SMFT 670-001
Fall 2015
Advanced Methods in Science and Mathematics
Tuesday, 5:00-7:45 pm, ECTR 216
Face-to-Face and Online

Instructor: William R. Veal, Ph.D.
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School of Education, Health, and Human Performance
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Office Hours: Wed: 9-11 am; Thurs: 12-3 pm; or by appointment
Email Hours: M-F 9-12 am

Course Description:
This is an advanced course in teaching science and mathematics at the K-12 grade levels. In this course Teacher/Students (TSs) will study the elements necessary to help all elementary and adolescent students achieve high-quality mathematics and science instruction, including the nature of science and mathematics, problem-based and inquiry methods of teaching, curriculum development, assessment, and lesson planning, and STEM integration with literacy. The organization, content, and delivery of this course will focus on scientific processes, problem- and inquiry-based instruction, and the alliance of factual knowledge, procedural proficiency, and conceptual understanding.

Student Learning Outcomes:

<table>
<thead>
<tr>
<th>Student Learning Outcomes</th>
<th>Assessment Method and Performance Expected</th>
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</thead>
<tbody>
<tr>
<td>What will students know and be able to do when they complete the course?</td>
<td>How will each outcome be measured? Who will be assessed, when, and how often? How well should students be able to do on the assessment?</td>
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<tr>
<td>1. Recognize the importance of all students’ ideas, interests, beliefs, experiences, and needs in the design, implementation, differentiation, and evaluation of mathematically- and scientifically-based lessons.</td>
<td>Development of science inquiry or mathematics problem-based mini-unit. All students will complete a mini-unit in groups based upon grade level or content area. All students should score “acceptable” in greater than 90 percent of the rubric criteria.</td>
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<tr>
<td>2. Develop instructional practices derived from current research-based information.</td>
<td>Summarize the main content and focus of a research study. This paper should present the science or mathematics themes, implications to teaching, and results of any research and relate themes to Next Generation Standards or Common Core and NCTM. All students will complete one summary of a research article with supplementary resources. All students should score “acceptable” in greater than 90 percent of the rubric criteria.</td>
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<td>3. Demonstrate knowledge of the content and process/practice standards as prescribed by the NCTM, Common Core, Next Generation Science Standards, and the SC Standards.</td>
<td>Develop an “un-packing” list of learning outcomes and assessment items derived from standards for a grade level and content area. All students will complete a 9-week semester of standards. All students should score “acceptable” in greater than 90 percent of the rubric criteria.</td>
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Textbooks, Equipment, and Technology

Textbook:
There is no textbook for the course. Readings are supplied online in OAKS.

Technology:
Enrollment in this course requires you to utilize the following computer applications: PowerPoint, Excel, Internet/WWW, OAKS via Internet, e-mail, and Word Processing. These computer applications are available in the College of Charleston managed computer labs located in JC Long, the Library, and various other campus locations. If you do not have reliable access to these applications you should plan to use the campus computer laboratories.

Class Supplies:

Common Core Standards (both practice and content) for mathematics K-12 (online http://www.corestandards.org/Math)

NCTM Standards (both process and content) for K-12 (online http://nctm.org/standards)

Next Generation Science Standards (online http://www.nextgenscience.org/)

SC site aligning SC Standards with Common Core Standards (online http://ed.sc.gov/agency/se/Teacher-Effectiveness/Standards-and-Curriculum/ELAandMathematicsCrosswalks.cfm)

Attendance Policy

Excessive absences (i.e., more than 15% - approximately 5 hours/2 classes – may result in receiving a “WA/F.” Students will be tardy if they arrive in class within the first 20 minutes after class has started. Three tardies result in one absence. Students will be absent if they arrive after 20 minutes or if they leave class early. Regarding being tardy or having to leave class early, exceptions will be made on an individual basis, but students must speak with me about extenuating circumstances for such exceptions. Regarding absences, if a student exceeds allowable absences due to extenuating circumstances beyond the student’s control, a panel of professors from that semester will review the circumstances and make a final decision.

If a student exceeds allowable absences due to extenuating circumstances beyond the student’s control, a panel of professors from that semester will review the circumstances and make a final decision. SNAP students, if they wish special accommodations, must see the professor within the first two weeks of the course or as soon as they find out about potential accommodations if determined mid semester. Athletes who will miss class due to athletic events must see the professor within the first two weeks of the course and submit athletic schedule for the semester, identifying classes that will be missed. No other absences will be allowed for athletes who miss the maximum allowable absences due to athletic events.

Method of Instruction
The main method of delivery will be online and include discussion, lecture, videos, group learning, group projects, and interactive activities.
Online Communication
Since this is an online course, you will be required to participate in many online discussions with the professor and peers. In order to do this, we must build a community online that allows all to express their feelings, ideas, comments, and frustrations. The following are guidelines for participating in this online community:

- Everyone must comment in both number and quality;
- Polite and cordial argumentation is healthy;
- Respect what others have to say and cite others when appropriate;
- Do not attack a person, rather argue the idea;

Navigating Through the Course
I suggest the following in navigating through the course:
1. Start on the homepage with any announcements.
2. Look at the calendar to see if there are any items that are due.
3. Go to Content.
4. Follow the Module outlines from start to finish. You may go back at any time to reread the directions or content.
5. Each Module starts with objectives; see if you can finish these by the end of each Module.
6. Lectures & Readings contain the main ‘content’ and information for learning. You should be able to read all of the information, articles, or postings within the first 4 days of class.
7. Media Sources contains any video or audio support for the lectures and readings. These can be considered part of the content and information to learn.
8. Explore sections will include any activities that you will have to do alone, in pairs, or in groups. This is the action part of the course and you will be doing something; researching, arguing, constructing, posting, and responding.
9. Assignments will have all of the assignments that you are to complete, where to turn them in, and the due date.
10. Discussion will take you to the discussion board where you will find any discussion topics and threads to follow.

How to Access the Communication Tools

**Lecture and Readings:** You will find lectures recorded using voicethread. Most of these will be a guided lecture through a PPT presentation with some additional slides and explanations of content. Please progress and complete each of these. The readings are a compilation of online readings, which include chapters and articles. Most of these can be found online and are linked in the Module.

**Media Sources:** You will find links to various videos, podcasts, or streaming media sources that will help you develop skills of analysis. Watch and complete all media sources. Summarizing these may help you apply the content to your assignments and discussions.

**Explore:** These are activities that you will do or complete online. In addition to the readings, watching videos, and listening to lectures or podcasts, these are activities that are web-based and will involve you or a pair of students to complete a task that involves finding 'data' online to complete the task, which will usually be a set of questions to answer. Discussions may be used to follow-up on the activity.

**Assignments:** Some Modules will have assignments. Specific due dates with instructions will be given at the beginning of each Module. Some assignments will require you to work in pairs or
groups. The DropBox will be accessible to submit all assignments. Each assignment will have a specific method for labeling each assignment.

**Discussions:** Each Module will have a corresponding discussion or discussions. It is required that you make a minimum of two comments per discussion topic. This can consist of an original comment or a response to someone else's comment. Secret Word – Edisto The quality and depth of the comments will be assessed. Since this is asynchronous learning, it is expected that you will log into the course at least 2 times during the duration of the Module.

Completion of all assigned readings and assignments **ON TIME.**
See Course Assignments below for detailed descriptions.

**Responsibility for **ALL **course content**
Including lecture, outside readings, handouts, research, etc.

**Responsibility for keeping up with grades and attendance**
If you miss a class, ask a classmate for the missed assignments and notes.

**Grading Policy and Assignments**
Late submissions of assignments are *unacceptable* under normal circumstances. Please do not attempt to submit any assignments after the due date. I will NOT accept any late work. If assignments are turned in late, it is the discretion of the professor to determine the amount of points to be taken off the final grade. If needed, the professor will provide ample feedback on any assignment if the assignment is emailed to him at least 3-4 days prior to due date. All assignments are required to be uploaded to a designated DropBox in OAKS.

Any written assignment submitted is considered a final product that will be graded on both **what** is written (clarity, depth, and insight) and **how** it is written (the form of the written work). Therefore, it is crucial to realize that correct grammar and spelling, proper punctuation, adherence to assignment guidelines, and neatness will affect your grade. As an educator, you will be expected to demonstrate competency not only in verbal but also in written communication with parents, administrators, and other educators. Please use the resources around you to proofread and to edit your work. Rubrics for all assignments are provided on OAKS to assist you.

I encourage you to take advantage of the Writing Lab in the Center for Student Learning (Addlestone Library, first floor). Trained writing consultants can help with writing for all courses; they offer one-to-one consultations that address everything from brainstorming and developing ideas to crafting strong sentences and documenting sources. 843.953.5635 or [http://csl.cofc.edu/labs/writing-lab/](http://csl.cofc.edu/labs/writing-lab/).

**Evaluation**
It will be possible to earn 225 points during the semester. They will be distributed as follows:

- **Summary of Science or Mathematics** 50 points
- Research 100 points
- Mini-unit 25 points
- Science and Mathematics Notebook 50 points
- Standards “un-packing” 75 points
- Participation and Attendance 25 points


Evaluation Scale

<table>
<thead>
<tr>
<th>Letter Grades</th>
<th>Percentage Range</th>
<th>Grade Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>91-100%</td>
<td>4.0</td>
</tr>
<tr>
<td>B+</td>
<td>89-90%</td>
<td>3.3</td>
</tr>
<tr>
<td>B</td>
<td>84-88%</td>
<td>3.0</td>
</tr>
<tr>
<td>C+</td>
<td>82-83%</td>
<td>2.3</td>
</tr>
<tr>
<td>C</td>
<td>77-81%</td>
<td>2.0</td>
</tr>
<tr>
<td>F</td>
<td>≤76%</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Course Assignments:
Due dates for course assignments, as well as scheduled exams, are listed on the tentative daily schedule at the end of the syllabus. Any changes will be announced in class or posted on OAKs. All assignments must be turned in during the class on the date due. If, for medical or serious personal reasons, an assignment is late, the instructor should be informed of the reasons. Otherwise, each late course assignment will receive a FIVE-PERCENT deduction per day that it is late. DO NOT give assignments to School of Education personnel. Assignments will NOT be accepted via email (unless specified explicitly).

Written and Oral Communication
TSs are expected to use correct grammar at all times. Points will be deducted on written assignments for grammatical errors. All references must follow the American Psychological Association (APA) Guidelines for Term Papers. Writing Lab is located on the first floor of Addlestone Library (Monday through Thursday 9:00 am to 9:00 pm and Friday 9:00 am to noon). Further, it is imperative that TSs use correct grammar in all oral communication, especially during field experiences. Classroom teachers, student peers, and I will collaborate to eliminate all oral grammatical errors, using an approach of constructive criticism.

1. Summary of Science or Mathematics Research
   TSs will be expected to search for a research publication and summarize the main content and focus of the study. This paper should present the science or mathematics themes, implications to teaching, and results of any research and relate themes to Next Generation Standards or Common Core and NCTM. TSs will have to present the summary and classroom implications in a PPT. or Word document online in OAKS.

2. Science Inquiry or Mathematics Problem-Based Mini-Unit
   TSs will develop and demonstrate in pairs or groups an inquiry or problem-based mini-unit that reflects performance-based standards. The lesson activities must have students collect, organize, and analyze data.

3. Science or Mathematics Notebook
   TSs will be required to maintain a notebook that contains classroom notes, any homework, or reading summaries. This will be tuned in twice during the semester.

4. Standards Un-Packing Project
   TSs will develop a list, which is at least 9-weeks long, of learning outcomes and assessment items in their content area based upon performance-based standards.
5. **Class Preparation and Participation**
During the asynchronous class, there will be a number of online discussions and activities that will involve communicating with one another. In order to earn participation credit for classwork activities and discussions, TSs must be present and have completed the necessary readings and preliminary work. For any online work or discussion, TS must respond within the timeframe of a week.

### ADA Accommodations for Students with Disabilities

In compliance with the Americans Disabilities Act (ADA), all qualified students are entitled to “reasonable accommodations.” Any students requiring accommodations should contact the Center for Disability Services (953-1431) and provide me with documentation of needed accommodations within the first two weeks of the course or as soon as they find out about potential accommodations if determined mid semester.

**Center for Student Learning:** I encourage you to utilize the Center for Student Learning’s (CSL) academic support services for assistance in study strategies and course content. They offer tutoring, Supplemental Instruction, study skills appointments, and workshops. Students of all abilities have become more successful using these programs throughout their academic career and the services are available to you at no additional cost. For more information regarding these services please visit the CSL website at http://csl.cofc.edu or call (843)953-5635.

### Academic Integrity Statement

**Honor system:**
Lying, cheating, attempted cheating, and plagiarism are violations of our Honor Code that, when identified, are investigated. Each incident will be examined to determine the degree of deception involved. Incidents where the instructor determines the student’s actions are related more to a misunderstanding will handled by the instructor. A written intervention designed to help prevent the student from repeating the error will be given to the student. The intervention, submitted by form and signed by both the instructor and the student, will be forwarded to the Dean of Students and placed in the student’s file.

Cases of suspected academic dishonesty will be reported directly by the instructor and/or others having knowledge of the incident to the Dean of Students. A student found responsible by the Honor Board for academic dishonesty will receive a XF in the course, indicating failure of the course due to academic dishonesty. This grade will appear on the student’s transcript for two years after which the student may petition for the X to be expunged. The student may also be placed on disciplinary probation, suspended (temporary removal) or expelled (permanent removal) from the College by the Honor Board.

Students should be aware that unauthorized collaboration--working together without permission-- is a form of cheating. Unless the instructor specifies that students can work together on an assignment, quiz and/or test, no collaboration during the completion of the assignment is permitted. Other forms of cheating include possessing or using an unauthorized study aid (which could include accessing information stored on a cell phone), copying from others’ exams, fabricating data, and giving unauthorized assistance.

Research conducted and/or papers written for other classes cannot be used in whole or in part for any assignment in this class without obtaining prior permission from the instructor.
Program-Specific Elements

Course Objectives

All teacher preparation programs in the College of Charleston’s School of Education (SOE) are guided by a commitment to the conceptual framework of “Making the Teaching and Learning Connection.” Three elements of teacher competency (ETS) are fundamental to this framework; teachers must (1) understand and value the learner, (2) know what and how to teach and assess within a conducive learning environment, and (3) understand themselves as professionals. In addition, these competencies are foundational to the learning and assessments within this course, facilitating the development of knowledge, skills, and dispositions necessary for becoming an effective teacher.

Below are the specific end-of-course outcomes related to these teacher competencies. They are derived from the standards set forth by the National Council of Teachers of Mathematics (NCTM) National Science Teachers Association (NSTA) and relate to those of the (1) School of Education (SOE), (2) Council for Accreditation of Education Preparation (CAEP), (3) National Association for the Education of Young Children (NAEYC), (4) Association for Middle Level Education (AMLE), and State Standards for Teacher Education (SC). They, therefore, indicate the expectations for teacher candidates within the School of Education, early childhood teachers, elementary-grades teachers, and middle-grades teachers.

1. Teacher candidates (TSs) will demonstrate how all students learn mathematics or science concepts. EHHP I; NAEYC 4b

2. TSs will recognize the importance of all students’ ideas, interests, beliefs, experiences, and needs in the design, implementation, differentiation, and evaluation of mathematically- and scientifically-based lessons. EHHP I; NAEYC 1a, 5; AMLE 3.K5, 3.D4, 4.P3; SC 4

3. TSs will develop instructional practices derived from current research-based information. EHHP III; NAEYC 1, 4b; AMLE 1.P5, 1.P10, 4.K3, 5.K2; SC 4 (diverse learning styles)

4. TSs will assess student knowledge and dispositions using ongoing, systematic informal and formal assessments. EHHP VI; NAEYC 3, 4b; AMLE 1.P6, 5.K8, 5.D5, 5.P4, 6(all)

5. TSs will communicate concepts, ideas, and philosophies about and through science and mathematics. EHHP II; NAEYC 4b; AMLE 4.K4, 4.D4, 4.P5

6. TSs will demonstrate knowledge of the content and process/practice standards as prescribed by the NCTM, Common Core, Next Generation Science Standards, and the SC Standards. EHHP II; NAEYC 4b, 5; AMLE 4, 6.K5; SC 7

7. TSs will demonstrate in-depth competency of mathematical or science knowledge and skills. EHHP II;

Course Alignment with Common Core Standards

College and Career Readiness Mathematics Practice Standards
1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

**College and Career Readiness ELA Standards**

**Reading.**
- Key ideas and details.
- Integration of knowledge and ideas.
- Range of reading level and text complexity.

**Writing.**
- Text types and purposes.
- Production and distribution of writing.
- Range of writing.

**Speaking and Listening.**
- Comprehension and collaboration.
- Presentation of knowledge and ideas.

**Language.**
- Conventions of Standard English.

**Course Requirements:**

**Demonstration of SOE Dispositions**

Examples of how dispositions are evident are provided in italics.

- Belief that all students can learn, *participation and attitudes expressed about students and learning*
- Value and respect for individual differences, *interactions in class discussions and participation in group work*
- Value of positive human interactions, *participation in class and in group work*
- Exhibition and encouragement of intellectual curiosity, enthusiasm about learning, and willingness to learn new ideas, *participation in class and group discussions and performance on assessments*
- Dedication to inquiry, reflection, and self-assessment, *participation in class and group discussions; performance on assessments (especially the reading and course reflections assignments)*
- Value of collaborative and cooperative work, *thoughtful, constructive critiques of others’ work, participation in class activities*
- Sensitivity toward community and cultural contexts, *participation in class and group discussions, tolerating, discussing, and respectfully listening to differing points of views*
- Engagement in responsible and ethical practice, *performance on assessments, class attendance, and participation in group activities*
- Development of professional mastery over time, *performance over time in writing, thinking, and expression of knowledge*
Tentative Weekly Schedule

Class 1 - Week 1  August 25 – August 30
**Online**
**Introduction to Course**
Objectives: 1) Read Popular Media accounts on science and math teaching.
2) Introduce one another in the online forum.
Learning Outcome: Students summarize and discuss Popular Media online.
Readings: Online popular media stories.

Class 2 - Week 2  September 1 – September 7
**Online**
**Nature of Mathematics**
Objectives: 1) Read about the nature of math and science.
2) Determine practical classroom examples for the nature of math &
science.
Learning Outcome: Identify characteristics of the nature of math & science.
Readings: Tala, S., & Vesterinen, V. (2015). Nature of science contextualized:

Class 3 - Week 3  September 8
**Face-to-Face**
**Nature of Science**
Objectives: 1) Increase knowledge of nature of math and science.
2) Review research about nature of math and science.
Learning Outcome: Apply research to K-12 and informal classrooms.
Readings: See above.

Class 4 - Week 4  September 15 – September 21
**Online**
**Math Standards**
Objectives: 1) Read math standards from national and state resources.
2) Organize themes from standards for math instruction and curriculum.
Learning Outcome: Compare and contrast different national and state math standards.
South Carolina Department of Education (2015). *South Carolina College-
and Career-Ready Standards for Mathematics*. Author: Columbia, SC.
National Governors Association Center for Best Practices & Council of

Class 5 - Week 5  September 22 – September 28
### Online Math Standards

Objectives: 
1) Read math standards from national and state resources. 
2) Organize themes from standards for math instruction and curriculum. 

Learning Outcome: Unpack performance standards into activities. 

Reading: See above.

<table>
<thead>
<tr>
<th>Class 6 - Week 6</th>
<th>September 29 - October 5</th>
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<tbody>
<tr>
<td><strong>Online</strong> Math Standards</td>
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Objectives: 
1) Read science standards from national and state resources. 
2) Organize themes from standards for science instruction and curriculum. 

Learning Outcome: Compare and Contrast state and national science standards. 


Class 7 - Week 7 | October 6 |
<table>
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<tbody>
<tr>
<td><strong>Face-to-Face</strong> Science Standards</td>
<td></td>
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</table>
Objectives: 
1) Learn how to unpack performance standards. 
2) Create learning outcomes and assessment items for select standards. 

Learning Outcome: Unpack performance standards into activities. 

Reading: See above.

Class 8 - Week 8 | October 13 - October 26 |
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<tbody>
<tr>
<td><strong>Online</strong> Problem-based Learning</td>
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Objectives: 
1) Read, summarize, and discuss research articles. 
2) Define PBL. 

Learning Outcome: Develop a discipline-specific definition of PBL. 


Class 9 - Week 9 | October 20 |
| **Fall Break** | 

Class 10 - Week 10 | October 27 |
| **Face-to-Face** | 

Problem-based Learning

Objectives: 1) Experience math and science examples of PBL.
2) Construct discipline-specific representations and examples of PBL.

Learning Outcome: Content unit outline of instruction for PBL and inquiry.


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Class 11 - Week 11 November 3 – November 9

**Face-to-Face**

Inquiry Teaching

Objectives: 1) Experience inquiry math and science activities.
2) Participate in an inquiry environment.

Learning Outcome: Completion of inquiry activities.


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Week 12 November 10 – November 16

**Online**

Inquiry Teaching

Objectives: 1) Locate online calculators.
2) Develop lesson activities using online calculators.

Learning Outcome: Completion of data collection using online calculators.


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Week 13 November 17 – November 23

**Online**

STEM: Science, Technology, Engineering, Math, and Literacy Integration

Objectives: 1) Understand the US policy on STEM.
2) Develop a position on STEM.

Learning Outcome: Narrative on STEM policy.


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Week 14 November 24

**Online**

STEM: Science, Technology, Engineering, Math, and Literacy Integration

Objectives: 1) Understand history of STEM.
2) Apply understanding to classroom.

Learning Outcome: Discussion on STEM application to math & science classrooms.


**Week 15** December 1 – November 30  
**Face-to-Face**  
STEM: Science, Technology, Engineering, Math, and Literacy Integration  
Objectives: 1) Compare and contrast methods for integrating STEM and literacy.  
           2) Complete integrated STEM activities with literacy.  
Learning Outcome: Tables and graphic organizers for implementing STEM and literacy.  
Readings: Read/STEM: Linking Literacy and STEM Education.  

Final Exam - Final Project