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

EDCI 673
ADVANCED METHODS OF TEACHING SCIENCE IN THE SECONDARY SCHOOL
Fall Semester, 2010

Instructor:	Erin Peters Burton, Ph.D., NBCT
Date and Time:	August 30th – December 21st (Tuesdays 7:20 – 10:00 pm)
Class Location:	Robinson A 412
Telephone:	703-993-9695
E-mail:	epeters1@gmu.edu
Office:	Robinson A Room 354
Office Hours:	By appointment

REQUIRED 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.

RECOMMENDED TEXT RESOURCES

- 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;
- Design evidence-based assessment techniques in science instruction;
- 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;
- 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.

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 (epeters1@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 are expected to exhibit professional behavior and dispositions. See http://gse.gmu.edu/facultystaffres/profdisp.htm for a listing of these dispositions.
• Students must follow the guidelines of the University Honor Code. See http://academicintegrity.gmu.edu/honorcode/ for the full honor code.

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.

Field Experience Signup

The State of Virginia requires a number of hours of field work before you can do your internship. You will acquire 15 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 15 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 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).

Assignments	***Points***
1. Differentiation Project	20
2. Peer Teaching Report	20
3. Web Based Inquiry Project	10
4. Field Experience Paper	20
5. Diagnostic, Formative and Summative Assessments	15
6. Statement of Philosophy	5
7. Class participation	10

TOTAL POINTS: 100

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

A = 93-100%
A- = 90-92%
B+ = 88-89%
B = 80-87%
C = 70-79%
F = Below 70%

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.

Feel free to submit assignments either electronically or as a hard copy.

Make each project something that you will actually use in teaching.

1. Differentiation Project

For this project, you will differentiate lessons plans and assessments to address the diverse needs of students.

> Based on the class readings, discussions, and activities on diverse learners, identify a category of learner (ELL, G/T, LD, ED, or others) and differentiate three 90 minute lessons and the corresponding assessments from the unit plan you developed in EDCI 573 or another topic of your choice.

Your final submission will be an electronic submission (email with attached files or CD) with the following sections:

1. The original lesson plans from EDCI 573 or new lesson plans that total 90 minutes of instruction.
2. Three 90 minute lesson plans differentiated for one group of special needs students including all handouts for students. Include a diagnostic assessment, formative assessments throughout and a summative assessment. Please include a table as shown below with all learning objectives aligned to a particular assessment.

Learning Objective	Assessment

3. A description of the differentiation strategies, integration of technology, and assessments for each activity with supporting research cited. You may develop a narrative, a table, or another organizational technique to communicate this information.

2. Peer Teaching of Differentiated Lesson and Assessment

Research shows that the most effective teachers inform their practice by analyzing and reflecting on their teaching. You will have the opportunity to teach and assess your peer's knowledge from your unit lesson plans for a longer time period than in EDCI 573 and 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 differentiated 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 few minutes, tell the class what **effective science teaching and assessment strategies** (orally and visually presented) you just demonstrated.

This lesson will be **videotaped** for you. After you teach the lesson, you will review the videotape, and write a **6 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 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. Web-Based Inquiry Activity

You will design one inquiry-based lesson that uses web-based technology in your science discipline for your students. The lesson you develop is to take advantage of the dynamic nature of the web. The purpose of this assignment is to use web-based technology to help your students learn science, not to use the web as a textbook. The central focus is to be on learning science and not the technology.

Your science web-based lesson should:

1. follow good lesson design (detailed in the Bell et al. book and in class)
2. utilize at least one web-based science animation/simulation or science data set,
3. be inquiry-based,
4. help students understand science concepts,
5. include at least one aspect of the nature of science, and
6. be posted on our class Blackboard site under the sample web-based assignments for your discipline.

The lesson you design should take approximately 90 minutes for students to complete. Samples are posted on the class Blackboard site. Additionally, you will give a brief overview of your project in class. This is a short (~5 minute) synopsis of the activity and associated website(s).

4. 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 total of 15 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.

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 4-5 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.

5. Diagnostic, Formative, and Summative Assessments

As part of a larger project, the Differentiation Project, you will be asked to provide a diagnostic, formative and summative assessment for your topic. As we learn about the theory and practice of these types of assessments in class, these smaller, timelier assignments give you an opportunity to get feedback on your work before the final project is due. For these assignments, you simply turn in an assessment that you would give for your differentiation project for each of the types of assessments. Feedback will be given based on the information we learned about designing each particular type of assessment.

6. Updated Philosophy of Science Teaching

Based on your experience planning and implementing differentiated lessons and assessments, update your Philosophy of Science Teaching from EDCI 573. This should be an

approximately 1 to 2 page description of your rationale for planning the subject matter content and teaching strategies for your modified lessons and assessments, including supporting research and theory learned through this class. You will be submitting this assignment as part of your portfolio as your last assessment in the M.Ed. Program, so keep this on file.

7. 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.

Other Opportunities

I have established a few partnerships with surrounding schools so that teacher candidates can get into the classroom and teach to secondary students as soon as possible in our Secondary Science Program. Currently I have made arrangements with Robinson Secondary School (7^{th} and 8^{th} grade) and Mountain View Alternative High School (an alternative school) to meet with teachers to plan and implement two laboratory assignments. I highly encourage you to take some time for this opportunity to add to your skills and to your resume! Contact me by the second week of class for details.

SCHEDULE
(PLANS MAY CHANGE ACCORDING TO STUDENT NEEDS)

Date	Class topics	Readings (due on the listed week)	Work Due (due on the listed week)
August 31st	Overview and expectations of course Assessment for Learning and Teaching	Liu – Chapter 1 (Assessment for Learning and Teaching)	
September 7th	Assessment of Preconceptions	Liu – Chapter 2 (Assessment of Preconceptions)	
September 14th	Formative Assessments and Reteaching Concepts	Blackboard documents on Formative Assessment Liu – Chapter 6 (Assessment of Ongoing Learning)	Diagnostic assessment for feedback
September 21st	Summative Assessments	Liu – Chapter 3 (Summative Assessment)	Formative assessment for feedback
September 28th	Assessing Scientific Inquiry	Blackboard documents on Assessing Scientific Inquiry Liu – Chapter 4 (Assessment of Scientific Inquiry)	Summative assessment for feedback
October 5th	Differentiation – Getting Started	Tomlinson – Chapters 1-7 The sections on elementary school are optional	
October 12 – no class – Columbus Day – Monday classes meet on Tuesday			
October 19th	Differentiation – Planning, Implementation and Grading	Tomlinson- Chapters 8-14 The sections on elementary school are optional	

October 26th	Technology • videos • simulations • online data	Bell et al. – Chapters 1, 2, 3, and 6	
November 2nd	Technology • smartboards • probeware • inquiry	Bell et al. – Chapters 4 and 7	Differentiation project
November 9th	Field Experience Presentations Peer teaching experiences		Field Experience Paper
November 16th **VAST is November 18th – 20th**	Web-Based Inquiry presentations Peer teaching experiences		Web-Based Inquiry Project
November 23rd	Peer teaching experiences		Updated Philosophy of Teaching
November 30th	Peer teaching experiences		
December 7th	Peer teaching experiences		Peer teaching paper is due December 11th at midnight

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