George Mason University
College of Education and Human Development
Secondary Education Program

EDCI 483
ADVANCED METHODS OF TEACHING SCIENCE IN THE SECONDARY SCHOOL

Spring Semester, 2013

Instructor:	Len Annetta, Ph.D.
Date and Time:	January 23rd – May 8th (Wednesday 7:20– 10:00 pm)
Class Location:	Thompson Hall 2020
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Office:	Thompson Room 1406
Office Hours:	By appointment

REQUIRED TEXT RESOURCES

N/A

RECOMMENDED TEXT RESOURCES

- Bell, R., Gess-Newsome, J. & Luft, J. (2008). *Technology in the secondary science classroom.* Arlington, VA: NSTA Press.
- Liu, X. (2010). *Essentials of science classroom assessment.* Washington, DC: Sage Publications.
- Tomlinson, C. A. (2005). *How to differentiate instruction in mixed-ability classrooms.* Upper Saddle, NJ: Pearson.

- Keeley, P. (2008). *Science formative assessment: 75 practical strategies for linking assessment, instruction, and learning.* Arlington, VA: NSTA Press.
- Nitko, A. J. & Brookhart, S. M. (2007). *Educational assessment of students*. Upper Saddle River, NJ: Pearson

Online Resources

- Commonwealth of Virginia (2003). *Standards of Learning for Virginia Public Schools.* http://www.doe.virginia.gov/testing/sol/standards_docs/science/index.shtml

- Commonwealth of Virginia (2003). *Science Standards of Curriculum Framework Guides.* http://www.doe.virginia.gov/testing/sol/standards_docs/science/index.shtml

- National Science Teachers' Association. *Science Class* newsletter. http://www.nsta.org/publications/enewsletters.aspx.

- American Association for the Advancement of Science (1993). *Benchmarks for Science Literacy*. http://www.project2061.org/tools/benchol/bolframe.htm.

- National Academies Press (1996). *Classroom Assessment and the National Science Education Standards.* http://www.nap.edu/catalog.php?record_id=9847

Other articles/handouts will be distributed in class or posted on-line at the course website. (Your GMU email address is required for communication with the course instructor and for using Blackboard!)

Course Materials Online

The Blackboard site can be found at http://courses.gmu.edu. Use the same login as your GMU email.

Course Description

Prerequisite: EDCI 573. This is the second course in a two-part sequence of courses for preservice science teachers. The course is designed to build on the fundamentals of curriculum design and teaching from the first course and focus on using technology for students to investigate science and adapting instruction and assessment for the diverse needs of learners. In additional to using technology in the schools, preservice teachers will modify lessons and assessments to address the diverse needs of students, implement those lessons and assessments with their peers, and analyze the effectiveness of those lessons and assessments.

Goals

- Understand the relationship of assessment in understanding student learning and informing instruction; RESEARCH-BASED PRACTICE; SPA STANDARD 8
- Design evidence-based assessment techniques in science instruction; RESEARCH-BASED PRACTICE; SPA STANDARD 8

- Build a repertoire of science teaching and assessment strategies using technology to help students become scientifically literate, think critically and creatively, and see relationships among science, technology, and society; RESEARCH-BASED PRACTICE; INNOVATION; COLLABORATION; SPA STANDARDS 1, 2, 3, 5, 6, 8, 10
- Critique, adapt, and construct standards-based lessons including assessment and hands-on experiences for the diverse needs of learners including gender equity, cultural diversity, English language learners, gifted/talented students, and students with learning, physical, social, and emotional challenges. RESEARCH-BASED PRACTICE; SOCIAL JUSTICE; ETHICAL LEADERSHIP; SPA STANDARDS 1, 3, 4, 5, 6, 7, 8, 10

Relationship to Program Goals and Professional Organizations

EDCI 673 is the second course in a two-course sequence of science methods courses for students seeking a secondary school teaching license in earth science, biology, chemistry, or physics. The course builds on students' knowledge of their subject matter and from their first science methods course. The course focuses on using technology in science teaching and learning and meeting the diverse needs of learners as called for by the *Standards of Learning for Virginia Public Schools* and *National Science Education Standards* and as outlined by the National Council for Accreditation of Teacher Education (NCATE), the National Science Teachers Association (NSTA), and the Interstate New Teacher Assessment and Support Consortium (INTASC). EDCI 673 introduces students to integrating technology in learning and teaching science, adapting inquiry-based lessons, assessment techniques, and the diverse needs of students.

Sustainability at GMU

George Mason University is focusing on making our community "greener" and reducing the impact on the environment. This course will contribute to this effort in the following ways. I hope that you will create other ways to contribute to contribute to this effort.

- Handouts will be available electronically through the Blackboard platform
- You should consider reducing waste in your teaching practice (ex: unnecessary paper) and in developing your work products for this class
- Incorporate teaching sustainability in the content of your lesson plans (for example, human's role in reducing their impact on the environment.) Think about what the next generation needs to know about "greening".

Communication

If you would like to get in touch with me, email is the best form (lannetta@gmu.edu). During usual circumstances, turnaround time is 24-36 hours. Please don't leave a message on my university phone, as the system is relatively unreliable.

College Expectations and University honor Code

The Graduate School of Education (GSE) expects that all students abide by the following: Students are expected to exhibit professional behavior and dispositions.

Commitment to the profession
- Promoting exemplary practice
- Excellence in teaching and learning
- Advancing the profession
- Engagement in partnerships

Commitment to honoring professional ethical standards
- Fairness
- Honesty
- Integrity
- Trustworthiness
- Confidentiality
- Respect for colleagues and students

Commitment to key elements of professional practice
- Belief that all individuals have the potential for growth and learning
- Persistence in helping individuals succeed
- High standards
- Safe and supportive learning environments
- Systematic planning
- Intrinsic motivation
- Reciprocal, active learning
- Continuous, integrated assessment
- Critical thinking
- Thoughtful, responsive listening
- Active, supportive interactions
- Technology-supported learning
- Research-based practice
- Respect for diverse talents, abilities, and perspectives
- Authentic and relevant learning

Commitment to being a member of a learning community
- Professional dialogue
- Self-improvement
- Collective improvement
- Reflective practice
- Responsibility
- Flexibility
- Collaboration
- Continuous, lifelong learning

Commitment to democratic values and social justice
- Understanding systemic issues that prevent full participation
- Awareness of practices that sustain unequal treatment or unequal voice
- Advocate for practices that promote equity and access
- Respects the opinion and dignity of others
- Sensitive to community and cultural norms
- Appreciates and integrates multiple perspectives

COLLEGE OF EDUCATION AND HUMAN DEVELOPMENT STATEMENT OF

EXPECTATIONS:

All students must abide by the following:

- Students must adhere to the guidelines of the George Mason University Honor Code [See http://academicintegrity.gmu.edu/honorcode/].
- Students with disabilities who seek accommodations in a course must be registered with the George Mason University Office of Disability Services (ODS) and inform their instructor, in writing, at the beginning of the semester [See http://ods.gmu.edu/].
- Students must follow the university policy for Responsible Use of Computing [See http://universitypolicy.gmu.edu/1301gen.html].
- Students are responsible for the content of university communications sent to their George Mason University email account and are required to activate their account and check it regularly. All communication from the university, college, school, and program will be sent to students solely through their Mason email account.
- Students must follow the university policy stating that all sound emitting devices shall be turned off during class unless otherwise authorized by the instructor.
- Students are expected to exhibit professional behaviors and dispositions at all times.

Please note that:

o "Plagiarism encompasses the following:

1. Presenting as one's own the words, the work, or the opinions of someone else without proper acknowledgment.
2. Borrowing the sequence of ideas, the arrangement of material, or the pattern of thought of someone else without proper acknowledgment."

(from Mason Honor Code online at http://mason.gmu.edu/~montecin/plagiarism.htm)

o Paraphrasing involves taking someone else's ideas and putting them in your own words. When you paraphrase, you need to cite the source.

o When material is copied word for word from a source, it is a direct quotation. You must use quotation marks (or block indent the text) and cite the source.

o Electronic tools (e.g., SafeAssign) may be used to detect plagiarism if necessary.

o Plagiarism and other forms of academic misconduct are treated seriously and may result in
disciplinary actions.

• Students must agree to abide by the university policy for Responsible Use of Computing. See http://www.gmu.edu/facstaff/policy/newpolicy/1301gen.html.
Click on responsible Use of Computing Policy at the bottom of the screen.

• Students with disabilities who seek accommodations in a course must be registered with the GMU Office of Disability Services (ODS) and inform the instructor, in writing, at the beginning of the semester. See http://www2.gmu.edu/dpt/unilife/ods/ or call 703-993-2474 to **access the ODS.**

- The George Mason University Counseling and Psychological Services (CAPS) staff consists of professional counseling and clinical psychologists, social workers, and counselors who offer a wide range of services (e.g., individual and group counseling,

workshops and outreach programs) to enhance students' personal experience and academic performance [See http://caps.gmu.edu/].

- The George Mason University Writing Center staff provides a variety of resources and services (e.g., tutoring, workshops, writing guides, handbooks) intended to support students as they work to construct and share knowledge through writing [See http://writingcenter.gmu.edu/].

For additional information on the College of Education and Human Development, Graduate School of Education, please visit our website [See http://gse.gmu.edu/].

Field Experience Signup

The State of Virginia requires a number of hours of field work before you can do your internship. You will acquire 30 of those hours during this class. The university will place you in the field if you are not already teaching. EVERYONE needs to register on the website even if you are teaching, so that GMU has a record of where/when everyone did this 30 hours of field work.

The website to sign up is **http://cehd.gmu.edu/endorse/ferf.**

Grading

Since this is a graduate level course, high quality work is expected on all assignments and in class. **Attendance at all classes for the entire class is a course expectation.** Each unapproved absence will result in a grade reduction of 20 points and each two-class lateness will result in a 20-point grade reduction. Each graded assignment will be assessed using a scoring rubric, which will be handed out before the assignment is due. The rubrics are available on the Blackboard website at the beginning of the semester. All assignments are due at the beginning of class on the day they are due. Graded assignments that are late will automatically receive a ten percent grade reduction (one full letter grade lower). Grades are measured as experience points (XP). It is possible for everyone to reach level 12 with enough experience points. The notion of quality over quantity is alive and well in this course.

Assignments	***Points***
1. Avatar	30
2. Peer Teaching	600
3. Peer Teaching Report	445
3. Discrepant Events	300
4. Field Experience Report	800
5. Unit Plan	3000 total points
6. Professionalism	125
7. Blackboard Class participation/Reflections	700
8. Class Participation	500

TOTAL POINTS: 6500

Policy on Incompletes

If circumstances warrant, a written request for an incomplete must be provided to the instructor for approval prior to the course final examination date. Requests are accepted at the instructor's discretion, provided your reasons are justified and that 80% of your work has already been completed. Your written request should be regarded as a contract between you and the instructor and must specify the date for completion of work. This date must be at least two weeks prior to the university deadline for changing incompletes to letter grades.

Grading Scale/Levels

Level	XP	Letter Grade
Level Twelve	6500	A
Level Eleven	5500	A-
Level Ten	4500	B+
Level Nine	4000	B
Level Eight	3500	B-
Level Seven	3000	C+
Level Six	2500	C
Level Five	2000	C-
Level Four	1500	D+
Level Three	1000	D
Level Two	500	D-
Level One	0-499	F

Assignments

Science education research shows that frequent assessment of small amounts of material is most effective for learning science. Therefore, in this class formal and informal assessment will be continuously provided on assignments and class activities. Assessment is used as a tool for information that informs both learning and teaching, so this two-way communication loop is necessary for optimal learning. ALL assignments will be submitted online through Blackboard. Hardcopies and email submissions will not be accepted. Of critical importance, make each project something that you will actually use in teaching.

Quests:

1. Peer Teaching Lesson

Research shows that the most effective teachers inform their practice by analyzing and reflecting on their teaching. You will also incorporate an assessment (could be during the teaching or after the teaching, such as homework). Your peers will provide feedback on your teaching skills and knowledge and will provide assessment data for you to analyze to further inform practice.

You will implement one technology-based activity and a corresponding assessment (total of ~ 45 minutes) with your peers in class. During the first few minutes of the lesson you will give an **overview** (orally and visually presented) of your lesson plans including standards and rationale for the material you are about to teach. Engage your classmates in **hands-on science** as

if they were students at the grade level you teach **and administer a corresponding (short) assessment** for the material as if they were students. Be sure to collect the information from this assessment, as it will be a part of your final paper. For the last three minutes, tell the class what **effective science teaching and assessment strategies** (orally and visually presented) you just demonstrated.

2. Unit Plan

The unit plan is one of the gateways for the Secondary Education Program. **You will need to successfully complete this project in order to continue in the GMU degree program.** Your curriculum unit plan will reflect your ability to incorporate practical and theoretical aspects of teaching ranging from pedagogical methods to technology, inquiry, safety, the nature of science, and assessment. The assignment will also assist you in considering the various logistical and management problems that must be overcome in order for the greatest amount of learning to take place in finite amounts of time. This should be a product that you will teach someday!

These learning events/lessons must be connected and integrated, connecting each lesson to the next at the grade level of your choice. **The unit plan is at least 4 weeks (20 hours, ~10 lessons w/ block scheduling).** *You may share ideas, materials, and resources with your classmates, but you must write your own lessons for your unit.* Safety considerations, pedagogical approach, nature of science, soundness of activities, inclusion of technology(ies) and "connectivity" are a must. You should have your students engaged in hands-on science at least half of the time; including student-centered technology use. Though you will outline a four-week unit plan, you will only fully develop two weeks (10 hours) of daily lesson plans with all support materials. You are to find, adapt, and/or create the activities done by the students. Within your unit you will place developmental prompts based on the nature of science (provided to you) to enhance your students' knowledge of science as a way of knowing. Your unit should be developed in sufficient detail (including student and teacher support materials) that you or a substitute teacher could use it to teach from.

Lesson plans must demonstrate that your lessons utilize inquiry. In your plans, you must elaborate on how **students engage in making observations of the natural world, analyzing data, and making meaning from the data.** In addition to creating inquiry lessons, you should identify the **Level of Inquiry** using the following chart.

		How much information is given to the student?		
	Level of Inquiry	Question?	Methods?	Solution?
Teacher-Directed ↕ Student-Directed	1- Confirmation	✓	✓	✓
	2- Structured	✓	✓	
	3- Guided	✓		
	4- Open			

Figure 2. Four-Level Model of Inquiry (adapted from Bell, Smetana, & Binns, 2005)

All unit plans will include:

a. Overview (3-4 pages using the following headings)

Description of Students

In a very brief overview, describe the audience for which the unit is designed.

Theme

This is the topic for the unit.

Unit Question

This is the guiding question that the students will be investigating about the theme/unit.

Daily Questions

Each daily lesson plan will include at least one question for the day. In this section, list out the daily questions in order to show the "connectivity" of the ideas.

Level of Inquiry

For each class briefly describe how students are engaging in inquiry by making observations, analyzing data and/or making meaning from the data. Identify the Level of Inquiry (1, 2, 3, or 4) using the table noted above and explain why you have chosen this level.

Philosophy of Science Teaching

This is an approximately 250-word description of your rationale for planning the subject matter content and teaching strategies for this unit including supporting research and theory learned through this class.

Nature of Science Prompts

Use this section to describe the connection of the science content to the aspect of the nature of science (from the 7 aspects) you chose for your unit.

Standards of Learning

List the main standards including their codes from the Virginia Standards of Learning documents.

National Science Education Standards

List the standards from the National Science Education Standards that this unit addresses. Include the code (i.e. Content Standard B.1) for each standard.

Assessment Plan Overview

Summarize the multiple forms of assessment that will be embedded in the unit. Describe how the students' learning will be assessed both formally (graded) and informally (not graded). Identify the assessments as diagnostic, formative, or summative.

Sustainability

Explain the ways in which you can infuse the idea of reducing negative human impact on the environment in your curriculum. Also explain ways you can incorporate practices that conserve resources into your daily teacher routines.

b. Schedule

Include a one-page overview/list showing the science content being studied each day for four weeks. This could be displayed as a calendar. Indicate the two weeks (10 hours) of lessons you have fully developed with all support materials.

c. Daily Lesson Plans (1 lesson plan for each day for four weeks - see attached format)

Create a series of lesson plans that **engage students in making observations, analyzing data and making sense of data** and will include **daily questions, materials, learning activities including how long each activity will take, and assessment**. The daily question should relate to the unit question, the teaching activities should directly address the daily question, and the assessment should interpret student understanding of the daily question. As part of each lesson plan, **include key discussion questions that you will ask the students while introducing, discussing, or summarizing concepts**. Further, list anticipated misconceptions you might find in your students.

d. Support Materials (all materials for two consecutive weeks of the daily lesson plans)

For at least two consecutive weeks of the daily lesson plans, you will develop all support materials that the teacher and students will use. For teaching and learning activities **include each sheet of paper distributed to the students to carry out the daily lesson plans - laboratory experiments, activities, worksheets, instructions, assessments, rubrics, etc.** Attach these to the appropriate lesson plan. **Overhead transparencies (paper copy), PowerPoint slides (on paper) and other teaching aids** used during the unit should also be included. Select your two weeks in mind to illustrate the following three types of lessons: **introducing new content, hands-on assignments, and assessment of student learning**. Each day describe how the students' learning will be assessed both formally (graded) and/or informally (not graded). The assessment activities and how they will be assessed (i.e. rubrics) will be attached to the daily lesson plans**.** These activities should focus on the essential science concepts and connections, assess higher order thinking skills, and target different learning styles. Checking for understanding should be included daily. Include diagnostic, formative, and summative assessment. At least one of the days you choose to develop support materials needs to **include major assessment instruments and grading criteria for the unit**. The unit plan template included on this syllabus will help you account for all of the required components.

The rubric is based upon the requirements of National Council for Accreditation of Teacher Education (NCATE), the National Science Teachers Association (NSTA), and the Interstate New Teacher Assessment and Support Consortium (INTASC). With your completed unit, include a copy of the rubric on which you have scored yourself. **Please submit all Unit Plans electronically. You may need to scan documents to do this but all Unit Plans should be ONE file.**

Guild Chats:

1. Avatar

You will describe who you are and in 250 words explain how you came to pursue teaching credentials and how your avatar's personality fits into the group. You will also give your avatar a name.

2. Class Participation

Learning depends on the active engagement of the participant and frequent checking by the instructor as to the progress of the learner. Smaller assignments will be given as necessary in class in order to inform your learning and my teaching. Your participation in these assignments is essential to valuable class discussions and will help to "chunk" the large assignments into smaller, more attainable learning goal. Your classmates depend on your comments to extend their learning. Attendance for each class is necessary – please contact the professor BEFORE any absence. This is especially true in both online and in-class interactions.

Crafting/Gathering:

1. Field Experience Paper

The purpose of the field experience is to provide you with the opportunity to (1) connect to science education theories, concepts and research findings to classroom/school practice of assessments, (2) to study about assessments in a variety of classroom/school communities, and (3) to promote critical, self-reflection about your current and future teaching practice utilizing assessments.

Your field experience should focus on the **interaction of assessments and instruction**. You are required to observe and log-in a minimum of 30 hours, spread over the semester. During your field experience, you should, in a non-obtrusive way, ask the teachers you visit about their uses of assessments, where they get them, how they are designed, what they do with the information to inform their instruction, and the like. Then observe what you see in the classroom regarding how instruction and assessment are linked.

Specifically, you should observe and reflect on the following (forms will be provided for you in Blackboard):

1. Questioning
2. Class Management
3. Instructional Models/Strategies
4. Teaching With Technology
5. Laboratory Safety
6. Assessment (Formative and Summative)
7. Observation of students
8. Student shadowing

At the end of your field experience, you are required to analyze your field notes as well as any other relevant data you collected and prepare a Field Experience Report. Your Field Experience Report must be between 5-10 pages in length. Your report must describe and discuss:

- Background and context of the class(es),
- What information you found from the teacher
- Summary of findings from your observations, and
- Implications for your practice.

2. Peer Teaching Report

This lesson will be **video recorded** for you. After you teach the lesson, you will review the recording, and write a **3 page paper** that **describes** the teaching and assessment goals you had for the lesson (about 1 page), **analyze** the lesson in terms of effectiveness of teaching AND the specific outcomes of the assessment (about 3 pages), and **reflect** on improvements needed and successful events in both the lesson and the assessment (about 1 page). Finally, devote one page to how you would approach/change the next lesson based on the results of the assessment. That is, how did the outcome of the assessment inform how you would proceed in the instruction?

3. Discrepant Event Demo

A ***Discrepant Event*** is something that surprises, startles, puzzles, or astonishes the observer. Often, a discrepant event is one that does not appear to follow basic "rules of nature" and the outcome of a discrepant event is unexpected or contrary to what one would have predicted. The event throws the child "off balance" intellectually which most likely will motivate them to further investigate the science concept. Discrepant events can be used:

- to engage students in inquiry
- as a demonstration followed by discussion to introduce a new topic
- to engage students in science processes skills
- as a small group lab activity
- as a minds-on warm-up to stimulate critical thinking
- as a take home lab activity
- as a challenge for students to create investigative lab activities to find out more about the event

Assignment:

1) Find or develop a discrepant event (See resources below).
2) Be sure that the needed equipment and materials are available.
3) **e-mail the instructor** a brief description of your discrepant event or a link to its source so it can be **approved** (we don't want too many people presenting the same event- the earlier you find one the better the chance it hasn't already been claimed).
4) Fulfill each of the below **Expectations**

Expectations:

a) Present a discrepant event (**5-10 minutes**) in your small group. Present the event to your peers as **if you were presenting it to your students**. All materials should be ready and brought to class that day. Bring enough material to do your event twice (see Presentation Format section below). I can help procure materials.

c) Create an **accompanying document** that contains the following:

- A section that **outlines** the materials needed, time required, target grade level, and links to the VA SOLS
- A **summary of the science concepts/content** that helps explain your discrepant event (i.e. the background knowledge someone would need).
- A look at of the ***everyday ideas*** that students might have regarding the science content central to your event.
- A description of the ways in which your particular discrepant event helps students confront and revise their everyday ideas?
- A **list of questions** that you would use:
  - **a)** to set up the event
  - **b)** during the event
  - **c)** to follow-up or summarize the event
- A bibliography of sources or references

This should be brief (2-4 pgs. Typed; 12 pt. font). Bulleted lists and brief paragraphs are fine (i.e. it need not be in prose)

Presentation format:

Each student will present their individual discrepant event in their small group. After everyone has presented the group will discuss the events and choose one (1) to go forward to the next round. During round two each small group's selection will be presented to the larger group. From these events one will be crowned ELM 420's "Top Discrepant Event".

Resources:

Below are some web sites that have examples of discrepant events. The library also has various trade books that may have ideas.

http://www.fcl.org/edoc_resources/DocGizmo.pdf

http://scifun.chem.wisc.edu/HomeExpts/HOMEEXPTS.HTML

http://www.mcrel.org/whelmers/index.asp

http://www.stevespanglerscience.com/experiments/

http://www.elmhurst.edu/~chm/demos/

http://www.arches.uga.edu/~bcramond/home/DiscrepantEvents.htm

http://pbskids.org/zoom/activities/sci/
http://www.plu.edu/~vedrosr/discrepant.html

Helpful Hints:

Planning a Discrepant Event:

1. Go through the demonstration at least once before class begins.
2. Think carefully about and write out the questions you will ask during the demonstration.
3. Consider the time the demonstration will take (10 minute max.).

Conducting a Discrepant Event:

1. Make it easily visible.
2. Speak loudly enough to be heard in the back of the room.
3. Use dramatic techniques to excite and involve students.
4. Teach inductively, start your demonstration with a question.
5. Allow at least three seconds for students to reply to your questions.
6. If necessary use whiteboard or overhead to explain concepts and/or draw diagrams.

Scoring Rubric

Name of the Event	**The Event** (i.e. did it surprise, startle, puzzle, or astonish the observer; is it appropriate for elementary students)	**The Delivery** (i.e. poise, enthusiasm, speech, volume) **Use of Questioning** (i.e. meaningful, various levels, used to guide the inquiry process)	**Explanation of Concept** (i.e. scientifically sound, clear, concise, complete)	**Comments**	**Total Score**
Score each event in each category on a scale of 1 to 10 (10 being the best)!					

The following chart is a guideline to follow for assignments with its respective due date and points.

Assessments	Points	Due Date
Unit Concept Map – Organization of Ideas	71	January 30
Unit Objectives/Assessments	71	January 30
Lesson Plans 1 & 2	71	February 6
Lesson plans 3 & 4	71	February 27
Differentiated Lesson Plan 1	71	February 27
Lesson Plan Incorporating Technology 1	71	February 27
Lesson Plans 5 & 6	334	October 30, 2012
Unit Plan Overview	71	October 30, 2012
Differentiated Lesson Plan 2	335	October 30, 2012
Lesson Plan Incorporating Technology 2	334	October 30, 2012
Lesson Plans 7 – 10	751	March 27
Differentiated Lesson Plan 3	750	March 27
Lesson Plan Incorporating Technology 3	335	March 27
Field Experience Report	800	May 8
Peer teaching Paper	600	May 8
Blackboard Participation/Reflection Questions	700	Ongoing
Professionalism	125	Ongoing
Class Participation	500 (50x10 classes)	Ongoing
Discrepant Event Creation	300	Ongoing
Avatar	30	January 25

SCHEDULE
(PLANS MAY CHANGE ACCORDING TO STUDENT NEEDS)

Date	Class topics	Readings (due on the listed week)
January 23	Overview and expectations of course Assessment for Learning and Teaching	

	Avatar	
January 30	No class-Out in Schools [observe instructional models/strategies/student shadowing]	READ: Inside the Teen Brain; Misconceptions
February 6	Assessment of Preconceptions Formative and Summative Assessments and Reteaching Concepts	READ: NCREL Assessment
February 13	Lesson design and interconnectivity of lessons to form a unit	READ: Embedded Assessment
February 20	Technology • Serious Educational Games • Simulations • Online data	READ: Active Learning
February 27	No Class-Out in Schools [Assessment]	READ: Smetna & Bell; Annetta
March 6	Differentiation – Planning, Implementation and Grading	
March 20	Openers/Data analysis from assessments/ Confidence weighting	READ: 4 articles on Classroom management
March 27	No Class [Teaching with Technology & Safety]	READ: Differentiating Instruction
April 3	Discrepant Event Demos	READ: Warm-ups, PBL
April 10	No Class-Out in Schools [Questioning/observation of students/classroom management]	READ: Intelligent Teaching
April 17	Peer teaching experiences	READ: Art of Asking Questions READ: Implementing the Learning Cycle
April 24	Peer teaching experiences	READ: Active Learning
May 1	Peer teaching experiences	READ: Effective Teaching and Learning
May 8	Field Experience Presentations	

"Education is not a preparation for life; education is life itself." - John Dewey

"It is impossible to deny that science has played a major part in determining the nature of the modern world. The food we eat, the clothes we wear, the means of transportation that we in

going from place to place, the medicines that keep us well, the weapons we use in killing each other have been changed in recent years through scientific discovery. It may well be contented that the world is now in a dangerous situation because science and its application has developed faster than the understanding of the average citizen. It is evidently of great importance to attempt to improve this situation through a program of education of the citizen…The citizen must have knowledge enough of the world to make the right decisions; and in the modern world this means that the citizen must have a significant understanding of science." Linus Pauling (1951).

George Mason University

College of Education and Human Development

Secondary Education Program

Unit Plan –Science Assessment Rubric

Name	Date	Major Discipline within Science

This science rubric is supplemental to the Secondary Education Program's Unit Plan—General Evaluation Rubric. These guidelines and rubric describe the planning performance standards in the College of Education and Human Development at George Mason University that secondary school pre-service teachers need to meet before proceeding to the internship/student teaching. During the Science methods course for Teaching in the Secondary School (EDCI 573), each pre-service teacher will develop a two- to-four week unit plan for teaching. Two rubrics will be used to assess planning: a general rubric and this subject specific rubric.

Unit Plan Rubric

Standard	Unsatisfactory	Acceptable	Target	Accomplished

1a – Understand and can successfully convey to students the major concepts, principles, theories, laws, and interrelationships of their fields of licensure and supporting fields as recommended by the National Science Teachers Association;	Objectives for the unit do not appropriately identify the major concepts, principles, theories, laws associated with the unit as identified by the NSTA standards OR Activities and lessons are not clear, consistent, and coherent, connected to identified objectives AND Activities and lessons are not connected to one another potentially leading to isolated knowledge	Objectives for the unit clearly identify the major concepts, principles, theories, laws associated with the unit as identified by the NSTA standards AND Activities and lessons are clear, consistent, and coherent, connecting to identified objectives BUT Few activities and lessons are connected to one another potentially leading to isolated knowledge	Objectives for the unit clearly identify the major concepts, principles, theories, laws associated with the unit as identified by the NSTA standards AND Activities and lessons are clear, consistent, and coherent, connecting to identified objectives AND A majority of the activities and lessons are connected to one another allowing	Objectives for the unit clearly identify the major concepts, principles, theories, laws associated with the unit as identified by the NSTA standards AND Activities and lessons are clear, consistent, and coherent, connecting to identified objectives AND Activities and lessons are connected to one another allowing students to develop a depth and breadth of knowledge within the discipline

Standard	Unsatisfactory	Acceptable	Target	Accomplished
1b – Understand and can successfully convey to students the unifying concepts of science delineated by the National Science Education Standards;	Objectives for the unit do not include the unifying concepts identified by the NSTA standards OR Activities and lessons are not connected to identified objectives	Objectives for the unit include the unifying concepts identified by the NSTA standards AND Activities and lessons are clear, consistent, and coherent, connecting to identified objectives	Objectives for the unit include the unifying concepts identified by the NSTA standards AND Activities and lessons are clear, consistent, and coherent, connecting to identified objectives	Objectives for the unit include the unifying concepts identified by the NSTA standards AND Activities and lessons are clear, consistent, and coherent, connecting to identified objectives
Standard	Unsatisfactory	Acceptable	Target	Accomplished

1c – Understand and can successfully convey to students important personal and technological applications of science in their fields of licensure;	Activities and lessons do not have students recognize personal and technological applications of science related to the concepts being taught	Activities and lessons describe to students personal and technological applications of science related to the concepts being taught	Activities and lessons have students identifying personal and technological applications of science related to the concepts being taught	Activities and lessons are developed around the theme of personal and technological applications of science related to the concepts being taught
Standard	Unsatisfactory	Acceptable	Target	Accomplished

2a – Understand the historical and cultural development of science and the evolution of knowledge in their discipline;	Activities and lessons do not include historical and cultural developments related to the concepts being learned	Activities and lessons include 1-2 historical and cultural developments related to the concepts being learned	Activities and lessons include multiple historical and cultural developments related to the concepts being learned as a separate concept	Activities and lessons integrate multiple historical and cultural developments related to the concepts being learned
Standard	Unsatisfactory	Acceptable	Target	Accomplished
2b – Understand the philosophical tenets, assumptions, goals, and values that distinguish science from technology and from other ways of knowing the world;	Activities and lessons do not have students recognize personal and technological applications of science related to the concepts being taught	Activities and lessons describe to students RELEVANT personal and technological applications of science related to the concepts being taught	Activities and lessons require students to identify RELEVANT personal and technological applications of science related to the concepts being taught	Activities and lessons are centered around concepts that emphasize personal and technological applications of science
Standard	Unsatisfactory	Acceptable	Target	Accomplished

2c – engage students successfully in studies of the nature of science including, when possible, the critical analysis of false or doubtful assertions made in the name of science	Activities and lessons do not include any opportunities to engage in learning using the process of science or examine hypotheses and theories using evidence	At least two activities and lessons include at least two lessons that provide opportunities to engage in learning using the process of science or examine hypotheses and theories using evidence	Many activities and lessons provide opportunities to engage in learning using the process of science or examine hypotheses and theories using evidence	The unit is developed around providing opportunities to engage in learning using the process of science or examine hypotheses and theories using evidence
Standard	Unsatisfactory	Acceptable	Target	Accomplished
3b – engage students successfully in studies of the nature of science including, when possible, the critical analysis of false or doubtful assertions made in the name of science	Activities and lessons do not include any opportunities to engage in learning using the process of science or examine hypotheses and theories using evidence	At least two activities and lessons include at least two lessons that provide opportunities to engage in learning using the process of science or examine hypotheses and theories using evidence	Many activities and lessons provide opportunities to engage in learning using the process of science or examine hypotheses and theories using evidence	The unit is developed around providing opportunities to engage in learning using the process of science or examine hypotheses and theories using evidence
Standard	Unsatisfactory	Acceptable	Target	Accomplished

4a – Understand socially important issues related to science and technology in their field of licensure, as well as processes used to analyze and make decisions on such issues.	Activities and lessons do not have students recognize personal and technological applications of science related to the concepts being taught OR Activities and lessons do not have students recognize socially important issues science related to the concepts being taught	Activities and lessons describe to students RELEVANT personal and technological applications of science related to the concepts being taught AND Activities and lessons describe to students socially important issues science related to the concepts being taught including examination of risks, costs, and benefits of alternative solutions	Activities and lessons require students to identify RELEVANT personal and technological applications of science related to the concepts being taught AND Activities and lessons require students to identify RELEVANT socially important issues science related to the concepts being taught including examination of risks, costs, and benefits of alternative solutions	Activities and lessons require students to identify RELEVANT personal and technological applications of science related to the concepts being taught AND Activities and lessons require students to identify RELEVANT socially important issues science related to the concepts being taught including examination of risks, costs, and benefits of alternative solutions OR Activities and lessons require students to identify RELEVANT personal and technological applications of science related to the concepts being taught AND Activities and lessons require students to identify RELEVANT socially

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4b – Engage students successfully in the analysis of problems, including considerations of risks, costs, and benefits of alternative solutions; relating these to the knowledge, goals and values of the students.	No examples of activities where students analyze problems	Teacher describes and demonstrates analysis of problems, including risks, costs, and benefits of alternatives solutions	Student analyze problems, including risks, costs and benefits of alternative solutions with guidance from the teacher	Students identify problems and conduct analysis, including risks, costs and benefits of alternative solutions independently
Standard	Unsatisfactory	Acceptable	Target	Accomplished
6a – Understand the curricular recommendations of the National Science Education Standards, and can identify, access, and/or create resources and activities for science education that are consistent with the standards;	Does not include curricular suggestions of NSES	The overall unit includes 1-2 resources (either original or identified from other sources) that align with curricular suggestions of NSES	The overall unit includes multiple resources (either original or identified from other sources) that align with curricular suggestions of NSES	All lesson in the overall unit (either original or identified from other sources) are aligned with curricular suggestions of NSES
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6b – Plan and implement internally consistent units of study that address the diverse goals of the National Science Education Standards and the needs and abilities of students.	Does not include differentiated lessons	The overall unit includes 1-2 lessons (either original or identified from other sources) that are differentiated	The overall unit includes multiple lessons (either original or identified from other sources) that are differentiated	All lesson in the overall unit (either original or identified from other sources) are differentiated
Standard	Unsatisfactory	Acceptable	Target	Accomplished
7a – Identify ways to relate science to the community, involve stakeholders, and use community resources to promote the learning of science.	The unit does not engage students with the ways science relates to the community	Within the unit, the teacher identifies ways in which the students can use the science they are learning to engage with the community	Within in the unit, students identify ways in which the can use the science they are learning to engage with the community and implement with guidance of the teacher	Within in the unit, students identify ways in which the can use the science they are learning to engage with the community and implement independently
Standard	Unsatisfactory	Acceptable	Target	Accomplished

7b – Involve students successfully in activities that relate science to resources and stakeholders in the community or to the resolution of issues important to the community.	The unit does not include lessons that relate science to the local community of the school	The overall unit includes 1-2 lessons that relate science to the local community of the school	The overall unit includes multiple lessons that relate science to the local community of the school	All lessons in the unit include lessons that relate science to the local community of the school
Standard	Unsatisfactory	Acceptable	Target	Accomplished
8a – Use multiple assessment tools and strategies to achieve important goals for instruction that are aligned with methods of instruction and the needs of students;	Assessment tools are not varied AND Assessment tools do not evaluate objectives identified for the lesson	Assessment tools are primarily summative and not varied BUT Assessment tools evaluate objectives identified for the lesson	Assessment tools include formative and summative AND Assessment tools are varied AND Assessment tools evaluate objectives identified for the lesson	Assessment tools include diagnostic, formative, and summative AND Assessment tools are varied AND Assessment tools evaluate objectives identified for the lesson
Standard	Unsatisfactory	Acceptable	Target	Accomplished

9b – Know and practice safe and proper techniques for the preparation, storage, dispensing, supervision, and disposal of all materials used in science instruction	Either does not include the preparation, storage, dispensing, supervision and disposal of the materials relevant to the case OR does so inaccurately	Identifies some applicable preparation, storage, dispensing supervision and disposal of relevant materials for the class	Identifies and implements main preparation, storage, dispensing supervision and disposal of relevant materials for the class	Identifies and implements main preparation, storage, dispensing supervision and disposal of relevant materials for the class
Standard	Unsatisfactory	Acceptable	Target	Accomplished
9c – Know and follow emergency procedures, maintain safety equipment, and ensure safety procedures appropriate for the activities and the abilities of students;	Either does not include safety procedures in lessons	Identifies potential safety threats in lesson	Identifies potential safety threats in lesson, identifies management strategies to minimize risks, and includes appropriate emergency procedures to address any situations	Identifies potential safety threats in lesson, identifies management strategies to minimize risks, and includes appropriate emergency procedures to address any situations
Standard	Unsatisfactory	Acceptable	Target	Accomplished

d – Treat all living organisms used in the classroom or found in the field in a safe, humane, and ethical manner and respect legal restrictions on their collection, keeping, and use	Either does not include safe and ethical practices associated with living organisms relevant to the case OR does so inaccurately	Identifies some applicable. safe and ethical practices associated with living organisms including humane and ethical treatment, safety (both human and of the living organism), husbandry or disposal relevant to the case	Identifies main safe and ethical practices associated with living organisms including humane and ethical treatment, safety (both human and of the living organism), husbandry or disposal relevant to the case AND Addresses proper safe and ethical practices associated with living organisms that should be followed.	Identifies and analyzes main safe and ethical practices associated with living organisms including humane and ethical treatment, safety (both human and of the living organism), husbandry or disposal relevant to the case. AND Addresses proper safe and ethical practices associated with living organisms that should be followed