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

EDCI 473-001: Teaching Science in the Secondary School
3 credits, Spring Semester, 20167
Tuesdays, 4:30 – 7:10 pm, Thompson Hall 2020

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Tuesdays, 2 – 4pm and by appointment

Prerequisites/Corequisites
Students must also complete 15 hours of field experience. It is recommended that students take methods I in the same semester as they enroll in EDUC 372.

University Catalog Course Description
Provides study of methods, materials, content, and organization of science programs. Emphasizes curriculum planning, current methodologies, safety, and trends in secondary schools.

Course Overview
EDCI 473 is the first course in a two-part sequence of science methods courses for pre-service and provisionally licensed science teachers seeking a secondary school teaching license in earth science, biology, chemistry, or physics. The course builds upon students' knowledge of their subject matter and previous education coursework to construct fundamental knowledge of science teaching and learning including standards-based curriculum design and research-based teaching strategies. The course focuses on developing inquiry-based lessons for students to investigate science and assessing student understanding of science and the nature of science. The teachers will plan lessons for students to learn science, implement lessons in a high school classroom, observe students learning, and evaluate their teaching and student outcomes.

Per state guidelines, you are required to complete 15 hours of fieldwork during this class. Please go to http://cehd.gmu.edu/endorse/ferf to sign up for your placement.

Course Delivery Method
EDCI 473 is designated as a lecture course; however, students are expected to come to class prepared and actively participate in discussions and other learning experiences.

Learner Outcomes/Objectives
Below is a list of the major course goals along with their corresponding objectives and assessments.

Goal 1: Build a learning theory and see the value in using it for developing and implementing lessons.

Objective	Assignment
Students will be able to design lessons that clearly reflect their learning theory	Lesson plans

Goal 2: Do science to understand how science is done.

Objective	Assignment
Students will be able to design lessons in which students are actively engaged in hands-on science activities	Lesson plans
Students will be able to explain the epistemic features and unique characteristics of science (NOS)	Nature of science assignment

Goal 3: Recognize that inquiry learning using scientific practices has inherent risks that should be identified and addressed such that students learn to do science in an ethical and safe manner.

Objective	Assignment
Students will be able to describe the major safety and ethical concerns associated with conducting science in the classroom	Safety assignment
Students will be able to describe means to reduce the potential safety risks involved in conducting scientific investigations in the classroom while not compromising the benefit to students of conducting inquires	Safety assignment
Students will be able to design lessons that clearly indicate safety concerns, ways to reduce them, and what to do when accidents happen	Lesson plans

Goal 4: Develop an understanding of how inquiry can develop both scientific thinking and content knowledge.

Objective	Assignment
Students will be able to develop inquiry-based lessons that incorporate scientific practices and advance students' content knowledge	Lesson plans

Goal 5: Understand how to develop effective lessons and units with backwards design.

Objective	Assignment
Students will be able to use the basic organization of backwards design to develop a lesson plan	Lesson plans
Students will be able to write measureable objectives	Lesson plans
Students will be able to design teaching activities that support student achievement of measureable objectives	Lesson plans, microteaching
Students will be able to design assessments that evaluate student achievement of measureable objectives	Lesson plans, microteaching

Goal 6: Develop skills as reflective practitioners.

Objective	Assignment
Students will be able to effectively examine classrooms using their learning theory as a lens and student behavior, engagement, and learning (when possible) as evidence	Field experience paper
Students will be able to examine and use assessment data to reflect upon and improve their lessons	Microteaching

Professional Standards

The course focuses on the teaching of science as called for by the state and national science 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 473 builds a repertoire of science teaching and assessment strategies to facilitate student learning.

The pre-service and provisionally licensed teacher will:

- Build a repertoire of science teaching and assessment strategies by reading, writing, observing, participating in, and reflecting on the teaching and learning of science; RESEARCH-BASED PRACTICE; SPA STANDARDS 1, 3, 5, 6, 8, 10
- Develop strategies to help students become scientifically literate, think critically and creatively, understand the nature of science, and see the importance of science as a way of knowing; ETHICAL LEADERSHIP; INNOVATION; SPA STANDARDS 2, 3, 4
- Plan standards-based (local, state, and national) units of science study including daily lesson plans for students that reflect research in effective science teaching and learning; RESEARCH-BASED PRACTICE; SPA STANDARD 5, 6, 8, 10
- Construct science lessons that include alignment of objectives, activities, and assessments that address the needs of a variety of student populations including English language learner, special needs students, and gifted and talented students; ETHICAL LEADERSHIP; SPA STANDARDS 8, 10
- Learn about science laboratory safety and plan teaching activities that highlight safety; ETHICAL LEADERSHIP; SPA STANDARD 9
- Work collaboratively with peers to teach and discuss science and science teaching. COLLABORATION; SPA STANDARD 10
- Incorporate environmental sustainability into teaching paradigms and into daily life. SOCIAL JUSTICE; SPA STANDARD 4

Required Texts

Llewellyn, D. J. (2013). *Teaching high school science through inquiry and argumentation*, *2nd edition*. Thousand Oaks, CA: Corwin Press. ISBN: 978-1-4522-4445-7

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.

Recommended Online Readings

- Achieve, (2013). Next Generation Science Standards (2013). Achieve, Inc. http://www.nextgenscience.org/next-generation-science-standards
- Commonwealth of Virginia (2010). *Standards of Learning for Virginia Public Schools.* Richmond, Virginia. http://www.doe.virginia.gov/testing/index.shtml
- Commonwealth of Virginia (2003). *Science Standards of Curriculum Framework Guides.* http://www.pen.k12.va.us/VDOE/Instruction/sol.html#science
- National Research Council (1996). *National science education standards*. Washington, DC: National Academy Press. http://www.nap.edu/openbook.php?record_id=4962
- American Association for the Advancement of Science (1993). *Benchmarks for Science Literacy*. http://www.project2061.org/tools/benchol/bolframe.htm
- McComas, W. F. (1998). *The principle elements of the nature of science: Dispelling the myths.* http://coehp.uark.edu/pase/TheMythsOfScience.pdf
- Peters, E. E. (2006). *Why is teaching the nature of science so important?* http://www.vast.org/content/File/v1n1/linkedwhole.pdf
- American Chemical Society (2007). *Educators & Students page.* 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.* http://www.gpoaccess.gov/cfr/index.html
- U.S. Department of Labor (2007). *Occupational Health and Safety Administration.* http://www.osha.gov/
- American National Standards Institute (2007). *American National Standards Institute Homepage.* http://www.ansi.org/
- Maryland Public Schools (2007). *Legal Aspects of Laboratory Safety.* http://mdk12.org/instruction/curriculum/science/safety/legal.html

Other Recommended Readings

- Barnekow, D. J. (1998). *Graphic organizers for science.* Portland, ME: J. Weston Walsh.
- 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.
- Froschauer, L., & Bigelow, M. L. (2012). *Rise and shine: A practical guide for the beginning science teacher*. Arlington, VA: NSTA Press.
- Hassard, J. (2005). *The art of teaching science: Inquiry and innovation in middle school and high school.* New York: Oxford University Press.
- Haysom, J., & Bowen, M. (2010). *Predict, observe, explain: Activities enhancing scientific understanding*. Arlington, VA: NSTA Press.
- Johnson, D. W. & Johnson R. T. (1999). *Learning together and alone: Cooperative, competitive, and individualistic learning.* Boston: Allyn and Bacon.

- Kagan, S. (1994). *Cooperative learning.* San Clemente, CA: Resources for Teachers, Inc.
- Keely, P. (2008). *Science formative assessment: 75 practical strategies for linking assessment, instruction, and learning.* Arlington, VA: National Science Teacher Association Press.
- National Research Council. (2005). *How students learn: Science in the classroom.* Washington, DC: The National Academies Press.
- O'Brien, T. (2010). *Brain-powered science: Teaching and learning with discrepant events*. Arlington, VA: NSTA Press.
- Pinto, L. E. (2013). *From discipline to culturally responsive engagement: 45 classroom management strategies*. Thousand Oaks, CA: Corwin Press.
- Ritchhart, R., Church, M. & Morrison, K. (2011). *Making thinking visible: How to promote engagement, understanding, and independence for all learners*. San Francisco: Jossey-Bass.
- Slavin, R. E. (1995). *Cooperative learning.* Boston: Allyn and Bacon.
- Wiggins, G. & McTighe, J. (1998). *Understanding by design.* Alexandria, VA: Association for Supervision and Curriculum Development.
- Wong, H. K., & Wong. R. T. (2009). *The first days of school: How to be an effective teacher (4th ed.)*. Mountain View, CA: Wong Publications.

Course Performance Evaluation

Students are expected to submit all assignments on time in the manner outlined by the instructor (e.g., Blackboard, Tk20, hard copy).

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 a two-way communication loop that informs both learning and teaching. All written assignments must be submitted through Blackboard or Tk20 as indicated. General formatting includes 1" margins, double-spacing, and Times New Roman (or equivalent) font.

Assignment	Points	Due Date
Nature of Science Assignment (PBA)	10	February 28
Lesson Critique and Revision	20	March 21
Safety Assignment (PBA)	10	April 11
Original Lesson	20	May 9
Microteaching and Reflection	20	May 9
Field Experience Paper	10	May 9
Professionalism	10	All Classes
TOTAL	100	

Nature of Science Assignment (PBA):
During the early part of the semester, you will be involved in doing scientific investigations. For this assignment, you will provide a written reflection (1) highlighting how your experiences have assisted you in addressing the core science ideas listed below, (2) describing how you used the science practices listed below, and (3) explaining how you might apply scientific inquiry in your classroom in order to teach a science concept. This assignment must be submitted via Tk20. The rubric can be found at the end of the syllabus.

Nature of Science Ideas

1. Science cannot answer all questions.
2. Science employs multiple methods and types of reasoning that share many common factors, habits of mind, and norms.
3. Science produces, demands, and relies on empirical evidence.
4. Scientific knowledge is tentative, durable, and self-correcting.
5. Laws and theories are related but distinct kinds of scientific knowledge and play central roles.
6. Science is a creative endeavor.
7. Social, historical, and cultural factors play a role in the construction of scientific knowledge.
8. Science and technology are not the same but impact one another.
9. Science has a subjective element.

Science Practices

1. Asking questions/defining problems
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations/designing solutions
7. Engaging in argument from evidence
8. Obtaining, evaluating, & communicating information

Lesson Critique and Revision:
"A good teacher is a good thief." Many of your best lessons will come from colleagues, websites, or other resources. However, it is critical that you customize these activities to your own style, purpose, students, and – most importantly – teaching philosophy. For this assignment, you will find a lesson plan from your licensure area, critique it with the provided form, and then improve it to more closely align with best practices. Submit the original and revised lessons as well as the critique form via Blackboard.

Safety Assignment (PBA):
A safety plan is necessary for the health and safety of your students and yourself, as well as for legal reasons. For this assignment, you will design a science safety plan, which will include (1) a list of safety rules/procedures relevant to your subject area, (2) a one-page (front and back, if

necessary) safety contract that must be signed and dated by parents and students, (3) an evaluation of a science lesson for safety issues, (4) an engaging, safety-related assignment that teaches students the importance of safety, and (5) active maintenance of safety equipment in the classroom. This assignment must be submitted via Tk20. The rubric can be found at the end of the syllabus.

Original Lesson:

It is important that teacher candidates demonstrate their ability to design an effective lesson plan with specific, performance-based learning objectives that meet the learning needs of their students. Lesson planning can be guided by four basic questions: (adapted from Spencer, 2003, p. 251).

1. Who am I teaching? The number of learners, their academic level and prior knowledge.
2. What am I teaching? The content or subject, the type of learning (knowledge, skills, behaviors).
3. How will I teach it? Teaching models, learning strategies, length of time available, materials, technology resources, differentiation/modifications, etc.
4. How will I know if the students understand? Informal and formal assessments, formative and summative, higher order questioning techniques, feedback from learners, etc.

You might also want to ask:

- What do students know already?
- Where have students come from and what are they going on to next?
- How can I build in sufficient flexibility cope with emergent needs?

A lesson plan must be developed for each teaching session. During the internship and when teaching new content or grade levels, your lesson plans will be detailed. As you gain pedagogical content knowledge and are proficient, your lesson planning becomes less detailed. Part of the planning process includes considering the following tasks:

- list content and key concepts, (research more if needed)
- define your aims and identify specific learning outcomes or objectives
- create assessments that are aligned to your specific objectives
- think about the structure of the lesson, pacing, and transitions
- identify adaptations/modifications/extensions needed to meet student needs
- determine “best practice” and learning strategies aligned to the learning outcomes
- identify learning resources and support materials

For this assignment, you will write an original lesson that aligns with best practices. The lesson should be designed for 90 minutes of instruction and use the provided lesson plan template. Submit all files via Tk20. The rubric can be found at the end of the syllabus.

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 teach a 45-minute lesson

that you have designed with your partner(s). After teaching, you will submit a reflection about the experience via Blackboard.

Prior to the day of the lesson:

1. Identify any resources you need to teach your lesson and put in a request for what you cannot obtain to determine if it is available. Please do this at least two (2) weeks prior to the day you teach to ensure materials will be available.

Day of the lesson:

2. Give a one-minute overview in which you will describe to the class the setting of this lesson (subject, grade level, standards, objectives).
3. 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.
4. Be sure to conduct a **formative assessment** so you have data to determine whether or not students achieve the objectives.

After the lesson:

5. Examine the formative assessments, summarizing the results and determining from this data whether the objectives were achieved.
6. Write a 5-page paper that examines what happened during your lesson, focusing on how the activities might have influenced student learning (positively and negatively). The paper should be organized as follows:
    a. Identify the assessments used during lesson to evaluate the lesson objectives. Describe the results of the assessments of these objectives (e.g., percentage of the students achieved each objective).
    b. 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. Where/how could students think more deeply about the objective? Where/how could they be more 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. 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 Project:

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

In this course you will spend 15 hours in area classroom(s) with teachers instructing subject(s) and grade level(s) for which you are being licensed. Many of these hours will be spent observing these teachers' instruction, but you will also be expected to engage with students individually, in small groups, and in whole groups, as your mentor teacher determines. As part of this experience, you will be reflecting on how teachers design instruction to meet the needs of students and you will consider suggestions as to how you might do things similarly and/or differently.

You should spend a *minimum* of 5 days observing teachers, with each day being a *maximum* of 3 hours. The purpose of the field experience is to provide you with the opportunity to (1) connect the goals of your methods I class, education theories relevant to your subject matter, and concepts and research findings related to classroom/school practice, (2) study and begin to develop your pedagogical practices in a variety of classroom/school communities, and (3) promote critical, self-reflection about your current and future teaching practices.

Your Clinical Experience Summary Project should address all of the elements described on the Clinical Experience Observation Protocol and Critical Incidents Reflection Form:

1. your class's demographics
2. your classroom's layout and the teacher and student movements and interactions it enables or inhibits
3. your observations regarding your mentor teacher's and classroom's:
    a. teaching processes and practices
    b. student-teacher interactions
    c. student-student interactions
    d. teaching and learning with technology
    e. interactions with students with special needs
    f. interactions with diverse populations (e.g., ELLs or underrepresented racial/ethnic minority students)
4. critical teaching/learning incidents
5. burning issues/questions
6. "best practice" teaching tips

Consider your Protocol and Reflection Forms as well as any other relevant data you collected and prepare your Clinical Experience Summary and Analysis Project. This report will be submitted through Blackboard and consists of 4-5 page description and analysis of what you have learned. Be sure to reflect on the intersections and tensions between what you have encountered in our Methods I class, our course readings and activities, your own school experiences in similar classes, and your clinical experience observations. Finally, detail implications of this clinical experience, what you observed, and your analyses for your future teaching practices.

Note: Be sure to provide the Methods I Clinical Experience Introductory Letter to your mentor teacher, and discuss the hours expectation, Observation Protocol elements, Reflection Form

content, and this Summary and Analysis Project with your mentor teacher early in your clinical experience.

Professionalism:
Learning depends on the active engagement of the participant and frequent checking by the instructor as to the progress of the learner. Your classmates depend on your comments to extend their learning. Preparation, attendance, and participation are necessary for each class.

Other Requirements
Every student registered for any Secondary Education course with a required TK20 performance-based assessment (designated as such in the syllabus) must submit this/these assessment(s) **(Nature of Science**, **Safety**, and **Original Lesson Plan** assignments) to Tk20 through ***'Assessments'*** in Blackboard (regardless of whether a course is an elective, a one-time course or part of an undergraduate minor). Failure to submit the assessment(s) to Tk20 (through Blackboard) will result in 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.

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 and are due at the beginning of class on the day they are due. Late assignments will automatically receive a ten percent grade reduction (one full letter grade lower).

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

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.

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

Course Schedule
Faculty reserves the right to alter the schedule, as necessary, with notification to students.

Date	Topic(s)	Reading Due	Assignment Due
Jan 24	Intro to Course	MyMason site	
Jan 31	Nature of Science	Chapter 2, Articles	
Feb 7	Backwards Design	Chapter 9	
Feb 14	Assessment	Chapter 10	
Feb 21	(Mis)Conceptions	Article	
Feb 28	Learning Models	Chapters 3, 5	NOS Assignment
Mar 7	Inquiry	Chapters 1, 4, 6, 7	
Mar 14	NO CLASS – SPRING BREAK		
Mar 21	Managing the Inquiry Classroom	Chapters 8, 11	Lesson Critique and Revision
Mar 28	Safety		
Apr 4	Peer Review of Lessons		Original Lesson draft
Apr 11	NO CLASS – Planning Time		Safety Assignment
Apr 18	Microteaching		
Apr 25	Microteaching		
May 2	Microteaching		
May 9	NO CLASS – Remaining Assignments Due		

Core Values Commitment
The College of Education and 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/.

GMU Policies and Resources for Students

Policies

- Students must adhere to the guidelines of the Mason Honor Code (see http://oai.gmu.edu/the-mason-honor-code/).
- 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 Mason 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 with disabilities who seek accommodations in a course must be registered with George Mason University Disability Services. 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 silenced during class unless otherwise authorized by the instructor.

Campus Resources

- Support for submission of assignments to Tk20 should be directed to tk20help@gmu.edu or https://cehd.gmu.edu/aero/tk20. Questions or concerns regarding use of Blackboard should be directed to http://coursessupport.gmu.edu/.
- The Writing Center 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/).
- The 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 Student Support & Advocacy Center staff helps students develop and maintain healthy lifestyles through confidential one-on-one support as well as through interactive programs and resources. Some of the topics they address are healthy relationships, stress management, nutrition, sexual assault, drug and alcohol use, and sexual health (see http://ssac.gmu.edu/). Students in need of these services may contact the office by phone at 703-993-3686. Concerned students, faculty and staff may also make a referral to express concern for the safety or well-being of a Mason student or the community by going to http://ssac.gmu.edu/make-a-referral/.

For additional information on the College of Education and Human Development, please visit our website https://cehd.gmu.edu/.

Assignment Rubrics

Nature of Science Assignment (PBA)

Standard	Accomplished	Target	Acceptable	Unsatisfactory
Understand research and can successfully design, conduct, report, and evaluate investigations in science (1d)	Product provided is an independent investigation in which the candidate identifies the question, designs and implements the methods for investigating the questions, and reports the findings.	Product provided is a classroom assignment in which the candidate is given a question but designed and implemented the methods for investigating the question as well as reports on the findings.	Product provided is a classroom assignment in which the candidate was given the question and methods for investigating the question but candidate conducts the investigation and reports on the findings.	Produce submitted is not an example of scientific inquiry.
Understand and can successfully use mathematics to process and report data and solve problems in their field(s) of licensure (1e)	The mathematics used when reporting findings or solving the problem are appropriate and independently determined by the candidate.	The mathematics used when reporting findings or solving the problem are appropriate and largely determined by the candidate.	The mathematics used when reporting findings or solving the problem were largely determined by the instructor.	There are no or inappropriate examples of mathematics used to report findings or solve problems.
Understand the philosophical tenets, assumptions, goals, and values that distinguish science from technology and from other ways of knowing the world (2b)	Candidate fully explains all of the following aspects of the nature of science AND connects them to the investigations: 1. science cannot answer all questions 2. science produces, demands, and relies on empirical evidence 3. science and technology are not the same but impact one another.	Candidate fully explains all of the following aspects of NOS BUT DOES NOT connect them to the investigations: 1. science cannot answer all questions 2. science produces, demands, and relies on empirical evidence 3. science and technology are not the same but impact one another.	Candidate explains the following aspects of the nature of science in a partial or superficial way: 1. science cannot answer all questions 2. science produces, demands, and relies on empirical evidence 3. science and technology are not the same but impact one another.	Candidate cannot explain the following aspects of the nature of science: 1. science cannot answer all questions 2. science produces, demands, and relies on empirical evidence 3. science and technology are not the same but impact one another.
Understand the processes, tenets, and assumptions of multiple methods of inquiry leading to	Candidate fully explains the following aspects of the nature of science AND	Candidate fully explains the following aspects of NOS BUT DOES NOT connect them to	Candidate explains the following aspects of the nature of science in a partial or	Candidate cannot explain the following aspects of the nature of science:

Standard	Accomplished	Target	Acceptable	Unsatisfactory
scientific knowledge (3a)	connects them to the investigations: 1. Science employs multiple methods and types of reasoning that share many common factors, habits of mind, and norms 2. scientific knowledge is tentative, durable, and self-correcting	the investigations: 1. Science employs multiple methods and types of reasoning that share many common factors, habits of mind, and norms 2. scientific knowledge is tentative, durable, and self-correcting	superficial way: 1. Science employs multiple methods and types of reasoning that share many common factors, habits of mind, and norms 2. scientific knowledge is tentative, durable, and self-correcting	1. Science employs multiple methods and types of reasoning that share many common factors, habits of mind, and norms 2. scientific knowledge is tentative, durable, and self-correcting
Understand socially important issues related to science and technology in their field of licensure, as well as processes used to analyze and make decisions on such issues (4a)	Candidate fully explains the following aspects of the nature of science AND connects them to the investigations: 1. science is a creative endeavor 2. social, historical, and cultural factors play a role in the construction of scientific knowledge 3. science has a subjective element	Candidate fully explains the following aspects of NOS BUT DOES NOT connect them to the investigations: 1. science is a creative endeavor 2. social, historical, and cultural factors play a role in the construction of scientific knowledge 3. science has a subjective element	Candidate explains the following aspects of the nature of science in a partial or superficial way: 1. science is a creative endeavor 2. social, historical, and cultural factors play a role in the construction of scientific knowledge 3. science has a subjective element	Candidate cannot explain the following aspects of the nature of science: 1. science is a creative endeavor 2. social, historical, and cultural factors play a role in the construction of scientific knowledge 3. science has a subjective element

Safety Assignment (PBA)

Standard	Accomplished	Target	Acceptable	Unsatisfactory
Understand the legal and ethical responsibilities of science teachers for the welfare of their students, the proper treatment of animals, and the maintenance and disposal of materials (9a)	Within self-developed lessons and unit, candidate consistently identifies the legal responsibilities of the teacher AND is able to describe how to address these responsibilities	Given a hypothetical lab activity, the candidate is able to identify the legal responsibilities of the teacher AND describe how to address these responsibilities	Candidate is able to list the legal responsibilities of a teacher AND describe how to hypothetically address these responsibilities	Candidate is not able to list the legal responsibilities of a teacher AND is not able to describe how to address those responsibilities
Know and practice safe techniques for the preparation, storage, dispensing, supervision, and	Within self-developed lessons and unit, candidate can safely prepare, store, dispense, and	Given a hypothetical activity, candidate is able to list safe practices associated	Candidate is able to list safe practices associated with materials including preparation,	Candidate is not able to list safe practices associated with materials in the science

Standard	Accomplished	Target	Acceptable	Unsatisfactory
disposal of all materials used in science instruction	dispose of materials used during science instruction AND provide appropriate emergency procedures to share with students for activities	with materials including preparation, storage, disposal, and supervision AND is able to outline appropriate emergency procedures for the lab	storage, disposal, and supervision	classroom
Know and follow emergency procedures, maintain safety equipment, and ensure safety procedures appropriate for the activities and abilities of students (9c)	Within self-developed lessons, candidate is able to articulate safety concerns and appropriate emergency procedures, as well as what safety equipment should be available and how to use it	Given a hypothetical activity, candidate is able to list safety concerns and appropriate emergency procedures, as well as what safety equipment should be available and how to use it	Candidate is able to list emergency procedures, explain the maintenance of primary safety equipment, and determine how to address safety concerns within a particular activity	Candidate is not able to describe emergency procedures, explain the maintenance of any safety equipment, or determine how to address safety concerns for a particular activity
Treat all living organisms used in the classroom and found in the field in a safe, humane, and ethical manner and respect legal restrictions on their collection, keeping, and use (9d)	Within self-developed lessons, candidate is able to articulate safe, humane, and ethical practices associated with the use and disposal living organisms	Given a hypothetical activity, candidate is able to list safe, humane, and ethical practices associated with the use and disposal of living organisms	Candidate is able to list safe, humane, and ethical practices associated with the use and disposal of living organisms	Candidate is not able to list safe, humane, and ethical practices associated with the use and disposal of living organisms

Original Lesson (PBA)

Criteria	Does Not Meet Standard	Approaches Standard	Meets Standard	Exceeds Standard
LESSON PLANNING				
The candidate identifies performance-based objectives and appropriate curriculum goals that are relevant to learners. ***InTASC 7(a)***	The candidate **does not** identify performance-based objectives and appropriate curriculum goals that are relevant to learners.	The candidate identifies objectives and curriculum goals but they **are not** performance-based **or** appropriate for subject and/or grade level.	The candidate identifies performance-based objectives and appropriate curriculum goals and they are appropriate for subject and/or grade level.	The candidate identifies **well-developed,** performance-based objectives, appropriate curriculum goals that are appropriate for subject and/or grade level; **correctly formulated; and**

				addressed all domains.
The candidate identifies national/state/local standards that align with objectives and are appropriate for curriculum goals and are relevant to learners. ***InTASC 7(g)***	The candidate **does not** identify national/state/local standards that align with the objectives or the standards **are not** appropriate for curriculum goals or are not relevant to learners.	The candidate identifies national/state/ local standards but the standards **are not** aligned with the objectives and/or **marginally** relevant to learners.	The candidate identifies national/state/ local standards that are aligned with the objectives **and** relevant to learners.	The candidate identifies national/state/ local standards that are **clearly** aligned with the objectives **and** relevant to learners.
The candidate continually seeks appropriate ways to employ technology to support assessment practice both to engage learners more fully and to assess and address learner needs. ***InTASC 6(i)***	The candidate **does not** identify appropriate technology to engage learners even though it was available.	The candidate identify technology to engage learners though it would be ineffective to teach the content and address learner needs.	The candidate identifies appropriate technology to engage learners more fully and assess and address learner needs.	The candidate identifies effective, creative and appropriate technology to engage learners more fully and assess **and enhance** student learning needs.
The candidate facilitates learners' use of current tools and resources to maximize content learning in varied contexts. ***InTASC 5(c)***	The candidate's plans **do not** provide evidence of opportunities for learners' use of current tools (technology) **nor** resources to maximize content learning in varied contexts.	The candidate's plans provide evidence of opportunities for learners' use of current tools and resources **that are ineffective** to maximize content learning in varied contexts.	The candidate's plans **provide evidence** of opportunities for learners' use of current tools and resources **that are effective** to maximize content learning in varied contexts.	The candidate's plans provide **substantial** evidence of **multiple** opportunities for learners' use of current tools and resources **that are creative and effective** to maximize content learning in varied contexts.
The candidate plans how to achieve each student's learning goals, choosing accommodations to differentiate instruction for individuals and groups of learners. ***InTASC 7(b)***	The candidate's lesson plan **does not** provide evidence of accommodations to differentiate instruction for individuals and groups of learners.	The candidate's lesson plan provides evidence of **an effort** to meet student's learning goals, and **attempts** accommodations to differentiate instruction for individuals and groups of learners.	The candidate's lesson plan provides evidence of **successfully** meeting **each** student's learning goals, and **successfully** makes accommodations to differentiate instruction for individuals and groups of learners.	The candidate's lesson plan provides evidence of successfully meeting **each** student's learning goals, and **successfully** makes **a variety of accommodations** to differentiate instruction for individuals and groups of learners.

The candidate develops appropriate sequencing and pacing of learning experiences and provides multiple ways to demonstrate knowledge and skill. ***InTASC 7(c)***	The candidate **does not** plan for appropriate sequencing and pacing of learning experiences. Tasks, methods, strategies **are not** stated.	The candidate plans for appropriate sequencing and pacing of learning experiences; but tasks, methods and strategies are **not stated and/or not appropriate** or effective for the lesson.	The candidate plans for **appropriate** sequencing and pacing of learning experiences; and **all** tasks, methods, and strategies are **stated and/or are appropriate** and **effective** for the lesson.	The candidate plans for **appropriate** sequencing and pacing of learning experiences; tasks, methods and strategies include **a variety of creative, active learning, instructional strategies** that address learner differences to maximize learning.
PLANNED INSTRUCTIONAL STRATEGIES				
The candidate stimulates learner reflection on prior content knowledge, links new concepts to familiar concepts, and makes connections to learners' experiences. ***InTASC 4(d)***	The candidate **does not** plan an opening activity that stimulates learner reflection on prior content knowledge, links new concepts to familiar concepts, **nor** makes connections to learners' experiences.	The candidate plans an opening activity that used learner prior content knowledge, **but does not** link new concepts to familiar concepts, **or** make connections to learners' experiences.	The candidate plans an opening activity that stimulates learner reflection on prior content knowledge, links new concepts to familiar concepts, **and** makes connections to learners' experiences.	The candidate plans an opening activity that **actively** stimulates learner reflection on prior content knowledge, **effectively** links new concepts to familiar concepts, and **creatively** makes connections to learners' experiences.
The candidate engages learners in multiple ways of demonstrating knowledge and skill as part of the assessment process. ***InTASC 6(e)***	The candidate **does not** use assessment as closure to check for comprehension and student knowledge and skills.	The candidate uses assessment as closure to demonstrate knowledge and skills to check for comprehension **but** they are **inappropriate and/or ineffective**.	The candidate uses **appropriate assessment strategies** as closure to demonstrate knowledge and skills to check for understanding.	The candidate uses **creative appropriate assessments** for closure to demonstrate knowledge and skills to check for comprehension.
ASSESSMENTS				
The candidate plans instruction based on pre-assessment data, prior learning knowledge and skill. ***InTASC 7(d)***	The candidate **does not** plan instruction based on pre-assessment data, prior learning knowledge **or** skills.	The candidate plans instruction based on pre-assessment data, prior learning knowledge and skills but it was **not effective.**	The candidate plans instruction based on pre-assessment data, prior learning knowledge and skill. Pre-assessment strategy/method **appropriate** and **effectively** assess student prior knowledge.	The candidate plans instruction based on pre-assessment strategy/method that are **creative and effective** way to assess student prior knowledge and skills and **to guide instruction**.

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's lesson design **does not** include post-assessments strategies or methods.	The candidate's lesson design includes post-assessments strategies or methods but the strategies/methods were **not effective.**	The candidate's lesson design includes post-assessments that were appropriate to **effectively** assess student learning.	The candidate's post-assessment **matches learning objectives** and includes **creative strategies** to **effectively** assess student learning.

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