COURSE SYLLABUS
EDEL 443 / 643 Teaching Elementary School Science Methods
3 Credits
Summer Mini Term 2013
University of Nevada-Reno

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Class Meeting: Daily, 9:00 to 12:00 noon
Office Hours: Call me to make an appointment

Catalogue Description: Methods and pedagogy that offer effective techniques, management, and content in teaching science to children grades K-8. (Formerly CTL 403; implemented Fall 2007.) Prerequisite: content science courses listed in Elementary Education Major and acceptance in major.

REQUIRED COURSE MATERIALS
3. Optional Text: Science Is... (Scholastic, 1991) by S. Bosak. Available at UNR Bookstore
5. Lab Packet & Articles: Web CT

General Course Objective:
The purpose of the course is to introduce you to the principles of science education along with appropriate methodology and pedagogy needed to begin teaching science in pre K-8 settings. You will discover the rewards of hands-on learning, teaching and learning through reflection and the value of discovery / inquiry teaching methods for all individuals regardless of gender, race or cultural background. Although there is science content in the course, it is not meant to stand alone as the source of science knowledge required to teach quality science in the elementary schools. It is assumed that you have studied some college level science. This course will consist of lectures, discussions, readings, hands-on/ minds-on activities, demonstrations, group activities, teaching children in the schools, displays, as well as lab assignments and exams.

Personal Goal:
The purpose of this class is to provide a knowledge base for what elementary science is all about. It is my goal to first share my passion for science and the thrill of discovering new content science knowledge for me. My second goal is to provide a forum of discussion as to the different methodologies and philosophies in which science is best taught to elementary aged
children. My third goal is to expose the vast resources available to elementary teachers that are available to make science fun and interesting for their students.

**Conceptual Framework as applied to Course Objectives:**
The conceptual framework for basic and advanced professional preparation programs at the University of Nevada, Reno is organized around four themes: a lifelong love of learning; a strong fund of knowledge concerning all aspects of education; reflection on educational practices, and valuing democracy and multiculturalism. Although the term “conceptual framework” implies a fixed structure, we view this framework as being dynamic and one in which professional educators must immerse themselves.

The following goals/objectives have been developed to reflect the relationship of this course to the conceptual framework.

Upon successful completion of the requirements of this course, the student will be able to:

**Love of Learning:**
1. develop an understanding of learning, developmental, and conceptual change theories used in the construction of scientific knowledge and their implementation within an elementary science program; and

2. demonstrate knowledge of subject matter by enhancing elementary preservice teachers’ understanding of the nature of science, capacity to develop experimental designs, and ability to collect and interpret both qualitative and quantitative data.

**Strong Fund of Knowledge:**
3. acquaint pre-service elementary teachers with the historical development, current goals, and curricular expectations as recognized by the National Science Teachers Association (NSTA), American Association for the Advancement of Science (AAAS), the Next Generation Science Standards (NGSS); and connections to science in the Core Curriculum State Standards in Math and ELA. Additionally, STEM will be discussed as an integration of subjects from a science standpoint.

4. develop quality elementary science lessons through interdisciplinary (STEM+) approaches, integrated science, technology, engineering and math (STEM+) curricula, and alternative instructional strategies for oral presentation, demonstration, and "hands-on" lessons;

5. promote competency development in the areas of: (a) assessment of print/non-print materials for selection in instruction; (b) daily instructional planning; and (c) unit instructional planning on selected unified science topics;

6. facilitate competency development in the realms of: (a) matching appropriate learning activities with elementary grade levels; (b) assessing and modifying learning activities for use in multi-cultural environments; and (c) diversifying learning activities consistent with a holistic K-6 curriculum; and

7. demonstrate use of the LEARNING CYCLE (5-E model) as a model for lesson planning in
science that incorporates CCSS and NGSS Standards, hands-on Engagement & Exploration, teacher questioning techniques to assist students toward self-discovery or Explanation, and provides students with opportunities to Elaborate & Evaluate discovered concepts. Additionally, engineering and technology will be introduced through the Engineering Design Process.

**Engagement in reflective practice:**
8. foster among preservice elementary science teachers, the ability to perform reflective thought, self-analysis, and critical thinking with respect to effective and efficient methods for teaching elementary science; and

9. enhance among preservice elementary teachers, a reduced anxiety and a more positive attitude toward science as an instructional area of the elementary school curriculum.

**Value democracy and diversity:**
10. gain and understanding of the history of science as related to gender and ethnicity and the impact of such events in the current reform efforts in diversity within the science disciplines and school settings.

11. gain and understanding and demonstrate modifications to science lessons for English Language Learners (ELL)

12. demonstrate an understanding of the customs of the culture by distinguishing among the nature and roles of science, technology, and society and their integration within an elementary science program.

**Disability Statement:**
Each student who qualifies with a disability is to provide his or her instructor with a letter from the Disability Resource Center (DRC) stating the appropriate accommodations for this course. If you have a documented disability and wish to discuss how these academic accommodations will be implemented for this course, please contact me as soon as possible in person, at the above address, phone, or e-mail.

**Methodology**
This course is a methods course and will utilize a hands-on inquiry approach to instruction. Additionally, instruction will be provided through whole class instruction models that meet a discovery / inquiry approach. However, individual and small group discussions and problem solving experiences may be explored on occasion or when more methodologically appropriate.

**Academic Honesty:** has become more of an issue in recent years with the accessibility of the internet, technology, and use of cellular phones in picture and video mode, etc. The University of Nevada, Reno holds high expectations with regard to academic honesty. Any violation of university policy will result in serious consequences that may lead to a failing grade in this class or, in extreme cases, dismissal from the program. To read in-depth the universities policy on academic honest please visit: [www.ss.unr.edu/standard3/pdf/standard3.pdf](http://www.ss.unr.edu/standard3/pdf/standard3.pdf)
Grading:
Attendance: (Undergraduate & Graduate)

Each of you adds a unique dimension to class activities and discussions that cannot be duplicated. Your presence and contributions to this course are extremely important. As a classroom teacher you have the responsibility to your students to show up everyday and be prepared so that learning can be optimal. In this class I will hold you to those same professional standards of attendance and preparation that your school principal and profession demand. I also commit to being here and providing exciting and enriching learning experiences for you. Therefore, attendance is mandatory! To be eligible for an A in this course you must be present at least 90% of class time, regardless of points accrued. Each absence is 5 points or 5 % off your grade. Although absences from class really can’t be made up, I will work with you under special conditions. (remember - these will only be for extreme circumstances!) Tardiness is considered unprofessional behavior. Three (3) late arrivals to class will result in an unexcused absence and grade will be docked accordingly.

Major assignments: 55%
1) 5E lesson plan (10 %) (Domains 1-5) (Individual)
2) Midterm Science Fair, Engineering, or Invention Project (25%)
   (Domains 1-4) (Individual / partner)
3) Modify Lesson plan from text: (Domains 1-5) (Group) (20 %)
   Team Component (standards alignment, overview & assessment) (5 pts)
   Individual Component (Lesson plan) (5 pts)
   Teaching an Exploration (Hands-on) (10 Pts)

Minor assignments / quizzes: 40%
1) Quizes (there will be one quiz per week on reading / lab related material. (10%)
2) Responses to assigned readings = 30 % (Domains 1-4) (Individual)

Participation, Professionalism & Attitude - 5% (Domain 5)
This section of your grade is determined by your willingness to learn and keep involved in class. Although there is not a particular assignment or accurate assessment other than teacher observation, you will have input on this section on both your midterm and final evaluations. However, I will be watching for the willingness and positive attitudes toward both the teaching and learning that you would demonstrate in front of your own classroom.

Overall Course grading??
94% - 100% = A
90% - 93.99% = A-
87% - 89.99% = B+
83% - 86.99% = B
80% - 82.99% = B-
77% - 79.99% = C+
73% - 76.99% = C
70% - 72.99% = C-
67% - 69.99% = D+
63% - 66.99% = D
60% - 62.99% = D-
< 60% = F
EDEL 443.003 / 643.003
Mini Term 2012
Weekly Schedule

WEEK 1
May 20  Introductions: Cards & Syllabus, Apple a day – Next Generation Science Standards (NGSS)
May 21  5 E Polymers Lab & Science Notebooks (Balloon & Skewer, Diapers, Gak) (Intro to Assignment #1)
May 22  Nature of Science: Peanuts and Paper towels lab (Intro Major Assignment #2)
May 23  Physics & Inquiry (Soup Can Races, M&M Mashers)

Due: Reflection on Reading Assignments 1 Due
May 24  Chemistry & Inquiry (States of Matter - Water - Water, Melting? , Ice Cream) (Quiz 1)

WEEK 2
May 28  ** Memorial Day Holiday **
May 29  ELL and Science (lecture / activity)

Due: Major assignment #1 (5E Lesson Plan)
May 30  STEM Education: Intro to Technology, Engineering and the EDP
May 31  Chemistry & Inquiry (Tie Dye Science) (Introduce Major Assignment #3)

Due: Reflection on Reading Assignments 2 Due
June 1  Physics & Inquiry (Electricity: Battery and Bulbs, Humdingers – FOSS) (Quiz 2)

WEEK 3
June 04  Project Presentation & Performance Assessment (Major Assignment #2)
June 05  Earth Science & Inquiry (Rocks / Minerals; Edible Earth Movements)
June 06  Group project work day
June 07  Plants, Flowers, and Photosynthesis

Reflection on Reading Assignments 3 Due
June 08  Presentations - Major Assignment #3 (Quiz 3)
Readings for Reflections:

Reading Assignment #1: Introduction to Science Education and the Learning Cycle

3. Piaget & Learning Science (Jack Hassard Reading – Georgia State)

Reading Assignment #2: The Next Generation Science Standards

8. Bybee, Roger (2013) NGSS (Core Ideas) and Life Sciences. Science and Children (February)

Reading Assignment #3: Management, Equity, and Assessment:

18. McNair, S (2004). A is for assessment/ Science and Children (September)

Content/Teaching Strategy Lesson Plans
You have spent many years acquiring a broad background of general knowledge that must in some way be translated for children. As an elementary teacher you will be called upon to teach many different subjects. As you begin to explore preparing experiences for children you will need to mesh your content knowledge with the pedagogical knowledge that you are acquiring through professional education courses. You will probably find that you will need to review and refresh information and concepts for yourself. Where you lack the specific content background, you will need to study and teach yourself the new information and concepts.

Another factor in preparing to teach children is your own extensive experience as a student in school. This vast experience influences your views about the nature of teaching and what teachers do. For approximately 13,000 hours you have watched someone else, other teachers, do what you will many of the tasks that you think you will do as a teacher. Having watched "teaching" for so many hours may lead you to believe that you know what teaching is and should be. This view, however, can be quite misleading as you begin the process of planning for children.

While watching others teach may tell us some things about teaching, it certainly does not help us understand the thinking processes and decisions that lead to the behaviors we observe. Decisions are usually based upon theories that a teacher holds about the nature of knowledge, learning, and children. As you watch another teacher, the theories by which they make decisions may not be evident to you. As you begin planning lessons, then, it is important that you give careful consideration to the factors or theories that you consider in making your instructional decisions. You can learn from your involvement in planning lessons for children if you are reflective about your experience.

Planning should be a time for you to use the content knowledge and pedagogical knowledge that you have gained in your studies. It should also be a time for you to see how well you have observed the children that you work with to be able to decide what constitutes appropriate developmental instruction for them.

Planning in a reflective manner, integrating your background knowledge with your knowledge of the children with whom you work, should lead to effective instruction. But your planning does not stop with the delivery of the lesson. As you are teaching, you should find yourself reflecting on what you intended to teach in comparison to your impression of how children are engaged with the content or process of the activity. You should compare where the children are when the lesson concludes with what you had originally intended. Planning becomes a dynamic process, changing to meet the needs of the learner. The lessons that we plan should never stand in isolation from all other activities or experiences that are taking place in the classroom. Therefore, planning is a dynamic process, ever growing and changing in response to the lived experiences of teachers and children in classrooms.
443 / 643 Required Lesson Plan Format

Learning Cycle 5E Lesson Design
Based upon & Modified from Rodger Bybee (1990)

Title of Lesson
Name
Adapted from
Grade Level

Science Standards:
Next Generation Science Standard (grade level & standard – write out the entire thing)

ELL Language Standards (Reading, Writing, Listening & Speaking)

Background knowledge required (for):
Teacher:
A couple of paragraphs reviewing the content - enough information that a sub would know the content and be able to teach the lesson from it. Should be detailed and have references. May have detailed info attached to lesson plan. Should be at a more in-depth level than what you are teaching.

Student:
a) Prior Standards - Look to the standards, what should the students have as prior knowledge before beginning this lesson? What standards have been covered in previous grades? If an introductory lesson, indicate as such.
b) Life Experience – Thinking back to Piaget, what prior life experience would be reasonable for a child to have with this topic.

Materials List - detailed and in list form.

Safety procedures – list any possible safety hazards or issues that may appear in your lesson.

Lesson Body
Engagement: Activate prior knowledge and get interest of students… Can be a literature connection
Exploration: Detailed step by step procedures of a hands-on Inquiry activity
Explanation: (Write at least 5 questions that you would ask the students in debriefing in order to see if they learned the content that they were supposed to learn.) Includes key words and definitions of Tier 3 vocabulary that are introduced (E.g. Word Wall).
Elaboration: an extension activity that is hands-on with detailed procedures.
Evaluation:
Formative: (on-going e.g. teacher observation, questioning, etc. list what you will be looking for or asking questions about) Qualitative data
Summative: (final projects with grading rubrics) Quantitative data

Clean-up - How will you involve the kids?
Closure - State the objective and relate back to standards.

*Adaptations for ESL, Special Ed, or G.T.
Table 1: Standards & Vocabulary Lesson Scaffolding Planning Chart

<table>
<thead>
<tr>
<th>Content Standards</th>
<th>BICS (Tier 1) Engagement &amp; Exploration</th>
<th>BICS / CALP (Tier 2) Engagement &amp; Exploration</th>
<th>CALP (Tier 3) Explanation, Elaboration &amp; Evaluation</th>
<th>Definition</th>
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*Management Strategy*

Major Assignment #1
Writing a 5E lesson plan

The purpose of this assignment is for you to get used to writing an Inquiry lesson plan in the 5E format.

Using the 5E lesson plan format outline you will need to choose a science topic and build a complete learning cycle. This will be quite detailed and may take as many as 3-5 pages.

Begin with finding a standard to teach from the Next Generation Science Standards. The Standard becomes the Objective of the lesson!

Once you have identified all of this information – you are ready to do some background research (content) for you (the teacher). This should be heavily content laden and comprise of the “science” that you need to know in order to teach the lesson. This should be in-depth and in detail and will likely read like an encyclopedia entry. Be sure to cite your references.

Next you will do some background research for the students learning in your chosen grade level. Look at the standards prior to this level. Discuss what is needed as prior knowledge and past life experience.

Next, you will identify any possible safety concerns and then make a detailed materials list (e.g. water containers (20) – one for each child approx 50 Milliliters).

Now you are ready to write the Body of the 5E lesson plan. Note that you need to write something for Each E in detail. You may even start with prior preparation.

Inquiry lessons end with stating the objective / content standard – so after you have written how you will involve the children in clean up procedures – the last thing you write is what the children were supposed to learn as it pertains to the objective and content standard.

No Adaptations or management strategies are necessary for this first lesson plan, but keep them in mind for the next round.

Good luck – and remember that we use the Learning Cycle (5E) model – because “It Works!”
Major Assignment # 2  
Science Fair Project (Open Ended Inquiry)

You (and a partner) will conduct an open ended inquiry where you have conducted an investigation over time, collected data, and have come to some conclusions. Once you have chosen a partner and an idea – please check with me to make sure your project is ready to go.

Grading Criteria for an exemplary project

Part 1 – Project – write-up on a Foldable…
On a Dinah Zike Foldable include:
  - Title - may be in form of question
  - Abstract - clear and concise
  - Problem - a short statement about the problem you are exploring…
  - Background Research with minimum of 5 references
  - Hypothesis (Has its own section)
  - Procedures including controls, variables, Uncontrollable variables, and materials
  - Experimentation - steps are easily replicable
  - Data - in the form of graphs or charts w/ accompanying explanations of data.
  - Conclusion based solely on the data
  - Discussion – short narrative of what worked and went well with the experiment, questions for further research, and some application to the real world
  - Should be able to stand alone without need of explanation of project
  - Creative and aesthetically pleasing as well as professional in appearance

Part 2 - Presentation
  - Comments on all aspects of the report with emphasis on experimentation and results
  - Organized and well planned
  - Creative and/ or interactive
  - Fits within the presentation time frame
  - Ability to field questions about experiment
<table>
<thead>
<tr>
<th>Project Components</th>
<th>Points Possible</th>
<th>Full Points 100%</th>
<th>Well done 85-99 %</th>
<th>Average work 70-84%</th>
<th>Needs Work 60-70%</th>
<th>Incomplete or missing 0 - 59%</th>
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<td>Problem</td>
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<td>All parts of the report / research</td>
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Total Points____ Major Project #3
Plan and teach a 5E Learning Cycle

The purpose of this assignment is to get you familiar with the Next Generation Science Standards. To become familiar, you will be assigned to a grade level and design a unit of instruction based upon the NGSS. You will identify a science topic / concept to develop, write a detailed 5E lesson plan that ties into the others you are working with, and finally teach an Engagement, Exploration, and Explanation from one of the lessons in the unit to the class.

Team Component:
- Identify a concept / topic for your grade level from the Next Generation Science Standards and develop a series of related lessons (Unit).
- Write a short scope and sequence of the activities that you chose, showing the relationship between standards, content, activities and assessment.
- Come up with 1 (one) summative assessment idea that covers all 4 lessons in the unit and support the chosen standards to be taught.
- From the completed lesson plans, as a group, choose one engagement, exploration, and explanation that you can share with the entire class. This should be a hands-on experience that introduces your content and allows students to construct knowledge on the content. The exploration and presentation of unit will be 20 - 30 minutes.
- At the close of the session, you will review all the lessons and how they tie together with the standards and share your unit assessment idea.

Individual Component:
- The individual component of this project is to design an exciting hands-on inquiry based lesson (as demonstrated all semester long in this class) based upon the NGSS. You can use any resources available including FOSS kits, Harcourt series, or anything you can create to make a great lesson / unit.
- The lesson plan needs to be written up using the 5 E model (learning cycle) and include procedures for each E. The lesson should be as detailed as the first lesson plan that we did at the beginning of the semester.
  - Additionally include: 2 CCSS Language Arts standards, 2 CCSS math standards, and 2 ELL standards (WiDA) that reflect how the lesson addresses reading, writing, speaking and listening.
  - Note: The teacher background section of lesson plan may be a 1-2 paragraph overview of the content to be taught in the lesson with additional research attached to the back of the lesson plan.
- Each team member designs one lesson plan from the curriculum as it relates to the standard and overall theme. Thus the team total will be 4 lesson plans (or however many people are in your group).
- The lesson plans need to be assembled with the unit overview / introduction, scope and
sequence, and the unit assessment.

Presentation Component:
- Each team will present their project by planning and teaching a Mini Learning Cycle that includes an Engagement, Exploration, and Explanation phase of the learning cycle with the entire class.
- The entire presentation should take 25 minutes and should be hands-on and exciting.
- Everyone in the team needs to have an active role in the teaching of the activity.
- Remember an exploration is a hands-on activity where students will interact with phenomena and construct knowledge based upon experience. Science notebooks will be encouraged for taking notes and observations from the activity. Successful projects are extremely hands-on with very little “teacher up front” talking.
- Presentation ends with a brief discussion of the scope and sequence (how the lessons are tied together through standards) and the unit assessment.
# 5E Unit-Grading Rubric

**Students**

<table>
<thead>
<tr>
<th>Project Components</th>
<th>Points Possible</th>
<th>Points received</th>
<th>Comments</th>
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<tbody>
<tr>
<td><strong>Lesson Plan</strong></td>
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<tr>
<td>Title, Name, Adapted, Grade</td>
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<td>NGSS</td>
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<td>CCSS Math &amp; ELA / WiDA</td>
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<tr>
<td>Teacher Background</td>
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<td>Student Background</td>
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<tr>
<td>Materials &amp; Safety Precautions</td>
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<td>Engagement</td>
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<td>Exploration</td>
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<td>Explanation</td>
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<td>Elaboration</td>
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<td>Formative Evaluation</td>
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<td>Summative Evaluation</td>
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<td>Clean-up</td>
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<td>Closure</td>
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<td><strong>Total Points</strong></td>
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### Team Component

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<th>Teaching:</th>
<th>Points Possible</th>
<th>Points Received</th>
<th>Comments</th>
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<tr>
<td>Teaching an Engagement, Exploration &amp; Explanation Phase: 25 minutes long</td>
<td>5</td>
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<tr>
<td>Demonstrates best science teaching methods in each of the first 3E’s</td>
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<td>Active roles for each person in group</td>
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<tr>
<td>Includes having class record observations and uses them in lesson</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>20</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Group Write up Component

<table>
<thead>
<tr>
<th>Points Possible</th>
<th>Points Received</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope and Sequence for grade level (Overview of Unit and lessons to be taught)</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Unit Summative Assessment Plan with copy of assessment and grading rubric</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>15</strong></td>
<td></td>
</tr>
</tbody>
</table>

Total Points:
- Individual Points = 125  
  ___ / ____ = _____% = ____ / 10 Pts
- Team Teaching Points = 20  
  ___ / ____ = _____% = ____ / 5 Pts
- Team Write-up Points = 15  
  ___ / ____ = _____% = ____ / 5 Pts

Total grade % and points ____ / 20  
___ / 150  
Percentage out of 35% ________