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

SEED 673-001: Teaching Science in the Secondary School
3 credits, Fall 2021
Face-to-face class - Mondays, 4:30 – 7:10 pm
Thompson Hall 2020

Instructor:	Dr. Stephen Burton
Day and Time:	Mondays 4:30-7:20 pm
Dates:	Jan 24 – May 9
Class Location:	Thompson 2020
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 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.

Prerequisites/Corequisites: You must have taken SEED 573 prior to this course. Per state guidelines, you are required to complete 15 hours of fieldwork during this class. 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.

University Catalog Course Description: Provides advanced study of teaching and curriculum development based on research and current issues. Emphasizes integrating science and technology and adapting instruction to the needs of diverse learners.

Course Overview: SEED 483/673 is the second course in a two-course sequence of science methods courses for students seeking a secondary school teaching license in earth science, biology, chemistry, or physics. The course builds on students' knowledge of their subject matter and from their first science methods course. The course focuses on using technology in science teaching and learning and meeting the diverse needs of learners as called for by the Standards of Learning for Virginia Public Schools and National Science Education Standards and as outlined by the National Council for Accreditation of Teacher Education (NCATE), the National Science Teachers Association (NSTA), and the Interstate New Teacher Assessment and Support Consortium (INTASC). SEED 483/673 introduces students to integrating technology in learning and teaching science, adapting inquiry-based lessons, assessment techniques, and the diverse needs of students.

Course Delivery Method: This designated as a lecture course, however, the approach used in the class is intended to mirror best practices in the secondary classroom for developing both content knowledge and process skills.

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/.

Professional Dispositions: Students are expected to always exhibit professional behaviors and dispositions. See https://cehd.gmu.edu/students/polices-procedures/.

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
- Students must follow the university policy for 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.
- Students must silence all sound emitting devices during class unless otherwise authorized by the instructor.

Campus Resources

- Support for submission of assignments to VIA should be directed to VIAhelp@gmu.edu or https://cehd.gmu.edu/aero/VIA. 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.

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.

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

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. If you took Science Methods 1 during the Fall of 2021, you should have already paid for the year-long course pack and will not need to do anything further. However, if you did not take Science Methods 1 in the Fall of 2020 OR chose not to purchase the course pack, you will need to make the purchase (see QR Code to left for instructions).

Instructions for purchasing the NSTA Learning Center class bundle

The purchase of these electronic materials also gives you a membership to NSTA, which opens a great deal of resources to you. We are doing this instead of having one book for two reasons:

- 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
- NSTA peer-reviews all their work, so their professional development materials are the best available – and the biggest body of materials as well

To get the readings for the class, got to following collection - Burton GMU Classes - Advanced Methods in Teaching Science in the Secondary School Collection. I have set it as public, so you should all be able to have access to add this in one click. You may also find and save other items to your learning center account – most of the materials are free – including science objects and webinars.

Course Materials Online: For dissemination of information, I am sharing a Google Folder (see QR Code to left). You will need a Google account to access these materials. Instructions for creating a Google Account with an existing email can be found here. 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 final drafts of assignments. Use the same login as your GMU email for the Blackboard Sites.

Link to the SEED 673 Folder. Use this link to access all materials from the course as they become available.

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

Grade	Percentage
A	95-100%
A-	90-94%
B+	87-89%
B	83-86%
B-	80-82%
C	70-79%
F	Below 70%

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).

If circumstances warrant, a written contract (form provided by CEHD) 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.

Other Requirements: Every student registered for any Secondary Education course with a required VIA performance-based assessment (designated as such in the syllabus) must submit this/these assessment(s) (Original Lesson Plan assignments) to VIA 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 VIA (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 VIA submission, the IN will convert to an F nine weeks into the following semester.

Big Ideas in Science Education: During this semester, we will continue 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.

- Our job is to help students figure out how to be lifelong learners
- **Have a theory of learning** – it is what should guide your instruction as you develop lessons
- Know what you want your students to be able to do and how you will assess it before you design any instruction
- Know your students – get into their heads when designing lessons
- Measure everything you do against student learning
- You don't have to reinvent the wheel, but do need to customize it based on your learning theory and unit objectives
- The more students figure out answers to tough questions on their own, the more they will trust they can learn on their own
- Science is a process that uses evidence to think critically and explain the natural world
    - The process leads to the knowledge we currently teach as facts
    - **If students don't experience and explicitly learn the process,** they won't value its ability to explain the natural world – plus they will only see science as a collection of facts

SEED 673 Learner Outcomes/Objectives: Below is a list of the major course goals along with their corresponding objectives and assessments. They are written in the same ABCD format you learned in Methods I with the Audience, Behavior, Conditions, and Degree color coded as shown. To the right is the assignment(s) that will be used to evaluate achievement of the objectives (follow the link to get a detailed description of the assignment).

Goal 1: Build a learning theory for developing and implementing lessons

Objective	**Assignment (linked)**
Methods II students will recognize examples of the application of a constructivist learning theory lens within various pedagogical practices described in the science education literature, consistently.	Research Review
Methods II students will consistently argue, using evidence, how a unit plan does or does not align with the constructivist learning theory.	Learning Theory Alignment
Methods II students will design instruction that reflects a constructivist learning theory (self-created or obtained from other sources and modified) that allow students to build the knowledge rather than being told.	Lessons in the Unit Plan Lesson Analysis Learning Theory Alignment
Methods II students will explain how the 5-E lesson design, the Learning Cycle, and a student-centered approach represent a constructivist learning theory approach.	Learning Theory Alignment

Goal 2: Do science to understand how science is done

Objective	Assignment
Methods II students will integrate authentic science and engineering practices (SEP) into their instruction that explicitly develops students understanding of how science and engineering is undertaken.	Lessons in the Unit Plan

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
Methods II students will design lessons that clearly indicate within the lesson any safety concerns, how to reduce them and what to do when accidents happen.	Lessons in the Unit Plan

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

Objective	Assignment
Methods II students will explain how using a phenomenon as the basis for instruction can drive student inquiry while developing scientific thinking and content knowledge.	Learning Theory Alignment
Methods II students will explain how Model-Based Inquiry can be used as organizational approach and formative assessment to help students and the teacher evaluate development of scientific thinking and content knowledge.	Research Review Learning Theory Alignment
Methods II students will explain how Cognitive Apprenticeships can be applied in instruction specifically highlighting that building science and engineering practices (skills not content) require explicit instruction about processes	Research Review Learning Theory Alignment
Methods II students will develop instruction that effectively incorporates phenomenon, Model-Based Inquiry and Cognitive Apprenticeships	Lessons in the Unit Plan

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

Objective	Assignment
Methods II students will use backwards design principles to create a unit plan imbedded in a year-long course by using the CUE framework identified by the text Designing Effective Science Instruction	Unit Plan
Methods II students will create lessons for their unit plan that contain measurable objectives matched with assessments and instructional activities that will lead to student achievement of the objectives	Lessons in the Unit Plan

Goal 6: Develop skills as reflective practitioners.

Objective	Assignment
Methods II students will examine instructional activities and classroom management using their learning theory as a lens and student behavior, engagement, and learning (when possible) as the evidence	Field Experience Paper
Methods II students will evaluate efficacy of a lesson by using data from assessments aligned with the objectives.	Lesson Analysis

Assessments: 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. Assessments for each of the objectives are identified and linked to documents describing them. Due dates for each of the assessments (and links to describing them) can be found in the calendar below.

Tentative Calendar and Online Calendar (subject to change based on student needs):	
Date	**Topic**
Mon - Jan 24	**Overview – Setting Priorities – Establishing a Learning Theory** **DESI Strategy 1C – Identifying Big Ideas and Key Concepts – Planning Project**
Thurs - Jan 27	Research Review Part 1 – Question 1 Due
Sun - Jan 30	Research Review Part 1 – Question 2 & 3 Due
Mon - Jan 31	**Research Review Discussion and Activity (Models-Based Teaching)** **Phenomena Identification - Planning Project**
Thurs – Feb 3	Research Review Part 2 – Question 1 Due
Sun – Feb 6	Research Review Part 2 – Question 2 Due
Mon – Feb 7	**Research Review Discussion** **Organizing the Year - Planning Project**
Mon – Feb 7	Unit Plan- Planning Project Due (end of class)
Thurs – Feb 10	Research Review Part 3 – Question 1 Due
Sun – Feb 13	Research Review Part 3 – Question 2 Due
Mon – Feb 14	**Research Review Discussion** **DESI Strategy 1C, 2C, 3C, Objectives – Unit Plan**
Fri – Feb 18	Research Review Part 4 – Question 1 Due
Mon – Feb 21	**Research Review Discussion – Activity (Conceptual Modeling)** **DESI Strategy 4C, 5C, 6C** **Work Time – NSTA Resources for Activities and Lessons**
Mon – Feb 21	Unit Plan - Objectives Due (Before Class)
Fri – Feb 25	Research Review Part 4 – Question 2 Due
Mon – Feb 28	**Research Review Discussion and Activity (Data Practices)** **Learning Cycle and 5-E's** **DESI Strategy 2U, 3U, E1, E5** **Work Time**
Fri – Mar 4	Research Review Part 4 – Question 3 Due
Mon – Mar 7	**Research Review Discussion and Activity (Argumentation)** **DESI Strategy 1U, 4U, E2** **Work Time – Lesson 1**
Fri – Mar 11	Research Review Part 4 – Question 4 Due
Mon – Mar 14	**SPRING BREAK – NO CLASS**
Mon – Mar 21	**Work Time – Lesson 1**
Mon – Mar 21	Unit Plan - Lesson 1 Draft Due – End of Class
Mon – Mar 28	**Lesson 1 Discussion with Individual Groups** **Work Time - Revisions**
Fri – Apr 1	Unit Plan - Lesson 1 Final Due
Mon – Apr 4	**Work Time – Lesson 2**
Mon – Apr 11	**NO FORMAL CLASS – WORK TIME**
Mon – Apr 11	Unit Plan - Lesson 2 Draft Due (7:30 pm)
Mon – Apr 18	**Lesson 2 Discussion with Individual Groups** **Work Time- Revision**
Fri – Apr 22	Unit Plan - Lesson 2 Final Due
Mon – Apr 25	**Work Time - Overview, Remaining Lessons of Unit, Assessment Map**
Fri – Apr 29	Unit Plan – Overview, Remaining Lessons of Unit, Assessment Map Due
Mon – May 2	**Presentations – Peer Review and Evaluations**
Fri – May 6	Field Experience Paper & Lesson Analysis Due
Mon – May 9	**NO FORMAL CLASS – WORK TIME REVISIONS**
Mon – May 9	Unit Plan – Learning Theory Alignment Due