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

EDCI 671
INNOVATIONS IN SCIENCE TEACHING
Spring Semester, 2014

Instructor:	Len Annetta, Ph.D.
Date and Time:	Monday 4:30-7:10
Class Location:	Robinson A 352
Telephone:	703.993.5249
E-mail:	lannetta@gmu.edu
Office:	Thompson Hall 1406
Office Hours:	By appointment

COURSE DESCRIPTION
Focuses on the development and selection of teaching materials that reflect concepts of technology innovation with an emphasis on middle and secondary school science.

GOALS
Experimental and laboratory approaches will be the thrust of the assignments. There will be extensive use of instructional equipment and supplementary curriculum materials. The main course objective is to enable students to become experts in the use of instructional materials for the teaching of science. The focus of the course is the effective use of demonstrations and laboratories through proper selection, evaluation, modification, and use of supporting materials. Topics integrated within the instructional laboratory activities include:

Entrepreneurship in science teaching
Web based-Simulations
Serious Educational Games
Geographic Information Systems
Lead a Lab
Mobile Cyber infrastructure Assessment using technology

Goals: As a result of this class, students will be able to:

Design and modify instruction based on theory, philosophy, educational research, and best practice.

- Incorporate findings from educational literature into instructional strategies to improve student learning.
- Create a learning environment in which all learners feel welcome and can be successful.
- Modify instruction and learning environment based on assessment of student learning problems and successes.
- Seek, implement, and evaluate best pedagogical practice within the context of a specific learning setting.
- Monitor the effects of instructional actions, selection of learning materials, and other instructional decisions on students' learning.
- Design and modify instruction that is responsive to differences among learners.

Required Text Resources

- Will be provided electronically by the instructor on the Blackboard site.
- Because this course is flexible to the needs of the teacher candidates and in-service teachers, other articles/handouts than the ones indicated on this syllabus may be distributed in class or posted on-line at the course website.
- It is expected that the readings assigned for the class will be completed before the class meeting.

Online Resources

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

- 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.

Relationship to Program Goals and Professional Organizations

EDCI 671 is the second course in a three-course sequence of Advanced Studies in Teaching and Learning science courses for students seeking an advanced M.Ed. The course builds on students' knowledge of their subject matter and from their current or former teaching experiences. The course focuses on teacher as a reflective practitioner 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 National Boards for Professional Teaching Standards (NBPTS). EDCI 671 helps teachers develop an inquiry stance on their classroom practice as science teachers through action research adapting inquiry-based lessons, formative and summative assessment and evaluation techniques, and a targeted focus on meeting the diverse needs of students.

Additionally, this course was designed with a vision for accomplished teaching, as indicated by NBPTS Science Standards for Early Adolescence (http://www.nbpts.org/userfiles/File/ea_science_standards.pdf) and Adolescence and Young Adulthood (http://www.nbpts.org/userfiles/File/aya_science_standards.pdf) the Five Core Propositions of the National Board for Professional Science Teaching:

- Proposition 1: Teachers are Committed to Students and Their Learning
- Proposition 2: Teachers Know the Subjects They Teach and How to Teach Those Subjects to Students
- Proposition 3: Teachers are Responsible for Managing and Monitoring Student Learning.
- Proposition 4: Teachers Think Systematically about Their Practice and Learn from Experience.
- Proposition 5: Teachers are Members of Learning Communities.

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 (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/].

PROFESSIONALISM:
As a professional in the field of education, you need to take seriously your
Responsibility for learning and helping others learn in this class. As a professional,
You should:
• Attend all classes
• Arrive on time and remain for the entire period
• Be prepared for each class by having thoughtfully completed all readings and assignments
• Keep me informed of any extenuating circumstances in your life that may hinder your ability to succeed in this course
• Remain on task during class sessions
• Respect others' opinions in the class
• Be curious about ideas different than your own

I take very seriously the idea that our class is a community of learners. It is important that everyone feels both encouraged to participate and a responsibility to participate.
All ideas are welcome including those that are different than my ideas and those of the majority of the class.

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 2 points and each two-class lateness will result in a 2-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).

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 100 - 90 A -; 89 - 86 = B+, 85 - 83 = B; 82 - 80 = B – ; 79-70 C and 69 and below F

Assignments and Point Values

Grades will be determined after rounding of final percentage. For example 91.5 rounds to 92, which is an A-.

Entrepreneurship in science teaching: You will create a business canvas that helps you plan lessons but also aids students in thinking entrepreneurial in project-based learning. (10 points – 10% of grade)

Web-based Simulations: You will evaluate 10 simulations we review in class. In the week's online discussion board, you will name the simulation, provide the name/URL for it and give a detailed description and evaluation for each of the 10 simulations you review. You will then choose your favorite three simulations and design a 5E lesson plan for each. (10 points – 10% of grade)

Lead-A-Lab with Technology: You are required to lead a lab activity with the class. You can either choose to lead it by yourself, or you can team up with one other partner to lead the activity. You must collect all the needed materials, and provide all of the necessary paperwork. This lab activity should be appropriate for a particular grade level and subject for students in grades 6 through 12. The lab must focus on an objective from the Virginia Standards of Learning for science in middle school or in high school. (20 points – 20% of grade)

- The lab is to last between 30 and 40 minutes.
- You must include a lesson plan to be given to Dr. Annetta before the lab begins.

°Before the lab begins, you must state the grade level and/or course in which this lab would appropriately be conducted.

Other items for evaluation includes:
°Evidence of appropriate planning
°Evidence of appropriate preparation
°Classroom arranged for optimal learning
°Clear purpose for learning was evident
°Appropriate safety measures were demonstrated and applied
°Thought provoking questions were used
°The teacher circulated and assisted students
°The activity facilitated the learning of science process skills
°Smooth transitions between activities were evident
°Selected activities were appropriate for the objective
°Assessment was appropriate and corresponded to the learning objective

Lead-A-Lab is to be uploaded to Task Stream

GIS: Working in teams of 2-3, you will create a lesson in ArcExplorer and a lesson in GoogleEarth. For the GoogleEarth assignment, you will create a lesson on astronomy using both the normal GoogleEarth layer and the constellations layer. For each lesson created, you will explicitly write behavioral objectives for the cache and align your goals to the VA SOLs. (10 points – 10% of grade)

Serious Educational Games: You will evaluate 10 SEGs we review in class. In the week's online discussion board, you will name the simulation, provide the name/URL for it and give a detailed description and evaluation for each of the 10 simulations you review. You will then choose your favorite three SEGs and design a 5E lesson plan for each. (10 points – 10% of grade)

Mobile Learning: Infusing cell phone and tablet devices in the classroom is at the forefront of 21st century learning. In this assignment, you will create instructional materials using a variety of mobile apps. (10 points – 10% of grade)

Cyber infrastructure: Enabling students to manipulate and analyze data are a critical skill for scientists. You will design a 5E lesson plan around large science based data sets provided to you in class. (10 points – 10% of grade)

Peer Teaching: You will create a 5E lesson plan that aligns with the VA SOLs in science to teach a science lesson using an innovative technology learned in class (e.g., web-based simulations, SEGs, GIS, mobile, or probeware). (10 points – 10% of grade)

Assessment using technology: Using technology for technology sake is not a good form of instruction. This final assignment will require you go back through each technology innovation and create a formative assessment of student learning using each technology. (10 points – 10% of grade)

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.

SCHEDULE
(PLANS MAY CHANGE ACCORDING TO STUDENT NEEDS)

Class Meeting	Topic	Assignment Due
1-20	Introduction to class; Discussion of the 7 purposes & What research says / Entrepreneurship in Science Teacher	
1-27	Web-based simulations/Entrepreneurship presentations/ Intro to L-A-L	
2-3	Lead-A-Lab Presentations	Entrepreneurship
2-10	Lead-A-Lab Presentations	
2-17	GIS	Web simulations
3-3	Serious Educational Games	GIS
3-17	Serious Educational Games Presentations	SEG
3-24	Mobile learning	
4-7	Mobile learning Presentations	Mobile learning
4-14	Cyberinfrastructure	
4-21	Cyberinfrastructure	
4-28	Assessment/Cyberinfrstructure Presentations	Cyberinfrastructure
5-5	Peer Teaching/Assessment	
5-12	Peer Teaching/Assessment	Assessment

"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)

Possible format for the Lead-A-Lab lesson plan

Title of Lab:
Grade level / science course:

Objectives / Concepts Specific to the Lab: Alignment with VA SOL Competency Goal & Objective:

Required Materials (What and how much)	**Media** (software, overhead transparencies, video, etc)	**Equipment** (computer, display, OHP, VCR, etc)

Safety (Precautions and reminders)

Presentation Outline	
Time	**Event**
X min	Opener (Include questions that will be used for discussion or promoting inquiry)
Y min	
…	
…	
Z min	Closure

Assessments Pre assessment: Formative Assessment:

If you give homework, the class will be required to do it and you will have to evaluate it.

Lead-a-Lab Rubric

Criteria	1	2	3	Score
	Unacceptable	Acceptable	Target	
Appropriateness of the activity	The lab is not appropriate for the intended grade	The lab may have a questionable aspect	The lab is developmentally	

for grade level or course	level.	to it in regards to appropriateness for the intended grade level.	appropriate for the intended age group.	
Alignment of activity with VA SOLs	There lab activity does not correlate well with the written objectives.	The lab does not meet the all of the intended objectives, or the correlation with the objectives is not as strong as it should be.	The lab is in total alignment with the intended objectives	
Duration of activity	The lab was either over five minutes too long or five minutes too short from the required duration.	The lab was either 3-5 minutes too long or 3-5 minutes too short.	The lab did not meet the required duration.	
Evidence of appropriate planning.	The level of planning was not appropriate.	Some of the lab could use a little improvement due to not enough planning.	The lesson was well planned based on a clear and complete lesson plan.	
Evidence of appropriate preparation.	Not all of the materials were readily available for all students, or there was no evidence that the activity was tested.	Most everything was ready to go at the beginning of the lab activity.	All required material were ready and contingency plans were implemented if needed. Everything worked, which shows evidence of previous testing.	
Arrangement of classroom.	The arrangement of the room was not conducive to the best learning environment.	The room was arranged fine, but there was no apparent attempt by the teacher to arrange the room based on the needs of the activity.	The classroom was arranged in the most effective way for the given activity.	
Establishment of purpose of the activity.	The purpose of the activity was not evident, or no science concepts or processes were evident in the activity.	The activity had purpose, but there could have been more development of ideas, concepts or skills.	The purpose of the activity was clear to the participants.	
Safety measures	This was not a safe lab	Not all safety issues	The instructors	

	activity, or the safety issues were not addressed by the instructor at the beginning of the class, where it was indeed required.	were addressed, but the lab activity did not required strong statements about safety.	address any and all possible safety issues.	
Questioning	The activity lacked questioning by the instructors.	Questions were asked, but were mostly concerning procedures.	Good use of questioning to probe understanding and concept development.	
Circulating and assisting students	Instructors were at the front of the room, and did not interacted much with the participants during the activity.	The instructors circulated, but did not interact much with the participants.	Instructors moved among the participant and assisted and questioned when possible.	
Use of science process and skills	The activity required little science process skills.	Some process skills were necessary, but were not emphasized or needed.	Process skills were used and identified in the activity.	
Transitions between components of the activity	Transitions were poor, or there were no conceptual links among components of the activity.	Transitions were a bit rough, but each component of the activity showed linkage.	Transitions were made smoothly and the components were linked.	
Appropriateness of activity for the stated objectives	The activity did not align with the stated objectives, or the summary did not enable the students to develop the skills or concepts related to the objective.	The activity was related to the objectives, but the summary lacked connection.	The activity was aligned with the stated objectives.	
Level of correlation between assessment and learning objectives	No assessment was present	Included some formative or summative assessment, but could have been improved	Activity included some assessment that informed the instructor of student understanding.	
Appropriateness of activity for diverse groups	Some student groups may have been alienated in the activity.	Most students could relate to the activity.	The activity was appropriate for all student groups. No gender, race, or disability bias	

			was evident.	
Correctness of the content	More than one science content error was found.	Only one conceptual error was identified.	All the science content is accurate.	