**The Instruction and Management of Middle/High School Science Classrooms (3 credits)**
**George Mason University -  EDCI 597**
**Thompson Hall 2020**
**Fall 2014 – Spring 2013**

**Instructor Information:**
Mollianne Logerwell, PhD, mlogerwe@gmu.edu, 703-268-8025 (cell), Thompson Hall 2400

**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)**
- 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.
- Pinto, L.E. (2013). *From discipline to culturally responsive engagement: 45 classroom management strategies*. Thousand Oaks, CA: Corwin Press.

**Online**
- National Research Council (1996). *National Science Education Standards*. Washington, DC: National Academy Press.
  http://books.nap.edu/catalog.php?record_id=4962

- Commonwealth of Virginia (2010).
  - Teacher Direct: http://www.doe.virginia.gov/testing/teacher_direct/
  - *Standards of Learning for Virginia Public Schools* http://www.doe.virginia.gov/testing/sol/standards_docs/science/complete/stds_sciencek-12.doc
  - *Science Standards of Learning Curriculum Framework.* http://www.doe.virginia.gov/testing/sol/standards_docs/science/review.shtml
  - *Science Standards of Learning Enhanced Scope and Sequence.* http://www.doe.virginia.gov/testing/sol/standards_docs/science/index.shtml
- Council of State Science Supervisors. Science and Safety, Making the Connection. Download your grade level range. http://www.csss-science.org/safety.shtml
- Commonwealth of Virginia (2000). *Safety in Science Teaching.* *http://www.doe.virginia.gov/instruction/science/middle/safety_science_teaching.pdf*
- National Science Digital Library Literacy Maps (2011). http://strandmaps.nsdl.org/
- American Association for the Advancement of Science (AAAS*).*
  - *Benchmarks for Science Literacy*. http://www.project2061.org/
  - *Assessment website: http://assessment.aaas.org/*
- 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.
- Keeley, P. (2005). *Science Curriculum Topic Study.* California: Corwin Press.
- Hazen, R.M., & Trefil, J. (2009). *Science matters: Achieving scientific literacy, 2nd edition*. New York: Anchor Books, Random House.
- American Association for the Advancement of Science - AAAS. (2001). *Atlas of Science Literacy, Volume 1*. Washington, DC: AAAS Project 2061.
- American Association for the Advancement of Science - AAAS. (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:**
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. Because this course is part of a research grant, you are allowed to miss a maximum of 7.5 hours of class before your stipend and continued participation in VISTA are affected. Please make sure to notify your instructor of any unavoidable absences in a timely manner and complete all make-up work within the designated time frame.

**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 600 points available on the assignments. Course grades will be determined as follows:

A = 540 – 600 points
B = 480 – 539 points
C = 420 – 479 points
F = less than 419 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 *majo*r 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 two ways: (A) into a designated folder in SharePoint, or (B) hard copy. When submitted, 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 overarching categories in order to emphasize their purpose. Below is a brief description of each assignment. Please see the course pack for more information, including scoring rubrics, for the indicated assignments. **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.**

<u>**Reflective Professional Learning Community**</u>
1.    *Class Warm-Ups (40 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  annual 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) – Respond to the questions below prior to the first class and bring a copy of your responses with you. Also, have an electronic copy available for uploading to Sharepoint during class.

The questions are: 1) From your perspective, what is the goal/purpose of science education?; 2) Is the goal/purpose of science education different for different groups of students (e.g., future science majors vs. non-majors)? Why or why not?; 3) How should your science class be structured to help meet those goals/purposes?

5. ***VAST PDI Conference Reflection*** (25 points) – Submit a 300-400 word reflection on what you learned at the conference focusing on strategies, etc. that you intend to implement in your classroom. Upload it to the appropriate SharePoint folder.

6. ***Student Work Assessment/Analysis*** (50 points) – As noted in the course schedule, bring two samples of student work (representative of the top, middle, and bottom third of the class) that have been analyzed for student understanding of the concepts being taught. See the Course Pack for more information and the grading rubric.

**Effective Science Teaching and Management**
7. ***Annual Plan*** (25 points) – Monthly planning schedules/calendars for all the units of study in the chosen course.

| Component | Target (25 points) | Acceptable (15 points) | Unacceptable (0 points) |
|---|---|---|---|
| **Annual Plan** | Monthly schedules included for the entire course AND at least one safety rule to reinforce is identified. | Monthly schedules included for the entire course. | Monthly schedules for the entire course are not included AND at least one safety rule to reinforce is not identified. |

8. ***Finding your Management Style*** (25 points) – Through this assignment, you will review Chapter 3 from the Pinto book, reflect on your practices, and write a 300 word reflection on: 1) where you believe you are on the spectrum and evidence for your claim, and 2) where you would like to be and why and evidence you have reached your goal (see p58 Pinto).

| Component | Target (25 points) | Acceptable (15 points) | Unacceptable (0 points) |
|---|---|---|---|
| **Finding Your Management Style** | Thoughtful reflection on current and future management style including evidence. | Reflection on either your current or future management style. | Reflection is missing current and future goals as well as reasoning for statements. |

9. ***Safety Audit/Contract/Quiz*** (75 points) – You will conduct a safety audit of your classroom and adjoining storage areas and submit (1) the results of and a reflection on the audit, (2) your safety contract for the parents and students to sign and date, and (3) one safety quiz over the rules and procedures.

| Component | Target (75 points) | Acceptable (45 points) | Unacceptable (0 points) |
|---|---|---|---|
| **Safety Audit, Contract, and Quiz** | All components are provided AND are appropriate for the specified course. | One of the three components is missing. | More than one component is missing AND/OR they are not appropriate for the specified course. |

10. **_GIZMO lesson plan_** (25 points) – A lesson plan with a clear and thoughtful description of how one of the Explore Learning GIZMO's will be used in an inquiry-based experience. Describe how the specific gizmo will be introduced, how will the students use the gizmo (individually, small groups, or whole class), how students will share results, and how the class will make sense of the data and draw conclusions from the simulation.

| Component | Target (25 points) | Acceptable (15 points) | Unacceptable (0 points) |
|---|---|---|---|
| **GIZMO Lesson Plan** | Lesson plan is thoughtful and includes students using the gizmo in an inquiry-based experience. Directions are complete so that someone else could teach the lesson successfully. | Lesson plan does not describe an inquiry lesson using a gizmo OR the description is not complete for someone else to replicate. | Lesson Plan does not describe an inquiry lesson using a gizmo and is missing key components for replicability |

11. **_Unit Plan_** (310 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. Self-checklist (15 points) – Include your name, course name, unit title, targeted grade level(s), and date and review of your unit for completeness.

b. Unit Schedule (15 points) – 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.

c. Detailed Lesson Plans (160 points) – Following either the lesson plan template provided by your school division or the one on Sharepoint, provide all daily lesson plans for the unit.

d. Support Materials (25 points) – Include everything necessary to carry out the lesson plans including the assessments (e.g., handouts, readings, rubrics, quizzes, etc.).

e. Microteaching (25 points) – 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.)

f. Lesson Video Analysis (25 points) – For this assignment, <u>you will videotape the lesson from your microteaching when you implement it in your classroom</u>. 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.

g. Unit Reflection (45 points) – 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.

| Component | Target | Acceptable | Unacceptable |
|---|---|---|---|
| **Self-checklist (15 points)** | | All components are present. | Some components are missing. |
| **Unit Schedule (15 points)** | | One-page overview of daily activities. | Multiple pages OR no schedule provided. |
| **Support Materials (25 points)** | | All support materials are provided and are professional quality. | Some support materials are missing OR they are not professional quality. |
| **Microteaching (25 points)** | | 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 (25 points)** | | Presentation is ~10 minutes, includes pros/ cons/improvements, | Presentation is <<10 minutes, does not include pros/cons/ |

| Component | Target | Acceptable | Unacceptable |
|---|---|---|---|
| | | AND utilizes clips from the taped classroom lesson. | improvements, OR does not utilize clips from the taped classroom lesson. |
| **Unit Reflection (45 points)** | 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. |

| Lesson Plans (160 points) | | | |
|---|---|---|---|
| **Component** | **Target** | **Acceptable** | **Unacceptable** |
| **Annotation (10 points)** | | Lesson plans are annotated to indicate where hands-on, inquiry, NOS, connectivity, and differentiation are addressed. | Lesson plans are not annotated to indicate where hands-on, inquiry, NOS, connectivity, and/or differentiation are addressed. |
| **Content (30 points)** | The unit is standards-based and works through the content in a connected, appropriate sequence. | The unit is standards-based and worked through the content in an appropriate sequence. | The unit is not standards-based AND/OR does not work through the content in an appropriate sequence. |
| **Hands-On - Amount (10 points)** | ~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. |
| **Hands-On - Quality (30 points)** | Meaningful, appropriate hands-on lessons are utilized. | Appropriate hands-on lessons are utilized. | Hands-on lessons are inappropriate. |
| **Inquiry - Amount (10 points)** | 100% of the activities are inquiry-based. | At least 50% of the lessons are inquiry-based. | Less than 50% of the lessons are inquiry-based. |
| **Inquiry - Quality (30 points)** | A variety of inquiry levels are utilized. | A few levels of inquiry are utilized. | Only one level of inquiry is utilized. |
| **NOS- Amount (10 points)** | NOS reflection occurs regularly. | NOS reflection occurs occasionally. | NOS reflection occurs minimally OR not at all. |
| **NOS- Quality (30 points)** | Both the teacher and students explicitly reflect on NOS. | Only the teacher explicitly reflects on NOS. | Reflection on NOS is implicit or missing. |

**Course Schedule:**

| Date | Topic(s)/Activities | Readings/Assignments Due |
|---|---|---|
| Aug 16 (9/6) | • course intro<br>• class management<br>• safety | • science teaching philosophy questions<br>• set up SharePoint<br>• register for VAST |
| Sep 20 | • safety/management discussion<br>• intro to hands-on, inquiry, NOS<br>• annual planning | • finding your classroom management style (Pinto, p57-58)<br>• safety audit<br>• Metz & Gooding article<br>• VMSC NOS paper<br>•SOLs/division mapping docs |
| Oct 11 | • discuss evidence<br>• hands-on, inquiry, NOS• unit plan overview and planning time | • evidence (lesson plan, student work, etc.) of inquiry/NOS in the classroom<br>• annual plan<br>• lab to modify |
| Oct 25 | • student work analysis (inquiry analysis)<br>• assessment• incorporate assessment strategies | • student work samples from modified lab (inquiry)<br>• Keeley book |
| Nov 8 | • assessment strategy discussion<br>• microteaching<br>• reflection, including how assessed | • evidence (lesson plan, student work, etc.) of assessment in the classroom |
| VAST Nov 23 | • VAST PDI debrief<br>• Gizmos, Part II | • unit plan outline |
| Dec 13 | • Gizmo lesson discussion<br>• hands-on, inquiry | • Gizmo lesson<br>• VAST PDI reflection<br>• Rowe article |
| Jan 10 | • discourse discussion<br>• NOS<br>• misconceptions | • evidence of discourse in the classroom<br>• misconceptions quiz |
| Feb 7 | • video analysis<br>• intro to STP2<br>• UVA survey | • video presentation<br>• unit plan |

**NOTE:** Mason classes will meet from 9:30am – 3:30pm. *Coaches will be invited to attend on these days.

**George Mason University College of Education and Human Development Statements:**
- Students must adhere to the guidelines of the George Mason University Honor Code [See http://oai.gmu.edu/honor-code/].
- Students must follow the university policy for Responsible Use of Computing [See http://universitypolicy.gmu.edu/policies/responsible-use-of-computing/].
- Students are responsible for the content of university communications sent to their 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/].
- Professional Dispositions: Students are expected to exhibit professional behaviors and dispositions at all times.
- Core Values Commitment: The College of Education & Human Development is committed to collaboration, ethical leadership, innovation, research-based practice, and social justice. Students are expected to adhere to these principles. http://cehd.gmu.edu/values/