Course Syllabus

Teaching Elementary and Middle Level Science Methods

Masters in teaching program

 2014 Spring Quarter

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Class Meeting: 1-4 Tuesdays

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**COURSE DESCRIPTION, ESSENTIAL QUESTIONS OBJECTIVES, AND STANDARDS**

**COURSE DESCRIPTION**

This course is designed to help you develop the theoretical background, practical knowledge, and skills essential for successful science teaching at the elementary through middle level. Current understandings of best practices will be introduced, discussed and practiced. You will have the opportunity to engage in learning activities both as learner and as a teacher, reflection on each experience and how one influences your thinking on the other. In doing so, you are encouraged to see yourself as a life-long learner and a professional in your field.

**ESSENTIAL QUESTIONS GUIDING OUR WORK TOGETHER THIS QUARTER**

1. What does it mean to be a professional educator in all of the dimensions of a teacher’s work?
2. What does it look like in the classroom and through interactions with students, parents, colleagues, and administrators to enact the belief that all students can learn?
3. How can we organize our classrooms in ways that support student learning, engagement, and empower students?
4. What does it look like when students are engaged in transformative learning experiences?

**COURSE OVERVIEW AND OBJECTIVES**

1. We will explore many topics related to quality teaching during the quarter, including the following “big ideas”. Quality science teachers:
2. Base their instruction around carefully thought-out instructional goals. They do not simply “cover: the textbook. They are able to provide a rationale for both what and how they teach every lesson.
3. Know how to create, locate and modify a wide variety of resources for quality instruction.
4. Carefully plan instruction to match their goals and rationale. They can articulate what they and their students should be doing throughout each of their lessons.
5. Understand and teach about the nature of scientific knowledge
6. Are reflective practitioners. They determine their actions produce desired outcomes, and if not, are able to make rational choices about alternative behaviors
7. Are able to use a variety of instructional strategies, and can match instructional approaches to lesson goals and student needs
8. Understand that teaching does not occur in absence of learning
9. Believe that all students can learn science
10. Growth towards becoming life-long learners, active in professional development throughout their careers.

At the end of this course, through large and small group instruction and discussion, hands-on learning experiences, clinical field work, and reflective writing, you will work toward the following *essential* instructional objectives:

* Developing specific skills, competencies, and points of view needed by teaching professionals
* Learning to apply course material in the classroom setting
* Gaining a broader understanding and appreciation of science as an intellectual and cultural activity
* Acquiring an interest in learning more by asking questions and seeking answers
* Learning how to find and use resources for answering questions or solving problems

You will also work toward the following *important* instructional objectives:

* Acquiring skills in working with others as a member of a team
* Learning fundamental principles, generalizations, or theories
* Developing skill in expressing oneself orally or in writing
* Developing a clearer understanding of, and commitment to personal values
* Learning to analyze and critically evaluate ideas, arguments, and points of view.

**COURSE Competencies**

Candidate works to build the interrelationships among science, technology, engineering, mathematics (STEM) and society; by applying fundamental concepts related to Disciplinary Core Ideas and promotes the scientific abilities of all children as they acquire new knowledge through the use of Crosscutting Concepts and Science and Engineering Practices in the Next Generation Science Standards (NGSS)

1. E. 4 Uses the Crosscutting concepts as an organizational framework for connecting core ideas across the earth and space sciences, the life sciences, physical sciences, and engineering design.

1.E. 6 Understands and integrates the use of appropriate tools, including technological tools e.g., 3-tools and interactive science notebooks

1.E.7 Develops knowledge of and applies safety precautions and procedures relative to science investigations e.g., student eye protection, safe storage of chemicals and equipment care and maintenance. Demonstrates responsible use and disposal of live organisms according to Washington State law.

**CORE ASSESSMENT REQUIREMENTS**

This course includes 2 Core Assessment requirements:

* Inquiry-based Science Plan and Lesson
* Science Safety Plan

These assignments must be submitted to Moodle

**CONCEPTUAL FRAMEWORK**

This course explicates the conceptual framework-teaching for social justice—of the Masters in Teaching program at The Evergreen State College. As teachers we recognize our connection to students as individuals and as members of a larger community. As leaders in our classrooms and larger school communities, we must attend to how education can be transformational and how we might be agents of change. In this course, we will explore what it means to hold high expectations for *all* learners; this includes academically challenging, personally and socially relevant knowledge and complex learning skills. In order to successfully provide opportunities for youth to meet these expectations, we must also be committed to reflection on our own practice and to continually develop our own knowledge, attitudes, skills and dispositions**.**

**COURSE TEXTS**

* Abell, Sandra (2006) First edition Seamless Assessment in Science ISBN 9780325007694
* Available on Amazon (Rent/15.53) (Used 22.07) (New 23.92)
* Harlen, Wynne (2001) First Edition. Primary Science: Taking the Plunge. ISBN 9780325003863
* Available on Amazon (23.33)
* Marcarelli, Kelli. (2010)Teaching Science with Interactive Notebooks ISBN 9781412954037
* Available on Amazon (Rent/22.75) (Used/30.92) (New 34.15)

**\****Other Readings will be provided in class and/or through Moodle*

**MATERIALS**

* Composition notebook
* Common Core Standards and the Next Generation Science Standards
* 3-ring binder

**COURSE POLICIES**

**ATTENDANCE AND PARTICIPATION**

Attendance is required. If you are unable to attend class, it is your responsibility to:

1. Notify the instructor in advance. Please note that informing the instructor does not excuse your absence.
2. Send assignments that are due.
3. Obtain handouts, assignments, class notes, and information about activities from a classmate prior to the meeting of the next class.
4. Be prepared for the next class.

*Participation in class activities and discussion is expected. You should come to class prepared and be ready to contribute and take part in class activities. Your contributions to discussions are valued.*

**LATE WORK AND EXTENSIONS REQUESTS**

All assignments are due on the dates listed in the syllabus. Late work will only be accepted under special circumstances (e.g. family emergency, illness). Please contact me in person or by phone or email prior to any given due date to discuss assignments extensions requests.

**REQUIREMENTS FOR ALL WRITTEN ASSIGNMENTS**

* Unless otherwise instructed, all written assignments completed outside of class must be double spaced, with one inch margins, word-processed in Times New Roman, 12-point font and saved electronically. You must have the capacity to produce the assignment again.
* **Unless noted all assignments should be submitted in class**. **Please note that the core assessments for this course will be submitted to Moodle.**
* References should be cited where applicable, following American Psychological Association style guidelines (APA-current edition)
* Written assignments will be evaluated for accurate mechanics and English grammar usage as well as thoughtful pertinent and clear content.

**ASSIGNMENTS**

Educators need to have three kinds of knowledge to deliver quality instruction in the classroom:

* Content knowledge—an understanding of the subject area to be taught-You received this through your undergraduate program of study.
* Pedagogical knowledge—an understanding of how people learn and how to teach—this will be a continuation of the previous strands (learning theory and child development) as well as central part of the work that we will do this quarter, including this strand and the understanding acquired from the differentiated instruction and classroom management strands)
* Pedagogical content knowledge—the central point to this course. What are the specific issues that are unique to teaching science?

To demonstrate your preparation in all these areas you will need to demonstrate the ability to plan lessons, implement at least portions of a lesson, and be reflective about your own practice. You will have the opportunity to demonstrate these skills through a variety of assignments listed below.

**Standards Assignment--**Access the ***Next Generation Science Standards*** Select the grade level in which you are currently placed and review the expectations for that particular grade level. Identify those areas from the standards that you see as your strengths and those areas in which you will need to grow. Be prepared to share this information in class.

**\*Science Interview—**Interview two students (one at a time) to get a sense of their scientific literacy. As you think of planning the interview consider the following: what have you seen students do in science, what concepts do you see students struggling with. Another thought is that you could focus on the science concept in which you will base your short unit plan.

You will only need to write up one of the interviews. *(Science Interview Assignment adapted from Secondary Science Methods syllabus by Dr. Sonia Wiedenhaupt)*

1. Tape record the conversation and keep all artifacts of the interview.
2. Before you start the interview, let the student know why you want to talk with them. Explain to them that you want to get a sense of what they think about science. You can also let them know that the conversation will help you as you are learning to become a teacher. End the interview with the following kind of questions: What do you think science is all about? Do you think scientists ask questions? What kind? What is an experiment? Do scientists do experiments? If so why? How does a scientist decide what kind of experiment to do?
3. Write Up-The write up consists of four parts. Treat each section as a section of your paper to which you should attend.
4. Describe the student you plan to interview. Include information you gather about the child (tell me what you know about this child as a learner, as an individual) Write about what you know about the students level of scientific literacy before the interview. \*Remember do not use the child’s real name
5. Scientific Literacy- Briefly explain the question or task you gave the student. Explain why you chose these tasks. For each main question asked (you will want to pose a probing question)
6. Analysis and Reflection-think about the questions posed and how your questions helped you to understand the child’s scientific literacy (what did the students do? Use verbatim comments from the student that helps clarify what the student did?)
7. What did the student understand about science? What misconceptions did the student have about science? What questions would you like to ask the student now in retrospect? (Individual)

**Science Notebook**—you will be expected to maintain a science notebook throughout the quarter. As noted on the course syllabus there will be reflection questions based upon the readings in which you will be expected to respond to. Science notebooks will be collected week 5 of the quarter.

Science All Around Us-Field-trip

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Practicum students will work in pairs—walk around campus (inside/outside) and look for examples of science as an everyday activity. Your goal is to gather and present visuals that represent science in our surroundings. Your collection of visuals should represent the range of science content areas (life science, physical science, and earth science). (Time: 40 minutes)

* Number of photos-10 to 15 pictures
* Variety –need to have pictures from the different content areas
* Real world relevance-As you are taking pictures, think about capturing visuals from the perspective of

 elementary age school students (what might they notice and/or what might they wonder about)

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Continuing to work in pairs, you will write questions for each picture that suggests possible explorations that could be done in an elementary classroom.

* It might be helpful to consider what kids might/could wonder about.
* For each picture write multiple sentences. Lastly, construct higher-order thinking questions utilizing

 Bloom’s Taxonomy to help you construct questions.

Share/Close

* Be prepared to share out visuals and questions with the large group
* Reflections: How could this assignment be modified to fit an elementary or middle level science classroom

Practicum Student Demonstration (In-class assignment)

*\*Practicum students will sign-up for times*

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This assignment requires you to choose, plan, practice, and present a demonstration appropriate for use in an elementary grades classroom. The demonstrations should last 5-10 minutes and will be presented to the members of the class. You may serve as assistants for one another, but each of you is responsible for writing and leading your own demonstration. The goal is to arouse children's interest and get them thinking; focus more on asking good questions than on giving explanations. *Be very careful you do not try to explain something you yourself do not understand*.

There are MANY resources with good demonstrations to try. Here are some places to start:

* [The Exploratorium "Science Snacks" page](http://www.exploratorium.edu/snacks/snacksbysubject.html): These demonstrations are written by the Exploratorium . The site is organized by subject. Each demonstration has an image.
* [Bizzarre Stuff You Can Make In Your Kitchen:](http://bizarrelabs.com/index.htm) A collection that includes some easy and fun demonstrations, complete with images. The index is organized around the materials, such as Eggs: Stupid Egg Tricks.
* [Experiments and Lecture Demos:](http://www.mpcfaculty.net/ron_rinehart/exptdemo.htm) A set of links to a variety of other sites from Ron Rinehart

You will be evaluated on both your written materials and your presentation itself.

Your written materials will be turned into the instructor the week prior to your demonstration and should include:

1. **Name of your demonstration.**
2. **Purpose and target concept(s).** Include a paragraph or two explaining the underlying science concepts involved. Include diagrams.
3. **Materials needed.**
4. **Procedure.** For ease of using this, a bulleted list is better than paragraph form. Include diagrams or pictures.
5. **Questions you will ask.** These may be sprinkled throughout your procedure, but they should be easy to pull out visually from the text. Include answers.
6. **Reference Sources.** Make sure to include sources for explanation of background information in addition to the source of the idea. Include titles, not just addresses and bibliographical information so that someone could find material if needed. \*Annotated Bibliography

As you plan, consider the following suggestions from Richard Black, in his article "Why Demonstrations Matter" (*Science and Children*, September 2005, pp. 52-55)—this article is located on Moodle

* State the concepts in your lesson plan, but do not offer them to students before the demonstrations;
* Question students throughout the demonstration (Why do you think...?);
* Elicit predictions and hypotheses and encourage conclusion development. (What do you think will happen if...?);
* Include students in carrying out the demonstration, being part of the procedure, and assisting with material set-up; and
* Encourage active observation that includes diagramming, illustration, etc. Students should utilize their science journal enter "Problem, Materials, Diagrams, Predictions" (before the presentation is carried out)," and "Observations, Results, and Conclusions" (after understanding the principle or concept)

Inquiry-based Science Plan and Lesson

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Working with a partner— develop a inquiry-based science plan and inquiry based science lessons in the 5-E format. Special attention will be given to questioning strategies, planning for diverse learners, assessment techniquest and the integration of other curricular areas.

Science Learning Plan (this plan should include 5 lessons, two of which are *fully developed*)

1. Title

2. Overview andStatement of Purpose

* Include a sentence or two explaining the purpose for the lesson.
* Include a sentence or two explaining how this lessons connects to the real world

3. Grade Level and Objectives

* Please list grade level and all science objectives being taught.
* You should connect this to the NGSS.
* Explain clearly in one or two sentences specifically how each objective will be met in the lesson.

4.  Curricular Integration.

*(Note: The intent of this section is to show that you are aware of some ways that you could integrate—look at NGSS it might help!).*

A. First Activity:

* What is an additional curricular integration activity you could use with your lesson plan? How would you integrate this activity?

B.  Second Activity:

* What is a second additional curricular integration activity you could use with your lesson plan? How would you integrate this activity?

5. Essential Knowledge (for teacher)

* Provide a detailed explanation of the science content being developed in the lesson. The purpose of this explanation is for you as a teacher to demonstrate your own understanding of the background knowledge and science content being taught in the lesson. It is beyond what students will need to know and should be written clearly enough to teach another teacher this background knowledge. Use diagrams where necessary.

6. Developmental Level/Student Background Knowledge

* How does this lesson fit the students coming to you in terms of what they might have experienced in real life?
* Explain how it is matched to their physical skills (what they can do with their bodies)?
 How is it matched to their conceptual skills (what is going on developmentally in their minds)?
 How does it relate to what they would have learned in previous grade levels (look at the standards)? How does it relate to what they will learn in the future (look at the standards)

Detailed Lesson Plan: The Learning Cycle (5E’s) should be developed in enough detail for a knowledgeable substitute to use. (Be sure to see the rubric for specific details of what to include in each of the phases of the 5E Learning Cycle.) ***While the overall plan is constructed in partnership, the lesson plan is an independent activity.***

Engagement with transition question, challenge, or problem

What will you do to engage the students?

What questions will you ask? (Provide sample answers)

 Exploration

 How will you transition from the engagement to the exploration?
 How will you set up this exploration? Include a table or example.
What data will students gather?
 How will you help students generate their own questions?
 What questions will you ask? (Provide sample answers.)

 Explanation

How will you get students to share their data?
What guiding questions will you ask? (Provide sample answers.)
What ideas will you be trying to develop?
 How might you act out or demonstrate the ideas you’re developing?
What terminology will you introduce, and how will you relate this to the data?

Expansion

What will students do in the Expansion phase?
What concepts will you be having them apply?
How is this different but related to what came before?
What guiding questions will you ask? (Provide sample answers.)

E.  Evaluation

What formative assessments will you use, and when in the lesson will you use them?
What specifically will you be looking for in these?
 What summative assessment will you use?
 What specifically will you be looking for in this?
Provide a sample response to the summative assessment and a rubric for grading this.

9. Modifications

What specific modifications will you make to meet the needs of all learners? It will be helpful when planning to consider specific learning styles evident in your practicum classroom.

10. List of Materials (Note: this should be an exhaustive list that speaks to the materials needed by both the teacher and the students)

11. Safety Considerations (Note: What safety concerns should be taken into consideration—e.g. working with materials)

12. Sources

Note a minimum of three different science sources used for developing the lesson plan and background information.

Each source should include a title, bibliographic information, and an annotated bibliography.
List at least one video you could use showing this concept in real life. This should not be an animation or video lesson, but a real life example related to your topic.

Science Safety Check-sheet

In order to help you develop the knowledge and skills to create a safe science classroom and laboratory, you will be required to create a comprehensive safety plan. You will work collaboratively with your partner to compile multiple components throughout the quarter in order to fulfill the requirements for this assignment (Note: each partner must contribute to the development of each component of the project so both are familiar with each component of classroom safety). This plan will be submitted as part of your inquiry based science plan. It should contain the following components:

* Classroom/laboratory safety guidelines for students (check with your school and the OSPI website for specifics)
* A safety quiz designed for students to take at that beginning of the school year, which includes questions on the safety rules/guidelines for the classroom, as well as what to do in various emergency situations.
* A safety contract that explains the basic safety procedures and features of the science classroom. The contract should include a space where students and parents can sign after reading
* An informational page explaining the safe, ethical, and humane treatment of living organism in the classroom and in the field. This should include rules and regulations for collecting organisms in the field and for handling living organisms during classroom experiences based on local, state, and/or national regulations
* A plan for behavior management of students in the science classroom. Be sure to include a clear description of proper student behavior in the lab, including special precautions that should be taken in science classroom when handing chemicals and lab equipment, working with living or non-living organism, or using safety equipment. In addition positive and negative consequence for behavior should be provided. Focus on making this a proactive plan to prevent unsafe behavior.

Science Circus

A science circus is a accumulation of different centers that elementary students can walk through and use, focusing on one of the basic process skills. These skills are observing, measuring, inferring, classifying, predicting, and communication. Each practicum student will draw one of these skills from a hat to see what their center will focus on. In designing the station, note that it must be self-explanatory, hands-on, and inquiry based. You will also be expected to complete a write up about the center to be handed out as a future reference to the rest of the class. The write-ups should contain grade level, NGSS content connection, the process skill that was targeted and how you did this through the design of the center, and lastly the write up should include a description with instructions and materials for other teachers to follow. For our science circus there will be 5 or 6 stations based around a theme. The theme could be weather, animals, plants, motion energy, etc. (the group will decide). You will work in groups of 3 to create a your portion of the science circus. Each station must contain student directions, teacher directions and all the supplies necessary for the activity. Consideration should also be given an idea of how long it will take to complete each activity (no more than 10 minutes).

Each student will be given a basic process skill and will create a station for our Basic Process Skill Circus. Your center should be a self-explanatory, hands-on, inquiry-based experience.

Science process skills are basic skills of inquiry that are used throughout the science curriculum, the following list contains much of what you would find in any description.

Basic Science Process Skills

• Observing: Using your senses to gather information about an object or event. This is *qualitative* data.

• Measuring: Using standard measures or estimations to describe an object or event.

• Inferring: Based on observation, inferring involves making some possible explanations.

• Classifying: Ordering or grouping objects or events into categories based upon characteristics.

• Predicting: Suggesting the most likely outcome of a future event based upon previously collected evidence.

• Communicating: Using drawings, words, numbers, or graphs to describe an event or object.

**Tentative Calendar**

*\*Instructor reserves the right to make changes to syllabus as deemed appropriate*

\*Hardcopies of assignments are due in class the day listed unless otherwise noted!

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| Week | Topic/Focus | Readings | Tasks/Assignment Due |
| Week 14/1 | Everyday ScienceScience All Around UsReview Syllabus/Assignments/Essential Questions for the Quarter | Fort articleText: Harlen (chaps. 1-3)Text: Marcarelli (chaps 1-3) | Standards AssignmentReflection Questions-What do you think about science education? Are you science shy, savvy, or smart?Science Field tripPhoto essay |
| Week 24/8 | What is Inquiry?Working with NGSSStage One: Big Idea/Essential Questions | Bybee articleText: Abell (pgs. 1-37); Harlen (chaps. 4-5) | Reflection Questions-How does the learning cycle connect with Piaget’s ideas about how children learn? How can you use science notebooks to teach the inquiry process?**\*Bring to class science curriculum from your practicum/teachers manual or student textbook** |
| Week 34/15 | Stage Two: Assessments  | Text :Abell (pgs. 58-85;101-114)Text: Harlen (chap. 6) | Science Student Interview-Due Stage One-DueReflection Questions: How do you plan on assessing your inquiry science classroom? How can science notebooks help you achieve this goal? |
| Week 44/22 | Micro Teaching | Micro Teaching | Micro Teaching |
| Week 54/29 | Stage Three: Learning Activity PlanInstructional Learning TargetsLearning targets/organization* Variety of modalities, strategies and materials
* Active Facilitation
* Effective Engagement
 | Text: Marcarelli (chaps 4-6)NGSS: Chap. 5 Science Safety (TBD) | Stage Two DueIn-class work session-drafting inquiry based science plan |
| Week 65/5 | 5-E Lesson planContent Understanding* Depth of Understanding
* Communication of Concepts and procedures
* Building Background Knowledge
* Transmission of Content Knowledge and Procedures
 | Black article Crowther articleText: Marcarelli (chaps 7-8)Text: Harlen (chaps 7-8) | In-class work session 5-E Lesson PlanningDemonstration Planning and Sign-up |
| Week 75/13 | Cohort Meets  | Cohort MeetsScience Circus article (PDF) | Cohort Meets \*Details TBAScience Safety Plan (HQD) Post to Moodle by 11:59pmHigh Quality Draft of Science inquiry plan and lessons-Post to Moodle by 11:59pm |
| Week 85/20 | Analysis and Problem-solving* Inquiry and Analysis

Opportunities for Novel Applications Quality of Feedback* Feedback Loops
* Scaffolding
* Building on Student Responses

Encouragement and Affirmation |  | Student Demonstrations Round 1Planning Science Circus CentersWork session |
| Week 95/27 | Instructional Dialogue* Cumulative Content-driven
* Distributed Talk
* Facilitation Strategies
 |  | Student Demonstrations Round 2Final Draft of Science Inquiry Plan and LessonsFinal Draft of Science Safety Plan \*Post to Moodle by 11:59pm |
| Week 106/3 | Revisit Essential Questions |  | Science Circus Presentation of CentersWrite-up due (hardcopy in class)Science Notebooks Due |