



The Instruction and Management of Middle/High School Science Classrooms (3 credits)

Virginia Commonwealth University – TEDU 540.902

Virginia Tech – EDCI 5774

The College of William and Mary – V63

George Mason University – EDCI 597

Fall 2013 – Spring 2014

Instructor Information:

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Course Description:

This is the first course in a two-part sequence of science methods courses for beginning secondary science teachers. The course is designed to build fundamental knowledge of the principles of science teaching and learning including standards-based curriculum design and research-based teaching strategies for the science classroom. The course focuses on developing and implementing inquiry-based science lessons that lead to student academic success. Emphasis is on assessing student understanding of science and the nature of science, encompassing the science content stipulated in the Virginia Standards of Learning for Science. Teachers will select appropriate instructional materials, develop and implement lessons in a secondary school classroom, collect evidence of student learning, and evaluate student outcomes. Teachers will construct valid assessments using a variety of formats and interpret the results of those assessments in order to measure student attainment of essential skills and to make decisions about how to improve instruction and student performance. Additionally, teachers will learn about age-appropriate classroom and behavior management techniques, classroom community building, and individual interventions, including techniques that promote emotional well-being and teach and maintain behavioral conduct and skills consistent with norms, standards, and rules of the educational environment. Field experience (classroom teaching) is a required part of this course.

Texts:

Hard copy (provided)

- Bell, R. L. (2007). *Teaching the nature of science through process skills: Activities for grades 3-8*. New York: Pearson. (ISBN-13: 978-0205433339)
- Froschauer, L. & Bigelow, M. L. (2012). *Rise and shine: A practical guide for the beginning science teacher*. Arlington, VA: NSTA Press. (ISBN-13: 978-1936137299)

- Keeley, P. (2008). *Science formative assessment: 75 practical strategies for linking assessment, instruction, and learning*. Arlington, VA: NSTA Press. (ISBN-13: 978-1412941808)
- Course Documents in SharePoint

Online

National

- National Research Council (2013). *Next generation science standards*. <http://www.nextgenscience.org/>
- Council of State Science Supervisors. *Science and safety: Making the connection*. <http://www.csss-science.org/safety.shtml>
- American Association for the Advancement of Science
 - *Benchmarks for science literacy* (1993, 2009). <http://www.project2061.org/publications/bsl/online/index.php>
 - Project 2061 Science Assessment website. <http://assessment.aaas.org/>
- National Science Digital Library Literacy Maps (2011). <http://strandmaps.nsdli.org>

State

- Commonwealth of Virginia
 - Teacher Direct. http://www.doe.virginia.gov/testing/teacher_direct/
 - *Science Standards of Learning for Virginia Public Schools*. http://www.doe.virginia.gov/testing/sol/standards_docs/science/index.shtml
 - Commonwealth of Virginia (2000). *Safety in Science Teaching*. http://www.doe.virginia.gov/instruction/science/middle/safety_science_teaching.pdf
- Virginia Math and Science Coalition (2011). *Scientific inquiry and the nature of science task force report*. http://www.vamsc.org/projects/VMSC_Inquiry_and_NOS_White_Paper_5_11_10.doc

In Class

- *Flinn Chemical & Biological Catalog Reference Manual* and new science teacher kit.
- American Association for the Advancement of Science. (2001). *Atlas of Science Literacy, Volume 1*. Washington, DC: AAAS Project 2061.
- American Association for the Advancement of Science. (2007). *Atlas of Science Literacy, Volume 2*. Washington, DC: AAAS Project 2061.

Goals:

The 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 via a variety of methods, including online collaborative tools;
- Develop strategies to help students become scientifically literate, think critically and creatively, understand the nature of science, and see relationships among science, technology, and society;
- 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;
- Construct inquiry, hands-on science lessons and experiences that address the needs of all students;

- Create a classroom management plan that explicitly delineates classroom rules and consequences, policies, procedures, and expectations for both general classroom and lab-specific situations that are based on learning theories;
- Learn about science laboratory safety and plan teaching activities that highlight safety; and
- Work collaboratively with peers to teach and discuss science and science teaching.

Relationship to Program Goals and Professional Organizations:

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). This course builds a repertoire of science teaching and assessment strategies to facilitate student learning.

Nature of Course Delivery:

Most class sessions start with cooperative or collaborative group activities based on the project that is due that day. This is an opportunity to share what you have developed and to expand your repertoire. During the rest of class, a variety of teaching strategies will be used to explore the themes of the day. All students will continuously analyze and evaluate teaching strategies as well as science content and processes.

Class Schedule and Attendance:

Class meets at scheduled times. One of the goals of the course is to develop a professional learning community. Therefore, your participation is critical to everyone’s success. Treat this class as if it were a part of your job, please be here! Attendance for all classes is a course expectation. Unavoidable circumstances may arise. They will be handled on a case-by-case basis, which means you talk to your instructor *before* such a circumstance arises (outside of emergency situations, of course).

Grading:

This class is all about helping you become a more effective teacher, so students are expected to complete all assignments, attend all classes, and participate fully. Since this is a graduate level course, high quality work is expected. All assignments are graded; mini assignments are assessed on participation/completion. Assignments are due at the beginning of class on the day they are due (see the Course Schedule). Graded assignments that are late will automatically receive a 25% point reduction. There are a total of 500 points available on the assignments. Course grades will be determined as follows:

- A = 450 – 500 points
- B = 400 – 449 points
- C = 350 – 399 points
- F = less than 350 points

Incompletes:

There are explicit policies regarding incompletes; please refer to the university catalog for more information. If circumstances warrant, a written request for an incomplete must be provided to the instructor for approval prior to the final course meeting date. Requests are accepted at the

instructor's discretion, provided your reasons are justified and that a *major* percentage 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. You must complete this class successfully before you take the second VISTA class.

Assignments:

Education research shows that frequent assessment of small amounts of material is most effective for learning and that the most effective science teachers assess learning and provide feedback daily. Therefore, in this class formal and informal assessment will be continuously provided on assignments and class activities.

Assignments will be submitted in three ways: (A) via your blog/discussion board or your comments on a colleague's blog/discussion board, (B) into a designated folder in SharePoint, or (C) hard copy. When submitted by method A, at the top of assignment include your name, date, and (if appropriate) grade level, subject area, and unit of study. When submitted via methods B and C above, on the front page of the assignment please include your name, course title, project title, date. Name your documents using the following format: YOUR LAST NAME.ASSIGNMENT NAME. Whenever possible, please create one file for each entire assignment. Make each project something that you will actually use in teaching.

The assignments have been grouped into two categories to emphasize their purpose. If no rubric is given, full credit will be given for complete assignments, half credit will be given for partially complete assignments, and no credit will be given for missing assignments.

Reflective Professional Learning Community

1. ***Class Participation*** (50 points)

2. ***Membership in VAST*** – As part of your participation in this, you are required to join the Virginia Association of Science Teachers (VAST). Your VAST membership and registration at the Professional Development Institute (PDI) will be paid by VISTA. Travel support to the PDI is also included. You are highly encouraged to join the National Science Teachers Association (NSTA, <http://www.nsta.org>) as well. Both NSTA and VAST* provide journals, newsletters and access to information on their websites.

(*VAST is in need of volunteers, and volunteering provides a way for you to help out while getting to know VAST members. For information on the PDI and an electronic registration form, go to <http://www.vast.org>. To thank VAST for partnering with VISTA, it is recommended that you sign up to volunteer on the registration form.)

3. ***Resources to Share*** – Throughout the semester, please share relevant resources with your instructor and classmates by uploading relevant files and/or links to the class' SharePoint site.

4. ***Science Philosophy and Vision*** (25 points) – Use the guide in *Rise and Shine* (pp5-6) to write a ~500 word description of your science teaching philosophy. Upload it in the appropriate folder in SharePoint.

5. **VAST PDI Conference Reflection** (25 points) – Upload a ~500 word reflection on what you learned at the conference focusing on strategies, etc. that you intend to implement in your classroom to the appropriate folder in SharePoint.
6. **Student Work Assessment/Analysis** (50 points each, 100 points total) – As noted in the course schedule, bring samples of student work representative of the top, middle, and bottom third of the class that have been analyzed for student understanding of the identified concept.

Effective Science Teaching and Management

7. **Unit Plan** (300 points) – Develop a 2- to 3-week-long (~15 hours of instruction) series of learning events focused on a science topic. Your goal is to design enough lessons to completely teach a topic. *You may share ideas, materials, and resources with your classmates; the final submitted module is yours alone.* Safety considerations, learning cycle approach, nature of science, hands-on, inquiry, and “connectivity” are a must. These learning events/lessons must be connected and integrated – connecting each lesson to the next and connecting across multiple areas of science at your chosen grade level. You can adapt and/or create the activities done by students. Your module should be developed in sufficient detail (including student and teacher support materials) that a substitute teacher could implement it. This should be a product that you will teach between mid-November and mid-January. While teaching the module, you will critique the effectiveness of the learning experiences for your students and assess their understanding. Pieces of this assignment are due at various times. Please refer to the Course Schedule for due dates. All written parts of this assignment should be posted in the appropriate folder on SharePoint.

Elements to be included in the unit plan:

- a. Title Page – Include your name, course name, unit title, targeted grade level(s), and date.
- b. Annual Plan – Monthly planning schedules/calendars for all the units of study in the chosen course. For each unit, identify at least one content-specific safety rule that needs to be reinforced (e.g., animal dissection unit = safely handling scalpels).
- c. Management and Safety Plan – Clearly delineate your classroom expectations, policies/procedures, and rules/consequences for both general classroom and lab-specific situations. Additionally, provide lesson plans and support materials – including a copy of your safety contract and safety quiz – for how you will teach laboratory safety. Your plans need to communicate the importance of safety and the on-going emphasis on safety throughout the year.
- d. Unit Schedule – Include a one-page overview/list showing the science content being studied each day during the specific unit taught during mid-November to mid-January.

- e. Web/Concept Map – The web should be a visual of the way your unit unfolds. This should show points of integration with other subject matter areas. A rich web will have cross-connections and evidence of relationships among branches.
- f. Detailed Lesson Plans – Following either the lesson plan template provided by your school division or the one in the SharePoint, provide all daily lesson plans for the unit.
- g. Support Materials – Include everything necessary to carry out the lesson plans including the assessments (e.g., handouts, readings, rubrics, quizzes, etc.).
- h. Microteaching – Choose a lesson from your unit plan and teach 20 minutes* of it to your VISTA classmates on the designated day, focusing on hands-on, inquiry-based science. This is an opportunity for you to practice an activity before doing it in your own classroom. (*The time may be adjusted based on the number of presentations.)
- i. Lesson Video Analysis – For this assignment, you will videotape the lesson from your microteaching when you implement it in your classroom. You will then make a 10 minute presentation to your VISTA classmates on the designated day that includes supporting segments from the videotape and discuss (1) what went well, (2) what issues/concerns you had, and (3) how you would improve that particular lesson the next time you teach it. Your coach is available to help you with the videotaping.
- j. Unit Reflection – After you complete teaching your unit, you will create an approximately 500-word summary of the entire unit’s major strengths, weaknesses, and improvements. Your reflection should include items such as acknowledgement of what worked well, how to improve worksheets or laboratory activities, how to reword assessment questions, how to clarify directions, and suggestions for improvement. Your comments will range from tiny details to big issues. Honest forthright reflection is what is important and not that you got it entirely right the first time.
- k. References – Appropriately cite your sources.

Component	Target (15 points)	Acceptable (8 points)	Unacceptable (0 points)
Title Page (x1)		All components are present.	Some components are missing.
Annual Plan (x3)		Monthly schedules included for the entire course AND at least one safety rule to reinforce is identified.	Monthly schedules for the entire course are not included AND/OR at least one safety rule to reinforce is not identified.
Management/ Safety Plan (x4)		All components are provided AND are appropriate for the specified course.	Some components are missing AND/OR they are not appropriate for the specified course.
Unit Schedule (x1)		One-page overview of daily activities.	Multiple pages OR no schedule provided.
Web/Concept	Graphic that shows	Graphic that shows	No graphic provided.

Map (x2)	connections among activities within the current unit as well as connections to other units.	connections among activities in the unit.	
Lesson Plans (x3)			
Length		~15 hours of instruction.	Significantly < 15 hours of instruction.
Template		All sections are completed for all lessons.	Some sections are not completed for some lessons.
Hands-On	~50% of the lessons meet the VISTA definition.	At least 25% of the lessons meet the VISTA definition.	Less than 25% of the lessons meet the VISTA definition.
Inquiry	100% of the activities are inquiry-based and a variety of inquiry levels are utilized.	At least 50% of the lessons are inquiry-based AND/OR only a few levels of inquiry are utilized.	Less than 50% of the lessons are inquiry-based AND/OR only one level of inquiry is utilized.
NOS	Both the teacher and students explicitly reflect on NOS throughout the unit.	Only the teacher explicitly reflects on NOS throughout the unit OR both the teacher and students explicitly reflect on NOS a few times during the unit.	Reflection on NOS is implicit or missing.
Support Materials (x3)		All support materials are provided and are professional quality.	Some support materials are missing OR they are not professional quality.
Microteaching (x2)		Activity is ~20 minutes, focuses on hands-on/inquiry, AND is from the designated unit.	Activity is << 20 minutes, does not focus on hands-on/ inquiry, OR is not from the designated unit.
Lesson Video Analysis (x2)		Presentation is ~10 minutes, includes pros/cons/improvements, AND utilizes clips from the taped classroom lesson.	Presentation is <<10 minutes, does not include pros/cons/ improvements, OR does not utilize clips from the taped classroom lesson.
Unit Reflection (x3)	Summarizes the unit's major strengths, weaknesses, and improvements AND cites specific examples.	Summarizes the unit's major strengths, weaknesses, and improvements.	One or more of the components is missing.
References (x1)		Sources are appropriately cited.	Sources are not appropriately cited.

Course Schedule:

Date		Topics/Activities	Readings/Assignments Due
VCU	Mason, VT,		

	and W&M		
Aug 5* (or Sep 7)	August 24* (or Aug 31 VT; Sept 7 GMU and W&M)	<ul style="list-style-type: none"> • Course introduction • Getting to know each other • Class management • Science class/lab safety • Syllabus/assignments 	<ul style="list-style-type: none"> • science teaching philosophy • set up SharePoint • register for VAST
Aug 6 (or Sep 14)	September 14	<ul style="list-style-type: none"> • Effective science teaching – inquiry, hands-on, NOS • Annual planning 	<ul style="list-style-type: none"> • management and safety plan • Metz & Gooding article • VSMC NOS paper • SOLs/framework, national standards • division mapping documents
Sept 28	October 12	<ul style="list-style-type: none"> • Effective science teaching – inquiry, hands-on • Unit planning 	<ul style="list-style-type: none"> • annual plan
Oct 12	October 26 (Nov 11 VT)	<ul style="list-style-type: none"> • Assessment • Analyzing student work 	<ul style="list-style-type: none"> • Keeley book • student work samples (inquiry/ hands-on)
November 9*		<ul style="list-style-type: none"> • Microteaching 	<ul style="list-style-type: none"> • unit plan draft
November 14 – 16: VAST PDI, Norfolk, VA			
November 16 – 17 Norfolk, VA		<ul style="list-style-type: none"> • VAST PDI debrief • Explore Learning Gizmos 	
December 14		<ul style="list-style-type: none"> • Effective science teaching – inquiry/hands-on • Discourse 	<ul style="list-style-type: none"> • VAST PDI reflection • Rowe article
January 11		<ul style="list-style-type: none"> • Effective science teaching – NOS • Misconceptions • Intro to VISTA Course 2 	<ul style="list-style-type: none"> • student work samples (NOS)
February 8*		<ul style="list-style-type: none"> • Video analysis 	<ul style="list-style-type: none"> • unit plan

NOTE: Mason, VT, and W&M's classes will meet from 9:30am – 3:30pm; VCU's classes will meet from 9am – 3pm. *Coaches will be invited to attend on these days.

University Policies:

George Mason University College of Education and Human Development Statements

1. Students must adhere to the guidelines of the George Mason University Honor Code [See <http://oai.gmu.edu/honor-code/>].
2. Students must follow the university policy for Responsible Use of Computing [See <http://universitypolicy.gmu.edu/policies/responsible-use-of-computing/>].
3. 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.
4. 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/>].
5. 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/>].
 6. Students must follow the university policy stating that all sound emitting devices shall be turned off during class unless otherwise authorized by the instructor.
 7. 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/>].
 8. Professional Dispositions: Students are expected to exhibit professional behaviors and dispositions at all times.
 9. Core Values Commitment: The College of Education & Human Development is committed to collaboration, ethical leadership, innovation, research-based practice, and social justice. Students are expected to adhere to these principles. <http://cehd.gmu.edu/values/>

VCU Statements of Expectations

• **Academic Integrity:** Please read the details of the VCU Honor System. Specifications of the VCU Honor System can be found in the University Resource Guide and can be located online at www.students.vcu.edu/rg/. *One reality for the classroom teacher is finding, modifying, and utilizing great teaching ideas and materials from the Internet as well as from printed sources. Hopefully you will also find these sources as great places for ideas and activities. Be sure to properly credit these sources and not "copy and paste" ideas and activities altered or unaltered as your own. This is called plagiarism. All applicable written work will be checked for plagiarism using SafeAssign.*

• **Inclement Weather:** During times of inclement weather (snow, ice, fog, etc), we will have class according to the Richmond City Schools schedule.

• **Academic Adjustments:** The Americans with Disabilities Act of 1990 requires Virginia Commonwealth University to provide a “reasonable accommodation” to any individual who advises us of a physical or mental disability. If you have a physical or mental limitation that requires an accommodation or an academic adjustment, contact the VCU Office of Disability Support Services and please arrange a meeting with me early in the semester.

• **Disruptive Student Policy:** Please read the details of the Disruptive Student Policy on VCU’s website. I encourage you to familiarize yourself with this document and carefully consider your role in promoting a culture of mutual respect. Also familiarize yourself with amendments to the Rules and Procedures policy under Section I. Application and Section III.C. Rights and Prohibited Conduct. A complete copy of the Rules and Procedures policy is available at: <http://www.students.vcu.edu/rg/pdf/ResourceGuide2005-Policies.pdf>. Cell phones and beepers should be turned off while in the classroom. Texting in class is considered a distraction.

• **Religious Holiday Policy:** It is the policy of the Virginia Commonwealth University to accord students, on an individual basis, the opportunity to observe their traditional religious holidays.

Students desiring to observe a religious holiday of special importance must provide advance written notification to each instructor by the end of the second week of class.

• **Accommodation Policy:** VCU does not discriminate on the basis of race, gender, age, or disability. Students with a disability should identify themselves to the instructor and arrange a brief meeting within the first two weeks of class to discuss the need for any reasonable accommodation or academic adjustment.

• **VCU Statement on Safety:** What to know and do to be prepared for emergencies at VCU:

- Sign up to receive VCU text messaging alerts (www.vcu.edu/alert/notify). Keep your information up-to-date.
- Know the safe evacuation route from each of your classrooms. Emergency evacuation routes are posted in on-campus classrooms.
- Listen for and follow instructions from VCU or other designated authorities.
- Know where to go for additional emergency information (www.vcu.edu/alert).
- Know the emergency phone number for the VCU Police (828-1234). Report suspicious activities and objects.

• **VCU Honor System:** Virginia Commonwealth University recognizes that honesty, truth, and integrity are values central to its mission as an institution of higher education. The Honor System is built on the idea that a person's honor is his/her most cherished attribute. A foundation of honor is essential to a community devoted to learning. Within this community, respect and harmony must coexist. The Honor System is the policy of VCU that defines the highest standards of conduct in academic affairs. The Honor System states that faculty members are responsible for:

- Understanding the procedures whereby faculty handles suspected instances of academic dishonesty. Faculty are to report any infraction of the VCU Honor System according to the procedures outlined in our policy.
- Developing an instructional environment that reflects a commitment to maintaining and enforcing academic integrity. Faculty should discuss the VCU Honor System at the onset of each course and mention it in course syllabi.
- Handling every suspected or admitted instance of violation of the provisions of this policy in accordance with procedures set forth in the policy.

The Honor System in its entirety can be reviewed on the Web at

http://www.provost.vcu.edu/pdfs/Honor_system_policy.pdf or it can be found in the 2012-13 VCU Insider at <http://www.students.vcu.edu/insider.html>

The Honor System must be upheld and enforced by each member of the Virginia Commonwealth University community. The fundamental attributes of our community are honor and integrity. We are privileged to operate with this Honor System.

• **Statement on Americans with Disabilities Act:** Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990 require Virginia Commonwealth University to provide an 'academic adjustment' and/or a 'reasonable accommodation' to any qualified individual with a physical or mental disability who self-identifies as having such. Students should contact the Disability Support Services office on the Monroe Park Campus (828-2253) or on the MCV Campus (828-9782) for appropriate academic adjustments or accommodations.

• **VCU Guidelines for Student Conduct:** VCU faculty play a critical role in helping to build an environment that is conducive to the academic success of our students. As you know, VCU has policies and procedures designed to create an environment conducive to academic excellence.

One of these policies and procedures can be found in a document entitled “Guidelines for Faculty Members Regarding Student Conduct in the Instructional Settings.” This document is available on the VCU Web at

<http://www.provost.vcu.edu/pdfs/FacultyGuideToStudentConductInInstructionalSettings.pdf><http://www.provost.vcu.edu/pdfs/FacultyGuideToStudentConductInInstructionalSettings.pdf> or it can be found in the 2012-13 VCU Insider. Understanding these guidelines will help you to encourage classroom behavior that does not detract from the quality of each student’s educational experience. Please read the document and think about your role in promoting a University culture based on mutual respect and civility. As a reminder, both faculty and students should turn off cell phones and pagers while in the classroom.

• **Important Dates:** Important dates for the Fall 2013 semester are available at:

http://academiccalendars.vcu.edu/ac_fullViewAll.asp?term=Fall+2013

• **VCU Mobile:** The VCU Mobile application is a valuable tool to get the latest VCU information on the go. The application contains helpful information including the VCU directory, events, course schedules, campus maps, athletics and general VCU news, emergency information, library resources, Blackboard and more. To download the application on your smart phone or for more information, please visit <http://m.vcu.edu/http://m.vcu.edu/>.

College of William & Mary Policies

- The College of William & Mary has explicit policies at the undergraduate and graduate levels for incompletes. Incompletes are granted only at the discretion of the professor. Refer to the W & M School of Education Graduate Program information on Incompletes can be found at <Http://www.wm.edu/education>.
- Please note that academic standards for graduate students state the successful graduate student must have a GPA of at least 3.0 in the program of studies. Credit is only granted for course grades at “C-“ or better. Refer to the W & M Graduate Programs Handbook for more information on Academic Standards.
- Honor Code: You are expected to be familiar with and abide by the College of William and Mary honor code.

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