr>
<tr>
<td>W</td>
<td>3/21</td>
<td><em>Donner Party continued</em></td>
<td></td>
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<tr>
<td>F</td>
<td>3/23</td>
<td>Finish <em>Donner Party w/ analysis</em></td>
<td></td>
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<tr>
<td>Day</td>
<td>Date</td>
<td>Activity</td>
<td>Text Chapter</td>
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<tr>
<td>W/F</td>
<td>3/28/30</td>
<td>Science and Literature Connections</td>
<td>Reading strategies for science content</td>
</tr>
<tr>
<td>W</td>
<td>4/4</td>
<td>Discrepant Events/Alternative Conceptions</td>
<td>Text Chapter 4</td>
</tr>
<tr>
<td>F</td>
<td>4/6</td>
<td>No class – WSU Break Day</td>
<td></td>
</tr>
<tr>
<td>W</td>
<td>4/11</td>
<td>Inductive Reasoning Activity</td>
<td>Text Chapter 4</td>
</tr>
<tr>
<td>F</td>
<td>4/13</td>
<td>Lab – H2Olympics</td>
<td>All units due</td>
</tr>
<tr>
<td>W</td>
<td>4/18</td>
<td>Lab Safety &amp; Safety Plan</td>
<td></td>
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<tr>
<td>F</td>
<td>4/20</td>
<td>No class – MnSTA Conference</td>
<td></td>
</tr>
<tr>
<td>W</td>
<td>4/25</td>
<td>Lab – Birds of a Feather</td>
<td>Safety Plan due</td>
</tr>
<tr>
<td>F</td>
<td>4/27</td>
<td>Professional organizations</td>
<td></td>
</tr>
</tbody>
</table>

Finals week is April 30 to May 4 – Invention Fair presentations on the scheduled finals day.