GEORGE MASON UNIVERSITY
COLLEGE OF EDUCATION AND HUMAN DEVELOPMENT
Secondary Education Program

EDCI 673-003: Advanced Methods of Teaching Science in the Secondary School
3 credits, Spring Semester, 2016
Wednesdays, 7:10-10:00pm, Thompson Hall 2020

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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.

Nature of Course Delivery
A variety of teaching strategies will be used to explore the themes of the day. These will largely include face-to-face interactions with the professor and fellow students. All students will continuously analyze and evaluate teaching strategies, as well as science content, processes, and ways of knowing in science.

Learning Goals, Objectives and Assessments
Within the big ideas above are more specific goals and objectives (tasks) that you should be able to achieve by the end of the semester and two-semester sequence of the Science Methods. Below is a list of the major goals with specific objectives and the assessments that will allow you to show that you have achieved those goals.

Goal: Build a learning theory and see the value in using it for developing and implementing lessons

Objective	Assignment
Students will be able to explain why a student- centered approach to learning is effective in learning	Research Review
Students will be able to describe their theory of learning, supporting with evidence from the literature	Learning Theory/ Teaching Philosophy
Student will be able to design lessons that clearly reflect their learning theory	Unit Plan, Microteaching Reflection
Students will be able to explain how the 5-E lesson design, the	Unit Plan

Objective	Assignment
Learning Cycle, and a student-centered learning theory are effective ways to think about learning and lesson design	

Goal: Do science to understand how science is done

Goal: Recognize that inquiry learning using scientific practices has inherent risks that should be identified and addressed such that students learn to do science in and ethical and safe manner.

Objective	Assignment
Students will be able to design lessons and clearly indicate within the lesson: safety concerns, how to reduce them and what to do when accidents happen	Unit Plan

Goal: Develop an understanding of how inquiry can develop both scientific thinking and content knowledge

Objective	Assignment
Students will be able to explain what inquiry in a science class looks like	Unit Plan
Student will develop lessons that are inquiry	Unit Plan
Students will be able to develop lessons that incorporate Model-Based Inquiry	Unit Plan
Students will be able to explain Cognitive Apprenticeships and its potential impact on helping students learn science content and scientific thinking	Unit Plan
Students will be able to develop lessons that incorporate Cognitive Apprenticeships	Unit Plan

Goal: Understand how to develop effective lessons and units with backwards design

Objective	Assignment
Student will be able to explain the basic premise and order of backwards design	Unit Plan
Students will use the basic organization of backwards design to develop a lesson plan	Unit Plan
Students will be able to write measurable objectives	Unit Plan
Students will be able to describe how teaching activities support student achievement of measurable objectives	Unit Plan, Microteaching Reflection
Students will be able to describe how assessments evaluate student achievement of the measurable objectives	Unit Plan, Microteaching Reflection

Goal: Develop skills as reflective practitioners.

Objective	Assignment
Students will be able to effectively examine classrooms using their	Field Experience Paper

learning theory as a lens and student behavior, engagement, and learning (when possible) as the evidence	
Students will be able to examine use assessment data to reflect on and improve upon lessons	Microteaching Reflection

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.

Associated Professional Association Standards

- 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

Big Ideas In Science Education

During this semester, we will be focusing on developing as a reflective practitioner of reformed science education practices. In particular, we will focus on the following big ideas as a way to frame your understanding of effective science education practices.

- Our job is to help them figure out how to be lifelong learners
- The more they figure out answers to tough questions on their own, the more they will trust they can learn on their own
- Science is a process that uses evidence to think critically and explain the natural world
    - Process leads to the knowledge we currently teach as facts

    - If students don't experience the process they won't value its ability to explain the natural world – plus they will only see science as a collection of facts
- Know your students – get into their heads when designing lessons
- Have a theory of learning – it is what should guide your instruction as you develop lessons
- Know what you want your students to be able to do and how you will assess it before you design any unit or lesson
- Measure everything you do against student learning
- You don't have to reinvent the wheel, but do need to customize it based on your objectives

Course Materials

The online site for this course can be found at http://mymasonportal.gmu.edu. Students are expected to routinely check the online course portal for supplemental information, readings, etc.

There are no required texts for this course.

Online Resources

- Next Generation Science Standards (2013). Achieve, Inc. Available online at http://www.nextgenscience.org/next- generation-science-standards
- Commonwealth of Virginia (2010). *Standards of Learning for Virginia Public Schools.* Richmond, Virginia. Retrieved on August 14, 2011 from http://www.doe.virginia.gov/testing/index.shtml
- Commonwealth of Virginia (2003). *Science Standards of Curriculum Framework Guides.* Retrieved on August 14, 2007 from http://www.pen.k12.va.us/VDOE/Instruction/sol.html#science.
- National Research Council (1996). *National science education standards*. Washington, DC: National Academy Press. Available online at http://www.nap.edu/openbook.php?record_id=4962
- National Science Teachers' Association. *Science Class* newsletter. Retrieved on August 14, 2007 from http://www.nsta.org/publications/enewsletters.aspx.
- American Association for the Advancement of Science (1993). *Benchmarks for Science Literacy*. Retrieved on August 14, 2007 from http://www.project2061.org/tools/benchol/bolframe.htm.
- McComas, W. F. (1998). *The principle elements of the nature of science: Dispelling the myths.* Retrieved on August 14, 2007 from http://coehp.uark.edu/pase/TheMythsOfScience.pdf.
- Peters, E. E. (2006). *Why is teaching the nature of science so important?* Retrieved on August 14, 2007 from http://www.vast.org/content/File/v1n1/linkedwhole.pdf.
- American Chemical Society (2007). *Educators & Students page.* Retrieved on August 14, 2007 from http://www.chemistry.org/portal/a/c/s/1/educatorsandstudents.html.
- American Chemical Society (2003). *Safety in Academic Chemistry Laboratories Accident*

Prevention for Faculty and Administrators. (800 227-5558) Free single copies or online: http://membership.acs.org/c/ccs/pubs/sacl_faculty.pdf
- U.S. Government Printing Office (2007). *Code of Federal Regulations.* Retrieved on August 14, 2007 from http://www.gpoaccess.gov/cfr/index.html.
- U.S. Department of Labor (2007). *Occupational Health and Safety Administration.* Retrieved on August 14, 2007 from http://www.osha.gov/.
- American National Standards Institute (2007). *American National Standards Institute Homepage.* Retrieved on August 14, 2007 from http://www.ansi.org/.
- Maryland Public Schools (2007). *Legal Aspects of Laboratory Safety.* Retrieved on August 14, 2007 from http://mdk12.org/instruction/curriculum/science/safety/legal.html.

Recommended Reading

- Barnekow, D. J. (1998). *Graphic organizers for science.* Portland, ME: J. Weston Walsh.
- Bell, R., Gess-Newsome, J. & Luft, J. (2008). *Technology in the secondary science classroom.* Arlington, VA: NSTA Press.
- Bybee, R.W., Powell, J.C., & Trowbridge, L.W. (2008). *Teaching secondary school science: Strategies for developing scientific literacy.* Upper Saddle River, NJ: Pearson.
- Cothron, J. H., Giese, R. N., Rezba, R. J. (2005). *Students and Research*. Dubuque, Iowa: Kendall/Hunt.
- Hassard, J. (2005). *The art of teaching science: Inquiry and innovation in middle school and high school.* New York: Oxford University Press.
- Johnson, D. W. & Johnson R. T. (1999). *Learning together and alone: Cooperative, competitive, and individualistic learning.* Boston: Allyn and Bacon.
- Liu, X. (2010). *Essentials of science classroom assessment.* Washington, DC: Sage Publications.
- Nitko, A. J. & Brookhart, S. M. (2007). *Educational assessment of students*. Upper Saddle River, NJ: Pearson.
- Keely, P., Eberle, F., & Farrin, L. (2005). *Uncovering student ideas in science: 25 formative assessment probes.* Arlington, VA: National Science Teacher Association Press.
- Keeley, P. (2008). *Science formative assessment: 75 practical strategies for linking assessment, instruction, and learning.* Arlington, VA: NSTA Press.
- Tomlinson, C. A. (2005). *How to differentiate instruction in mixed-ability classrooms.* Upper Saddle, NJ: Pearson.
- Tomlinson, C. A., & McTighe, J. (2006). *Integrating differentiated instruction and understanding by design.* Alexandria, VA: ASCD.

Grading

High quality work and participation is expected on all assignments and in class. Attendance at all classes for the entire class is a course expectation. For each unexcused absence, the course grade will be reduced by 5% points. All assignments are graded. Each graded assignment will be assessed using a scoring rubric, which will be handed out before the assignment is due. 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).

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

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.

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.

Assessments	Points	Due Date
Research Review	5	Feb 10 and May 11
Microteaching Reflection	10	May 11
Field Experience Paper	10	May 11
Individualized Instruction and Assessment Task	10	May 11
Professionalism	10	Varied
Unit Plan (PBA)		
Unit Concept Map – Organization of Ideas	3	Feb 3
Unit Objectives/Assessments	3	Feb 17
Unit Plan Overview	3	Feb 24
Lesson 1 - Draft	5	Mar 2
Lesson 2 - Draft	5	Mar 16
Lesson 3 – Draft – Differentiated Lesson	10	Mar 30
Lesson 4 – Draft – Differentiated Lesson	10	Apr 6
Technology Lesson Plan	5	Apr 13
Learning Theory/Teaching Philosophy	5	Jan 27
Total Points	**100**	

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! This semester you will be required to develop a lesson plan for a single unit (no less than 8 days of instruction, including the final assessment). There will be several assignments over the course of the semester that will end up as a part of your overall unit.

All unit plans will include:

A. Learning Theory/Teaching Philosophy

This is an approximately one-page description of your learning theory and rationale for your teaching approach in your classroom. It should clearly relate to student learning and be reflected throughout your lessons in the unit plan.

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

Theme/Topic

This is the topic for the unit.

Description of Students

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

Unit Question

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

Standards of Learning

List the main standards from the Virginia SOLs

Objectives

List the major objectives that would represent what students should learn through the unit. Objectives should be written in such a way that they represent a measureable behavior. Be sure to include both the content and inquiry standards.

Assessment Plan Overview

After examining the objectives, identify the major summative assessments that you will use to assess achievement of each objective. There should be at least two assessments for each objective. Some assessments may assess multiple objectives (for instance a summative test or final project may assess many of the objectives), while others may be specific for a particular objective (for an essay may address only one objective).

Schedule

Include a one-page overview/list showing the science content being studied each day during the unit. This could be displayed as a calendar.

C. Detailed Lesson Plans (1 lesson plan for each day for two weeks)
You will write at least 4 **in-depth lessons** with all support materials. At least two of these lessons should be inquiry lessons.

D. Remaining Lessons of the Unit
The rest of 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 (use the for Short Lesson Plan format). In the short lessons, you decide what other detail to provide and to provide written argument why this is enough detail to be useful.

E. Final Assessment
You should develop a final assessment that would evaluate whether your students achieved the objectives at the end of the unit. This final assessment should include the questions/tasks the students are required to do and indicate what objectives are being assessed and how they are being assessed. For instance, a paper and pencil test should have a question for each objective. Assignments that are less traditional (posters, investigations, debates, etc.) will still require an indication of how you will evaluate each objective.

F. Support Materials (all materials for the daily lesson plans)
For 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. **Other teaching aids** (e.g., PowerPoint slides) used during the unit should also be included. Be sure that your unit plan can illustrate the following three aspects of teaching: **introducing new content, hands-on assignments, and assessment of student learning**. Each day describe how the students' learning will be assessed both formally (graded – summative assessment) and/or informally (not graded – formative assessment). 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). **Because the Unit Plan is your PBA, it will need to be submitted electronically through Tk20; therefore, you need to be sure all components are in ONE file.**

Individualized Instruction and Assessment Task

Candidates will develop an individualized plan for a child with developmental, learning, physical, or linguistic differences within the context of the general environment and curriculum that includes the following sections:

- Section 1. Description of the individual student that includes cognitive, linguistic, social, emotional, and/or physical developmental skill levels and abilities, interests and educational progress and statement of educational need. (1 page or less)
- Section 2. Identification of and rationale for three learning objectives that support meaningful learning outcomes for the student. (1 page or less)
- Section 3. Description of and rationale for at least three evidence-based instructional strategies that address the identified learning objectives and reflect the student's cognitive, linguistic, social, emotional, and/or physical developmental skill levels and abilities, interests and educational needs. (1 page or less)
- Section 4. Description of and rationale for instructional adaptations and accommodations needed, including the use of augmentative and alternative communication systems and assistive technologies or other appropriate technologies. (1 page or less)
- Section 5. Statement of plan for the assessment and documentation of the student's progress toward the identified objectives. (1 page or less)

This assignment will be submitted via Tk20.

Research Review

As scientists, we do not rely on instinct or perception to decide if a claim about how nature works is valid. Instead, we focus on the evidence, the methodology used to generate the evidence, and then decide if the claims can be accepted. As teachers OF SCIENCE, we should do the same when it comes to what does and does not work in instruction. There are lots of strategies that teachers and educators describe as being effective. Unfortunately, many teachers will rely on their perception of whether a strategy might be successful and then use anecdotal information from their own classroom (even science teachers). This approach leads to the perception that research in science education is of little use and anyone's perceptions are just as valid as the findings in research studies. Again, as scientists, we would never allow perception to rule but rely on evidence.

For this assignment, you will be asked to think about the educational research as a starting point for you to develop your teaching practices that are based on sound research evidence. Several strategies that we will identify in this class have been supported by evidence that is sound research. You will be working to find and evaluate science education research with regards to the strategies. But this reading of the literature isn't just about identifying what works, but understanding why these strategies work and how to develop lessons that utilize these strategies.

This research review will be done in two parts:

PART I – Due February 10

1. Read science_Stanovich.pdf.
   - What are examples of peer-reviewed journals that could contain empirical evidence regarding teaching science?
   - Look at the latest issue of the Science Teacher (NSTA's journal). This journal is considered to be peer-reviewed. Examine 2 articles and determine whether you think this journal might contain empirical evidence/research regarding teaching science. Provide evidence to support your claim.
   - Read the articles on inquiry. Which would be examples of research providing empirical evidence regarding inquiry? Which ones would be quantitative research? Which would be qualitative research?

2. Using Google scholar, Identify 5 research articles related to constructivism, inquiry teaching, model-based inquiry, and cognitive apprenticeships. For each article provide the following:
   - What key words/search terms did you use to get to this article?
   - How many articles have cited it?
   - Based on the reading, *What is Scientifically Based Research? A Guide for Teachers* from the National Institute for Literacy, does this article fit the criteria for federal perspective of scientifically based research? Provide evidence to support your claim.

PART II – Due May 11

Using the "Guide for Analyzing a Research Article" (http://www.unm.edu/~lkravitz/Article%20folder/understandres.html) answer the following questions (include the questions) for each of your 5 research articles. Use the appropriate questions for the quantitative and qualitative studies.

Quantitative Research

1. What was the purpose of the study?
2. What was (were) the research question(s)?
3. What were the topics of the literature review?
4. What type of research was conducted? (Quantitative/Qualitative)?
5. What type of sampling was used?
6. How were the data collected?
7. How were the validity and reliability of the data assessed?
8. What descriptive and/or inferential analyses were used?
9. Is the study experimental or non-experimental?
10. Were the participants assigned at random to treatment conditions?
11. If it is non-experimental, was the researcher attempting to examine cause-and-effect issues? If yes, did he or she use the causal-comparative method? (see Airasian&Gay-UNLV.pdf)
12. What types of measures were used? Did the authors give enough information to make a decision on validity and reliability on the instruments?

13. Did the instruments align with the research questions?
14. How was the sample of participants obtained?
15. What are the demographics of the sample?
16. Were there statistical differences in the results?
17. What conclusions did the researchers report?
18. Did the researcher critique his or her own work in the limitations section?

Qualitative Research

1. What was the purpose of the study?
2. What was (were) the research question(s)?
3. What were the topics of the literature review?
4. What type of research was conducted? (Quantitative/Qualitative)?
5. Was the study conducted by an individual or research team?
6. Was the initial analysis conducted independently by more than one researcher?
7. Were outside experts consulted for peer review?
8. Did the researchers participate in member checking?
9. How were the participants obtained?
10. What are the demographics of the participants?
11. Do the researchers explain their methods of analysis?
12. How were the data collected?
13. How were the validity and reliability of the data assessed?
14. What descriptive and/or inferential analyses were used?
15. What conclusions did the researchers report?

Microteaching and Reflection

Research shows that the most effective teachers inform their practice by analyzing and reflecting on their teaching. Toward the end of the semester, you will work with a classmate to teach lesson that you have constructed with a partner or partner(s). You will be videotaped so you have other evidence to draw from for the analysis part of this assignment. What follows are instructions for the microteaching and reflection that will follow.

PRIOR TO THE DAY OF YOUR LESSON:

1. Identify any resources you think you would need to teach your lesson and put in a request for what you cannot obtain to determine if it is available. This is important to do at least three (3) weeks prior to the day you teach to ensure whether or not materials will be available.
2. Make enough copies of your lesson plan to give to your classmates and the instructor. This can be done by clearly posting your lesson on your Wiki site but must be done 24 hours to teaching the lesson. Otherwise, you will need to come with hard copies of your lesson.

DAY OF THE LESSON:

1. There will be a one minute overview in which you will describe to the class the setting of this lesson (what subject, what grade, what is expected that students should or should not know for this lesson).

2. For the remainder of the time, you will engage your classmates in an **inquiry lesson** that teaches both specific science concepts and nature of science ideas.
3. You will be expected to conduct formative assessments including an exit assessment from which you will draw data from students to determine whether the students achieve the objectives.

AFTER THE LESSON:

4. Observe the video of your teaching and take note of what the students and teachers are doing that would reflect on the learning in the classroom.
5. Examine the formative assessments, summarizing the results of the exit ticket and determining from this data whether the objectives were achieved.
6. Write a 5 page paper that examines what happened in the classroom during your lesson, focusing on how activities that occurred might have influenced student learning (positively and negatively). The paper should be organized thus:
    a. Page 1 – Identify the assessments used during lesson to evaluate the lesson objectives. Describe the results of the assessments of these objectives (provide more than just qualitative results, what # and % percentage of the students achieved the objective?)
    b. Pages 2-4 – Examine the lesson in detail to determine what happened in the classroom that might have influenced the results of the assessments and what could be done to improve student achievement. Focus on where in the lesson students were supposed to have experienced an activity that would get them to think more deeply about the objective? Where were they have asked to be explicit (either as a class or individually) about what they had learned before the assessment? Further, you should conduct a critical review of the assessment as to whether it is a valid measure of the lesson objectives. Use evidence from assessments to draw your conclusions about your lesson.
    c. Page 5 – Examine the specific actions you undertook as a teacher (mannerisms, answering questions, etc.) and categorize these into those actions that might help with student learning and those that might hinder student learning. In each category, explain how it might influence student learning.

Field Experience

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

1) Turn in a log sheet, signed by the teacher(s) showing you completed the 15 hours of field experience.
2) Summarize your observations in a 4-5 page field experience report.

This task is intended largely to help develop your ability to reflect on classroom experiences on more than a superficial level. It is expected that you will develop your own thoughts and ideas based on your experience. As it is a development task, it will be evaluated on a completion

bases if it is clear that you have undertaken the task authentically. Considering that this is the field that you will entering, it is assumed that you desire to be professional and will undertake this task with authentic reflection on your future.

You are required to observe and log a total of 15 hours, spread over the semester. During your field experience, you are required to keep detailed field notes, a log sheet indicating dates, times, subject area, grade levels, teachers' or principals' signatures and collect any relevant data. **You will turn in a log, signed by the teacher(s) showing you completed the time.**

As you are making observations in your field experience, it is necessary to focus what you are watching for so that you begin to examine ideas and processes associated with teaching. Your field experience should focus on two or more of the following:

1. the teaching process and teacher practices
2. implementing specific lesson plans
3. preparing and testing instructional materials with diverse learners
4. students' learning styles
5. student-student and student-teacher interactions
6. planning, implementing, and evaluating specific assessment instruments with diverse learners
7. teaching and learning with technology
8. students' behavior in a specific teaching/learning context
9. specific classroom management strategies
10. teacher interaction with students with special needs
11. teacher interaction with non-traditional students

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 excluding cover page, references and appendices. Your report must describe and discuss:

- Your guiding observational topics (see the list above),
- Background and context of the class(es),
- Summary of findings, and
- Implications for your practice.

The university will place you in the field. The website to sign up is http://cehd.gmu.edu/endorse/ferf.

Performance-Based Assessments (PBA) and Tk20

In this course, the entire unit plan is the Performance-Based Assessment. Every student registered for any Secondary Education course with a required performance-based assessment is required to submit these assessments to Tk20. Evaluation of your performance-based assessment will also be provided using Tk20. Failure to submit the assessment to Tk20 will result in a the course instructor reporting the course grade as Incomplete (IN). Unless this grade

is changed upon completion of the required Tk20 submission, the "IN" will convert to an "F" nine weeks into the following semester.

Professionalism
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.

Tentative Calendar (subject to change based on student needs):

Date	Topic	Item(s) Due
Jan 20	Introduction to Course	
Jan 27	Backwards Design, Connecting Lessons, and Unit Concept Mapping	Learning theory/ teaching philosophy
Feb 3	Inquiry Learning in Science, Part 1	Unit concept map
Feb 10	Inquiry Learning in Science, Part 2	Research review
Feb 17	Differentiating Inquiry in Science, Part 1	Unit objectives
Feb 24	Differentiating Inquiry in Science, Part 2	Unit plan overview
Mar 2	Instructional Technology in Science	Lesson 1 draft
Mar 9	**NO CLASS SPRING BREAK**	
Mar 16	Assessing Inquiry in Science, Part 1	Lesson 2 draft
Mar 23	Assessing Inquiry in Science, Part 2	IITA draft
Mar 30	Interdisciplinary Science Connections	Lesson 3 draft
Apr 6	Scientific Discourse	Lesson 4 draft
Apr 13	Science Education Policy Perspectives	Technology lesson
Apr 20	Micro-Teaching – 3 groups	
Apr 27	Micro-Teaching – 3 groups	
May 4	Micro-Teaching – 3 groups	
May 11	**NO CLASS – REMAINING ASSIGNMENTS DUE**	

GSE Student Expectations
Students must adhere to the guidelines of the George Mason University Honor Code (See **http://oai.gmu.edu/the-mason-honor-code/**). The principle of academic integrity is taken very seriously and violations are treated as such. ***Violations of the Honor Code*** include:

1. Copying a paper or part of a paper from another student (current or past);
2. Reusing work that you have already submitted for another class (unless express permission has been granted by your current professor **before** you submit the

work);

3. Copying the words of an author from a textbook or any printed source (including the Internet) or closely paraphrasing without providing a citation to credit the author. For examples of what should be cited, please refer to: https://owl.english.purdue.edu/owl/resource/589/02/
4. You may also not "reuse" fieldwork hours. Each placement must have 20 documented hours that are solely for each course that you are in; you may be at the same site, but the same hours may not be counted towards the same course.

Students must follow the university policy for Responsible Use of Computing (See **http://universitypolicy.gmu.edu/policies/responsible-use-of-computing/**).
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.

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/**).

Students with disabilities who seek accommodations in a course must be registered with George Mason University Disability Services and inform their instructor, in writing, as soon as possible. Approved accommodations will begin at the time the written letter from Disability Services is received by the instructor (See **http://ods.gmu.edu/**).

Students must follow the university policy stating that all sound emitting devices shall be turned off during class unless otherwise authorized by the instructor.

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/**).

Emergency Procedures
You are encouraged to sign up for emergency alerts by visiting the website https://alert.gmu.edu. There are emergency posters in each classroom explaining what to do in the event of crises. Further information about emergency procedures exists on http://www.gmu.edu/service/cert.

Professional Dispositions
Students are expected to exhibit professional behaviors and dispositions at all times.

Core Values Commitment
The College of Education & Human Development is committed to collaboration, ethical leadership, innovation, research-based practice, and social justice. Students are expected to adhere to these principles: **http://cehd.gmu.edu/values/**.

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

Field Experience Rubric

Element	Target	Acceptable	Unacceptable
Log of Hours		Completed, signed log showing 15 hours turned in	Log incomplete, not signed, OR not turned in
Reflection – Background and Context	Detailed information about the class(es) observed is provided	Information about the class(es) observed is provided	No information about the class(es) observed is provided
Reflection – Summary	Thorough, thoughtful summary of the field experience is provided	Thorough summary of the field experience is provided	Cursory OR no summary of the field experience is provided
Reflection – Implications	Thorough, thoughtful implications to future practice is provided	Thorough implications to future practice is provided	Cursory OR no implications to future practice is provided

Research Reflection Rubric

Element	Target	Acceptable	Unacceptable
Part 1	All components completed thoroughly	All components completed	Some components missing
Part 2	All questions answered thoroughly for all five articles	All questions answered for all five articles OR some questions missing for one article	Some questions not answered for two or more articles

Individualized Instruction and Assessment Task Rubric

Criteria	Does Not Meet Standard 1	Approaches Standard 2	Meets Standard 3	Exceeds Standard 4
Section 1 - Description of Individual Student				
The candidate regularly assesses individual and group performance in order to design and modify instruction to meet learners' needs in each area of development (cognitive, linguistic, social, emotional, and	The candidate does not provide a description or the description of student **does not** include assessment data **related to cognitive, linguistic, social, emotional, and/or physical** developmental skill	The candidate provides description of student that includes appropriate assessment data related to **some but not all** of the following: cognitive, linguistic, social, emotional, and/or	The candidate provides description of student that includes appropriate assessment data on **all** of the following: cognitive, linguistic, social, emotional, and/or physical developmental skill	The candidate provides description of student that includes both appropriate and multiple forms of assessment data on **all** of the following: cognitive, linguistic, social, emotional, and/or physical

physical) and scaffolds the next level of development. ***InTASC 1(a)***	levels and abilities, interests, **or** educational progress.	physical developmental skill levels and abilities, interests, **or** educational progress.	levels and abilities, interests, and educational progress. The candidate describes impact of student characteristics on learning.	developmental skill levels and abilities, interests, and educational learning need. The candidate describes **and** provides examples of impact of student characteristics on learning.
Statement of Educational Need				
The candidate effectively uses multiple and appropriate types of assessment data to identify each student's learning needs and to develop differentiated learning experiences. ***InTASC 6(g)***	The candidate **does not** address student educational needs or **inappropriately uses** assessment data to create a statement of educational need.	The candidate uses assessment data to create a statement of educational need that is **marginally** aligned with assessment results.	The candidate uses assessment data to create an **appropriate** statement of educational need that is **aligned** with assessment results.	The candidate **effectively** uses assessment data from **multiple sources** to create a **thorough and appropriate** statement of educational need that is **aligned** with assessment results.
Section 2 - Identification of Learning Objectives				
The candidate individually and collaboratively selects and creates learning experiences that are appropriate for curriculum goals and content standards, and are relevant to learners. ***InTASC 7(a)***	The candidate identifies learning objectives that are **either** (a) **incomplete** because related outcomes are not identified **or** (b) the objectives are **not directly related** to student educational need.	The candidate identifies learning objectives **without relevance** to student educational need.	The candidate identifies learning objectives with related outcomes that are **relevant** to individual student needs. .	The candidate identifies **distinct** learning objectives with related outcomes that are **relevant** to individual student needs.
Identification of Rationale for Learning Objectives				
The candidate plans for instruction based on formative and summative assessment data, prior learner knowledge, and learner interest. ***InTASC 7(d)***	The candidate **does not provide** rationales which are aligned to the specific learning objectives and/or the relationship of the learning objectives to student educational needs is **missing or unclear.**	The rationales provided **are not** be aligned to the specific learning objective and the relationship of the learning objectives to student educational needs is **unclear**.	The rationales provided **are aligned** with the learning objective and the relationship of learning objectives to student educational needs is **clearly** identified.	The rationales provided **are aligned** with the learning objective and the relationship of the learning objectives to student educational needs is **clearly and effectively** identified.
Section 3 - Description of Instructional Strategies				
The candidate plans how to achieve each student's learning goals, choosing appropriate strategies and accommodations, resources, and materials to differentiate instruction for individuals and groups of learners.	The candidate **does not** identify instructional strategies or identifies instructional strategies that are **not related** to the learning objectives **or** student learning needs.	The candidate identifies instructional strategies that are **marginally** related to the learning objectives **or** student learning needs.	The candidate identifies **evidence-based** instructional strategies that are aligned to the learning objectives and student learning needs.	The candidate identifies **evidence-based** instructional strategies that are aligned to **specific** learning objectives and student learning needs. The candidate provides **specific sources of**

InTASC 7(b)				evidence for the instructional strategy.
Rationale for Instructional Strategies				
The candidate understands that each learner's cognitive, linguistic, social, emotional, and physical development influences learning and knows how to make instructional decisions that build on learners' strengths and needs. ***InTASC 1(e)***	The candidate **does not provide** rationales which are aligned to the specific instructional strategies **and/or** the relationship of instructional strategies to the learning objectives and student educational needs is **missing or unclear**.	The rationales provided **do not** aligned to the specific instructional strategies and, the relationship of the instructional strategies to the learning objectives that meet student educational needs is **unclear**.	The rationales provided **are aligned** with instructional strategies and, the relationship of the instructional strategies to the learning objectives that meet student educational needs is **clearly** identified.	The rationales provided **are aligned** with the strategies and, the relationship of the instructional strategies to **specific** learning objectives that meet student educational needs is **clearly and effectively** identified.
Section 4 - Description of Instructional Adaptation				
The candidate accesses resources, supports, and specialized assistance and services to meet particular learning differences or needs. ***InTASC 2(f)***	The candidate **does not identify** either adaptations or accommodations to support student achievement of learning objectives.	The candidate identifies **either** adaptations or accommodations that **minimally support** student achievement of learning objectives.	The candidate identifies and describes appropriate adaptations or accommodations that **clearly support** student achievement of learning objectives.	The candidate identifies and thoroughly describes appropriate adaptations or accommodations that **clearly support** student achievement of learning objectives.
Rationale for Instructional Adaptation				
The candidate knows a range of evidence-based instructional strategies, resources, and technological tools and how to use them effectively to plan instruction that meets diverse learning needs. ***InTASC 7(k)***	The candidate **does not provide** rationales that are aligned to the adaptations and accommodations **and/or** the relationship of the adaptations and accommodations to student educational needs is **missing or unclear**.	The rationales **marginally provides** evidence to support the adaptations and accommodations and the relationship of the adaptations and accommodations to student educational needs is **unclear**.	The rationales provide **adequate** evidence to support the adaptations and accommodations and the relationship of the adaptations and accommodations to student educational needs is **clearly identified.**	The rationales provide **evidence-based support** for the specific adaptations and accommodations and the relationship of the adaptations and accommodations to student educational needs is **clearly and thoroughly** identified.
Section 5 - Assessment and Documentation of Student Progress				
The candidate designs assessments that match learning objectives with assessment methods and minimizes sources of bias that can distort assessment results. ***InTASC 6(b)***	The candidate **does not** describe an assessment plan that that evaluates all student learning objectives **or** describes a plan that **does not** directly measure all of the student learning objectives (e.g., is **not observable, measurable**).	The candidate describes an assessment plan that evaluates all student learning objectives but **does not** include documentation of **both** formative and summative measures that **does not** address possible assessment bias.	The candidate describes an assessment plan that evaluates all student learning objectives **and includes both** formative and summative assessments that minimize sources of bias. The candidate describes the assessment results that would prompt modification of instructional plans **and**	The candidate describes an assessment plan that evaluates **all** student learning objectives, **includes** formative and summative assessments that minimize sources of bias and includes **multiple** data sources for each objective. The candidate describes **multiple** assessment results that would prompt modification of instructional plans **and**

			those specific modifications.	those specific modifications.

Microteaching Presentation Rubric

Element	Distinguished - 4	Proficient - 3	Insufficient - 2	Unacceptable - 1
Preparation	Complete lesson plan available digitally the day before the lesson was to be taught	Complete lesson plan available in hard copy format	Lesson plan incomplete but available in hard copy format	Lesson plan not available for microteaching
	Materials requested at least three weeks prior as well as finding materials on own to implement lesson AND well prepared microteaching (seamless implementation of lesson)	Materials requested at least three weeks prior as well as finding materials on own to implement lesson AND prepared microteaching but implementation was no seamless (appears to have attempted lesson prior to make sure setup and lesson implementation went smoothly)	Materials requested at least three weeks prior as well as finding materials on own to implement lesson BUT was minimally prepared before microteaching (did not attempt lesson prior to make sure setup and lesson implementation went smoothly)	Materials were not requested early AND was not prepared before microteaching (did not attempt lesson prior to make sure setup and lesson implementation went smoothly)
Overview	Establishes the background for the lesson		No background for the lesson	
Inquiry Activity	Appropriate example of an inquiry lesson that encourages scientific thinking WITH nature of science concepts explicitly highlighted by the class somewhere during the lesson	Appropriate example of an inquiry lesson that encourages scientific thinking BUT nature of science concepts were made explicit by the teacher somewhere during the lesson	Appropriate example of an inquiry lesson that encourages scientific thinking BUT nature of science concepts are not made explicit anywhere during the lesson	Lesson not an example of inquiry
Assessments	Provided formal exit assessment for evaluating achievement of student objectives		No formal exit assessment provided for evaluating achievement of student objectives	
Time	Lesson completed in the time allotted		Lesson incomplete because class ran out of time	

Microteaching Reflection Rubric

Element	Distinguished - 4	Proficient - 3	Insufficient - 2	Unacceptable - 1
Page 1 - Results	Both formal and informal examples of assessments were described and matched with objectives as well as assessments to gauge student engagement with material, progress toward a content objective, etc. Shows a clear understanding of	Both formal and informal examples of assessments were described and matched with objectives – assessments shows cursory understanding of how to use assessment to guide teaching.	Assessments of the objectives were described but no discussion of how assessments were used to guide teaching.	No assessments were described.

	how assessment can be used to guide teaching.			
	Results of assessments were described in detail with # and % achieving each objective basing it upon the exit assessment.	Results of assessments were described superficially with no information about # or % achieving each objective based upon the exit assessment	No results were described.	
Pages 2-4 – Analysis of Lesson Effectiveness	Discussion integrates multiple pieces of evidence from assessments with reflection to describe conclusions and offer suggestions for improvement for each objective	Uses minimal evidence from assessments to reflect and offer suggestions for improvement for each objective.	Sometimes uses evidence from assessments to describe conclusions and offer suggestion for improvement for each objective.	Never uses evidence from assessments to describe conclusions and offer suggestions for improvement
	Provides a deep introspective examination of the lesson based upon the objective examining the assessment for validity of measuring achievement and actions in class to help students achieve the objective	Provides a superficial examination of the lesson based upon the objective examining the assessment for validity of measuring achievement and actions in class to help students achieve the objective	Examination does not focus on the objective OR No discussion regarding the assessment OR No discussion regarding the activities	
Page 5 – Teacher Characteristics Impacting Learning	Discussion consistently focuses on how actions might influence student learning	Discussion sometimes focuses on how actions might influence student learning	Discussion rarely focuses on how actions might influence student learning	Discussion never focuses on actions OR how they might influence student learning

Unit Plan Rubric

Standard	Unsatisfactory	Acceptable	Target	Accomplished
1a - Understand the major concepts, principles, theories, laws, and interrelationships of their fields of licensure and supporting fields as recommended by the National Science Teachers Association. 1c - Show an understanding of state and national curriculum standards and their impact on the content knowledge necessary for teaching P-12 students.	Objectives for the unit do not appropriately identify the major concepts, principles, theories, laws associated with the unit as identified by the NGSS and VA SOL OR Activities and lessons are not clear, consistent, and coherent, connected to identified objectives AND Activities and lessons are not	Objectives for the unit clearly identify the major concepts, principles, theories, laws associated with the unit as identified by the NGSS and VA SOL AND Activities and lessons are clear, consistent, and coherent, connecting to identified objectives BUT Few activities and lessons are connected to one another potentially	Objectives for the unit clearly identify the major concepts, principles, theories, laws associated with the unit as identified by the NGSS and VA SOL AND Activities and lessons are clear, consistent, and coherent, connecting to identified objectives AND A majority of the activities and lessons are	Objectives for the unit clearly identify the major concepts, principles, theories, laws associated with the unit as identified by the NGSS and VA SOL AND Activities and lessons are clear, consistent, and coherent, connecting to identified objectives AND Activities and lessons are connected to one another allowing

Standard	Unsatisfactory	Acceptable	Target	Accomplished
	connected to one another potentially leading to isolated knowledge	leading to isolated knowledge	connected to one another allowing	students to develop a depth and breadth of knowledge within the discipline
1b - Understand the central concepts of the supporting disciplines and the supporting role of science-specific technology.	Objectives for the unit do not include the big ideas and cross-cutting concepts identified in the NGSS OR Activities and lessons are not connected to identified objectives OR Activities do not use or refer to appropriate science-specific technology	Objectives for the unit include the crosscutting concepts identified in the NGSS AND Activities and lessons are clear, consistent, and coherent, connecting to identified objectives AND Activities do not use or refer to appropriate science-specific technology	Objectives for the unit include the crosscutting concepts identified in the NGSS AND Activities and lessons are clear, consistent, and coherent, connecting to identified objectives AND Activities do not use or refer to appropriate science-specific technology	Objectives for the unit include the crosscutting concepts identified in the NGSS AND Activities and lessons are clear, consistent, and coherent, connecting to identified objectives AND Activities do not use or refer to appropriate science-specific technology
2a - Plan multiple lessons using a variety of inquiry approaches that demonstrate their knowledge and understanding of how all students learn science.	Activities and lessons do not include inquiry of any kind	Activities and lessons include limited examples of inquiry beyond cookbook labs	A few activities and lessons include multiple opportunities for students to be involved in inquiry	The unit is organized around providing multiple opportunities for students to be involved in inquiry
3a - Use a variety of strategies that demonstrate the candidates' knowledge and understanding of how to select the appropriate teaching and learning activities – including laboratory or field settings and applicable instruments and/or technology- to allow access so that all students learn. These strategies are inclusive and motivating for all students.	Lessons are not differentiated AND Lessons do not demonstrate an understanding of pedagogy that supports learning science	The overall unit includes 1-2 lessons (either original or identified from other sources) that are differentiated but still allow for limited engagement with scientific inquiry to learn content AND Lessons demonstrate an understanding of pedagogy that supports learning science	The overall unit includes multiple lessons (either original or identified from other sources) that are differentiated but still allow for engagement with scientific inquiry to learn content AND Lessons demonstrate an understanding of pedagogy that supports learning science that includes a variety of approaches	All lesson in the overall unit (either original or identified from other sources) are differentiated but still allow for engagement with scientific inquiry to learn content AND Lessons demonstrate an understanding of pedagogy that supports learning science that includes a variety of approaches
2b - Include active inquiry lessons where students collect and interpret data in order to develop and communicate concepts and understand scientific processes, relationships and natural	Activities and lessons do not include opportunities for students to experience authentic science	Activities and lessons include historical development of scientific knowledge allowing students to	Activities and lessons include multiple examples of students engaged in collecting and interpreting data to	The unit is developed around providing opportunities to engage in learning using the process of science or examine

Standard	Unsatisfactory	Acceptable	Target	Accomplished
patterns from empirical experiences. Applications of science-specific technology are included in the lessons when appropriate.		examine and interpret data to develop their understanding of content and science process	develop their understanding of content and science process AND Activities and lessons include appropriate use of science-specific technology for data collection	hypotheses and theories using evidence to develop their understanding of content and science process AND Activities and lessons include appropriate use of science-specific technology for data collection
3b - Develop lesson plans that include active inquiry lessons where students collect and interpret data using applicable science-specific technology in order to develop concepts, understand scientific processes, relationships and natural patterns from empirical experiences. These plans provide for equitable achievement of science literacy for all students.	Does not include differentiated lessons that allow for any engagement with scientific inquiry to learn content	The overall unit includes 1-2 lessons (either original or identified from other sources) that are differentiated but still allow for limited engagement with scientific inquiry to learn content	The overall unit includes multiple lessons (either original or identified from other sources) that are differentiated but still allow for engagement with scientific inquiry to learn content	All lesson in the overall unit (either original or identified from other sources) are differentiated but still allow for engagement with scientific inquiry to learn content
2c - Design instruction and assessment strategies that confront and address naïve concepts/preconceptions.	Unit plan does not engage students preconceptions (naïve and misconceptions)	Lesson and activities engage commonly identified students preconceptions (naïve and misconceptions) BUT Do not have students make their own preconceptions explicit	Students are required to participate in describing or identifying their preconceptions as part of diagnostic assessments AND Lesson and activities engage commonly identified students preconceptions (naïve and misconceptions)	Students are required to participate in describing or identifying their preconceptions as part of diagnostic assessments AND Lesson and activities engage commonly identified students preconceptions (naïve and misconceptions) AND Formative and summative assessments document changes in student conceptions as a result of the lesson

IMPORTANT INFORMATION FOR LICENSURE COMPLETION

Student Clinical Practice: Internship Requirements

Testing

Beginning with Spring 2015 internships, **all** official and passing test scores must be submitted and in the Mason system (i.e. Banner/PatriotWeb) by the internship application deadline. Allow a minimum of six weeks for official test scores to arrive at Mason. Testing too close to the application deadline means scores will not arrive in time and the internship application will not be accepted.

Required tests (For details, please check http://cehd.gmu.edu/teacher/test/)

- Praxis Core Academic Skills for Educators Tests (or qualifying substitute)
- VCLA
- Praxis II (Content Knowledge exam in your specific endorsement area)

Endorsements

Please note that ALL endorsement coursework must be completed, with all transcripts submitted and approved by the CEHD Endorsement Office, prior to the internship application deadline. Since the internship application must be submitted in the semester prior to the actual internship, please make an appointment to meet with the Endorsement Specialist and plan the completion of your Endorsements accordingly.

CPR/AED/First Aid

Beginning with spring 2015 internships, verification that the Emergency First Aid, CPR, and Use of AED Certification or Training requirement must be submitted and in the Mason system (i.e. Banner/PatriotWeb) by the application deadline. Students must submit one of the "acceptable evidence" documents listed at http://cehd.gmu.edu/teacher/emergency-first-aid to CEHD Student and Academic Affairs. In order to have the requirement reflected as met in the Mason system, documents can be scanned/e-mailed to CEHDacad@gmu.edu or dropped-off in Thompson Hall, Suite 2300.

Background Checks/Fingerprints

All local school systems require students to complete a criminal background check through their human resources office (not through George Mason University) **prior to beginning the internship**. Detailed instructions on the process will be sent to the student from either the school system or Mason. Students are **strongly advised** to disclose any/all legal incidents that may appear on their records. The consequence of failing to do so, whether or not such incidents resulted in conviction, is termination of the internship.

Application and Deadlines

The internship application and deadlines can be found at
http://cehd.gmu.edu/teacher/internships-field-experience