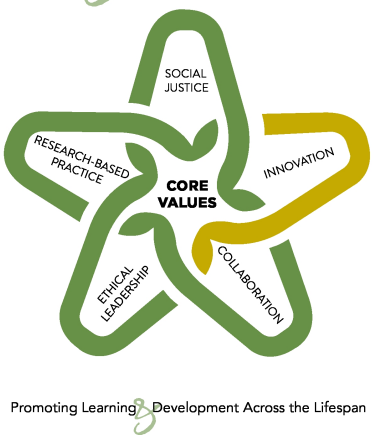
George Mason University
College of Education and Human Development
Secondary Education Program

EDCI 473-001/573-001:
TEACHING SCIENCE IN THE SECONDARY SCHOOL
Spring 2020 – 3 Credits - Fairfax

College of EDUCATION & HUMAN DEVELOPMENT — GEORGE MASON UNIVERSITY



Promoting Learning & Development Across the Lifespan

INSTRUCTOR: Dr. Stephen Burton
DATE AND TIME: Jan 21-May 5
Tuesdays 4:30-7:20 pm
CLASS LOCATION: Thompson 2020
TELEPHONE: 616-502-2175
E-MAIL: sburton7@gmu.edu
OFFICE HOURS: By appointment

COMMUNICATION: Email is the best form of communication. During usual circumstances, turnaround time is 24-36 hours. You can also reach me on my cell phone at 616-502-2175. However, please text me first using asking if I can receive a call at that time. If I do not respond right away, then I am unavailable. I will, text back later and we can schedule a time to talk on the phone.

REQUIRED ELECTRONIC TEXTS: We will have required readings from an **NSTA class bundle**, consisting of various books and journals (and sometimes webinars) from the National Science Teacher Association (NSTA) – our national organizing body. The purchase of these electronic materials also gives you a membership to NSTA, which opens up a great deal of resources to you. We are doing this instead of having one book for two reasons:

1. NSTA is an important organization to know over the course of your career as a science teacher – they are a premiere organization in professional development- and you should get to know them and get involved as soon as possible
2. NSTA peer-reviews all of their work, so their professional development materials are the best available – and the biggest body of materials as well

We suggest you purchase the year-long course pack ($99) if you plan to take Methods 2 next semester, as that course also uses the course pack. If you want to purchase the course pack for just this semester it is ($79). INSTRUCTIONS FOR PURCHASING THE NSTA LEARNING CENTER (NSTA LC) CAN BE FOUND HERE: http://bit.ly/2SvreS9.

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 372/672, Human Development.

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 473/573 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.

COURSE DELIVERY METHOD: EDCI 573 is designated as a lecture course; however, students are expected to come to class prepared and actively participate in discussions and other hands-on learning experiences.

COURSE MATERIALS ONLINE: For dissemination of information, we will be using the website https://sites.google.com/site/gmusciencemethods/. Materials will be added throughout the semester based upon needs from the course. The Blackboard site, found at http://mymasonportal.gmu.edu, will be used primarily for submitting assignments and grades. Use the same login as your GMU email for the Blackboard Sites.

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 https://ready.gmu.edu/.

BIG IDEAS IN SCIENCE EDUCATION: During this semester, we will be focusing on helping you begin your journey to becoming a reflective practitioner of reformed science education practices. We will focus on the following big ideas as a way to frame your understanding of effective science education practices throughout both Science Methods I and Science Methods II.

- Have a theory of learning – it is what should guide your instruction as you develop and implement 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
- 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
- Know your students – get into their heads when designing lessons
- 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
- You don't have to reinvent the wheel, but do need to customize it based on your objectives

LEARNING GOALS, OBJECTIVES AND ASSESSMENTS: 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 1: Build a learning theory for developing and implementing lessons

Objective	Assignment	Who must do this?
Students will be able to explain why a student-centered approach to learning is effective in learning	Research Review	Methods I and II – Grad Students Only
Students will be able to describe their theory of learning, supporting with evidence from the literature	Learning Theory Alignment	Methods II
Student will be able to design lessons that clearly reflect their learning theory	Lessons (Both), Unit Plan (Methods II), Microteaching Reflection (Both)	Methods I and II
Students will be able to explain how the 5-E lesson design, the Learning Cycle, and a student-centered learning theory are effective ways to think about learning and lesson design	Reflection Questions	Methods I and II

Goal 2: Do science to understand how science is done

Objective	Assignment	Who must do this?
Students will be able to conduct an investigation that results in new scientific knowledge	Nature of Science Assignment	Methods I
Students will be able to explain the epistemic features and unique characteristics (NOS) of science	Nature of Science Assignment	Methods I

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 and ethical and safe manner.

Objective	Assignment	Who must do this?
Students will be able to explore the web to describe the major safety and ethical concerns associated with conducting science in the classroom	Safety Assignment	Methods I
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 the students get while conducting inquiries	Safety Assignment	Methods I
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	Lessons (Both), Unit Plan (Methods II)	Methods I and II

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

Objective	Assignment	Who must do this?
Students will be able to explain what inquiry in a science class looks like	Reflection Questions	Methods I and II
Student will develop lessons that are inquiry-focused	Lessons (Both), Unit Plan (Methods II)	Methods I and II

Students will be able to explain Model-Based Inquiry and its potential impact on helping students learn science content and scientific thinking	Reflection Questions	Methods I
Students will be able to develop lessons that incorporate Model-Based Inquiry	Lessons (Both), Unit Plan (Methods II)	Methods I and II
Students will be able to explain Cognitive Apprenticeships and its potential impact on helping students learn science content and scientific thinking	Reflection Questions	Methods I and II
Students will be able to develop lessons that incorporate Cognitive Apprenticeships	Lessons (Both), Unit Plan (Methods II)	Methods I and II

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

Objective	Assignment	Who must do this?
Student will be able to explain the basic premise and order of backwards	Reflection Questions	Methods I and II
Students will use the basic organization of backwards design to develop a lesson plan	Lessons (Both), Unit Plan (Methods II)	Methods I and II
Students will be able to write measurable objectives	Lessons (Both), Unit Plan (Methods II)	Methods I and II
Students will be able to describe how teaching activities support student achievement of measurable objectives	Lessons (Both), Unit Plan (Methods II), Microteaching Reflection (Both)	Methods I and II
Students will be able to describe how assessments evaluate student achievement of the measurable objectives	Lessons (Both), Unit Plan (Methods II), Microteaching Reflection (Both)	Methods I and II

Goal 6: Develop skills as reflective practitioners.

Objective	Assignment	Who must do this?
Students will be able to effectively examine classrooms using their learning theory as a lens and student behavior, engagement, and learning (when possible) as the evidence	Field Experience Paper	Methods I and II
Students will be able to examine use assessment data to reflect on and improve upon lessons	Microteaching Reflection (Both)	Methods I and II

Professional Association Standards (met through EDCI 473/573)

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 573 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

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).

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).

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 contract 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: Findings from 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. See Assignments section of the Syllabus for a description of the assignment.

Assessments	EDCI 473	EDCI 573	Due Date
Research Review	5	5	Feb 17
Nature of Science Assignment (PBA)	10	10	Mar 4
Lesson Critique	10	10	Mar 13
Lesson Revision	NA	5	Mar 20
Safety Assignment (PBA)	10	10	Apr 7
Final Original Lesson	10	10	Apr 21 OR 28
Microteaching	10	10	Apr 21 or 28
Microteaching Reflection	10	10	May 5
Field Experience Paper	10	10	Apr 27
Reflection Questions	10	10	Varied
Professionalism	10	10	Always
Total Points	**95**	**100**	

FIELD EXPERIENCE SIGNUP: Per state guidelines, you are required to complete 15 hours of fieldwork during this class. For more information about field placement, go to https://cehd.gmu.edu/epo/field-experience. Additionally, please answer the survey sent by Dr. Zenkov. If you have missed this survey, go to http://cehd.gmu.edu/endorse/ferf to sign up for your placement.

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/.

PROFESSIONAL DISPOSITIONS: Students are expected to exhibit professional behaviors and dispositions at all times. See https://cehd.gmu.edu/students/polices-procedures/

GMU POLICIES AND RESOURCES FOR STUDENTS:

Policies

- Students must adhere to the guidelines of the Mason Honor Code (see https://catalog.gmu.edu/policies/honor-code-system/).
- 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 https://ds.gmu.edu/).
- Students must silence all sound emitting devices 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/.
- For information on student support resources on campus, see https://ctfe.gmu.edu/teaching/student-support-resources-on-campus

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

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

Date	Topic
Jan 21	What is learning? What is important for students to learn? Introduction to scientific investigation and NOS
Jan 28	Science Lesson What is the role of models in the science classroom? Models-Based Science Teaching
Feb 4	Science Lesson How can students communicate their models? Scientific Argumentation
Feb 11	Science Lesson How can we help students develop both content knowledge and science process skills? Teaching with Inquiry
Feb 17	Assignment Due – Research Review
Feb 18	Science Lesson What do effective teachers do to encourage learning? Backwards Design, Objectives
Feb 25	Science Lesson How do we know if students are learning? Exploring assessment data and lesson design
Mar 3	Science Lesson What approach to writing lessons reflects the current understanding of how students learn?
Mar 4	Assignment Due – Nature of Science (PBA)
Mar 10	***GMU SPRING BREAK***
Mar 13	Assignment Due – Lesson Critique
Mar 17	Lesson Revision
Mar 24	Planning Original Lesson
Mar 31	Planning Original Lesson
Apr 7	***NO FORMAL CLASS MEETING*** Online Safety Assignment Assignment Due: First Draft Original Lesson due by 4:30 pm Assignment Due: Safety Assignment due by 11:59 pm
Apr 14	How do we help students experience science safely? review Planning Original Lesson
Apr 21	Micro-Teaching
Apr 27	Assignment Due – Field Experience Paper
Apr 28	Micro-teaching
May 5	***NO FORMAL CLASS MEETING*** Assignment Due: Microteaching Reflection and Final Draft Original Lesson

ASSIGNMENTS:

ALL ASSIGNMENT INSTRUCTIONS ARE POSTED ON BLACKBOARD – THE INSTRUCTIONS GIVEN ON THE SYLLABUS ARE FOR DESCRIPTIVE PURPOSES ONLY

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 1-2 page written reflection highlighting how your experiences have assisted you in addressing the following:

- Understand research and can successfully design, conduct, report, and evaluate investigations in science
- Understand and can successfully use mathematics to process and report data and solve problems in their field(s) of licensure
- Understand the philosophical tenets, assumptions, goals, and values that distinguish science from technology and from other ways of knowing the world
- Understand the processes, tenets, and assumptions of multiple methods of inquiry

This assignment must be submitted via Tk20. The rubric can be found at the end of the syllabus.

Nature of Science Ideas	*Science and Engineering Practices*
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.	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

Research Review:

For this assignment, identify three peer-reviewed research articles related to student-centered and inquiry-based science teaching. Relevant articles can be found via Google Scholar (http://scholar.google.com) and/or the Mason library search engine (http://library.gmu.edu). You will then write a review of the articles, including (1) a description of the research questions, participants, methodology, and measures, (2) a synopsis of the findings, and (3) a discussion of how the findings can/should influence your classroom practice. Be sure to provide APA citations for each article. Submit the assignment via Blackboard.

Lesson Critique and Revision:

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 30-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, and 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 expectation for hours, 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.

Recommended Online Resources:

- Achieve, Inc. on behalf of the twenty-six states and partners that collaborated on the NGSS (2013). Next Generation Science Standards (2013). Achieve, Inc. Retrieved on Dec 28, 2019 from http://www.nextgenscience.org/next-generation-science-standards
- Commonwealth of Virginia (2018). *Standards of Learning for Virginia Public Schools.* Richmond, Virginia. Retrieved on Dec 28, 2019 from http://www.doe.virginia.gov/testing/sol/standards_docs/science/2018/index.shtml
- National Research Council (1996). *National science education standards*. Washington, DC: National Academy Press. Retrieved on Dec 28, 2019 from http://www.nap.edu/openbook.php?record_id=4962
- American Association for the Advancement of Science (1993). *Benchmarks for Science Literacy*. Retrieved on Dec 28, 2019 from http://www.project2061.org/publications/bsl/online/index.php
- McComas, W. F. (1998). *The principle elements of the nature of science: Dispelling the myths.* Retrieved on Dec 28, 2019 from http://www.pestl.org/images/The_Myths_of_Science_Article_by_McComas.pdf.
- Peters, E. E. (2006). *Why is teaching the nature of science so important?* Retrieved on Dec 28, 2019 from http://www.auburn.edu/~cgs0013/Schnittka_timeline.pdf
- Dagher, Z. R. & Erduran, S. (2017). Abandoning patchwork approaches to nature of science in science education. Canadian Journal of Science, Mathematics, and Technology Education, 17(1), 46-52. http://dx.doi.org/10.1080/14926156.2016.1271923.
- American Chemical Society (2007). *Educators & Students page.* Retrieved on Dec 28, 2019 from https://www.acs.org/content/acs/en/education.html
- American Chemical Society (2003). Chemical Science Safety in the Classroom. Retrieved on Dec 28, 2019 from https://www.acs.org/content/acs/en/education/policies/safety.html
- U.S. Government Printing Office (2007). *Code of Federal Regulations.* Retrieved on Dec 28, 2019 from https://www.govinfo.gov/content/pkg/CFR-2007-title45-vol1/pdf/CFR-2007-title45-vol1.pdf
- U.S. Department of Labor (2007). *Occupational Health and Safety Administration.* Retrieved on December 28, 2019 from https://www.osha.gov/laws-regs
- 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 December 28, 2019 from http://mdk12-archive.msde.maryland.gov/instruction/curriculum/science/safety/legal.html

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

Other Resources

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.

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.

Kagan, S. (1994). *Cooperative Learning.* San Clemente, CA: Resources for Teachers, Inc.

Keely, P., Eberle, F., & Farrin, L. (2005). *Uncovering student ideas in science: 25 formative assessment probes.* Arlington, VA: National Science Teacher Association Press.

Llewellyn, D. (2002). *Inquire within: Implementing inquiry-based science standards.* Thousand Oaks, CA: Corwin Press.

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NOTICE OF MANDATORY REPORTING OF SEXUAL ASSAULT, INTERPERSONAL VIOLENCE, AND STALKING: As a faculty member, I am designated as a "Responsible Employee," and must report all disclosures of sexual assault, interpersonal violence, and stalking to Mason's Title IX Coordinator per University Policy 1202. If you wish to speak with someone confidentially, please contact one of Mason's confidential resources, such as Student Support and Advocacy Center (SSAC) at 703-380-1434 or Counseling and Psychological Services (CAPS) at 703-993-2380. You may also seek assistance from Mason's Title IX Coordinator by calling 703-993-8730, or emailing titleix@gmu.edu.

SUSTAINABILITY AND DISPOSITIONS INFORMATION

SUSTAINABILITY AT GMU

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

- Handouts will be available electronically through the Blackboard platform
- All assignments will be submitted through the blackboard on a Wiki site established fir each individual student.
- You should consider reducing waste in your teaching practice (ex: unnecessary paper) and in developing your unit plan
- Incorporate teaching sustainability in the content of your lesson plans (for example, human's role in reducing their impact on the environment.) Think about what the next generation needs to know about "greening".

COLLEGE EXPECTATIONS AND UNIVERSITY HONOR CODE

- Students are expected to exhibit professional behaviors and dispositions at all times. See ***Graduate School of Education Dispositions for A Career Educator*** section below and follow the instructions.
- Students must adhere to the guidelines of the George Mason University Honor Code [See http://oai.gmu.edu/honor-code/].
    - Please note the following.
        - "Plagiarism encompasses the following:
            1. Presenting as one's own the words, the work, or the opinions of someone else without proper acknowledgment.

2. Borrowing the sequence of ideas, the arrangement of material, or the pattern of thought of someone else without proper acknowledgment." (from Mason Honor Code online at http://mason.gmu.edu/~montecin/plagiarism.htm)
    - Paraphrasing involves taking someone else's ideas and putting them in your own words. When you paraphrase, you need to cite the source using APA format.
    - When material is copied word for word from a source, it is a direct quotation. You must use quotation marks (or block indent the text) and cite the source.
    - Electronic tools (e.g., SafeAssign) may be used to detect plagiarism if necessary.
    - Plagiarism and other forms of academic misconduct are treated seriously and may result in disciplinary actions.
- 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 the George Mason University Office of Disability Services (ODS) and inform their instructor, in writing, at the beginning of the semester [See http://ods.gmu.edu/].
- Students must follow the university policy 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/].
- 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 [See http://gse.gmu.edu/].

Graduate School of Education Dispositions for a Career Educator

Students are expected to exhibit professional behavior and dispositions. The Virginia Department of Education and the National Council for Accreditation of Teacher Education promote standards of professional competence and dispositions. Dispositions are values, commitments, and professional ethics that influence behaviors toward students, families, colleagues, and all members of the learning community. The Graduate School of Education expects students, faculty, and staff to exhibit professional dispositions through a:

I. Commitment to the profession

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

II. Commitment to honoring professional ethical standards

- Fairness
- Honesty
- Integrity
- Trustworthiness
- Confidentiality
- Respect for colleagues and students

III. Commitment to key elements of professional practice

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

IV. Commitment to being a member of a learning community

- Professional dialogue
- Self-improvement
- Collective improvement
- Reflective practice
- Responsibility
- Flexibility
- Collaboration
- Continuous, lifelong learning

V. Commitment to democratic values and social justice

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

GO TO THE FOLLOWING WEBSITE, DOWNLOAD SIGN AND PROVIDE THE FOLLOWING DOCUMENT AGREEING TO DEMONSTRATE THE ABOVE PROFESSIONAL DISPOSITIONS:
http://cehd.gmu.edu/assets/docs/cehd/Dispositions%20for%20a%20Career%20Educator.pdf

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:

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

For details, please check http://cehd.gmu.edu/teacher/test/

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.

Please Note: Your G-Number must be clearly noted (visible and legible) on the face of the document(s) that you submit.

Application

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

Deadlines:

Spring internship application:

- Traditional: September 15
- On-the Job: November 1

Fall internship application:

- Traditional: February 15
- On-the Job: May 1