EDUC 5356 - Methods of Teaching Science

Course Syllabus – Fall 2014

Course Instructor: Dr. Tonya D. Jeffery
Course: EDUC 5356
Course Dates: 10/16/14 to 12/02/14
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Office Hours: Virtual Hours via Blackboard (Bb): Tues./Wed., 4:30PM – 6:30PM (CST), or by appointment
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EDUC 5356 is an Online Course:
EDUC 5356 uses Blackboard as its only teaching and learning environment. All EDUC 5356 students must have access to Bb9 to be successful in this course. Bb9 is available through the TAMU-CC homepage and requires EDUC 5356 students to have their normal NET ID to log into the course on Blackboard.

Since EDUC 5356 is a fully online course, the instructor and TAMU-CC assume that students who enroll in the course have, or will quickly obtain, the technical expertise, hardware, and software required to be successful in the course.

There is a student tutorial available on the Island Online website (http://iol.tamucc.edu). If you have any problems logging in, the Blackboard helpdesk phone number is 361-825-2825.

You are required to check your Blackboard account every day for announcements, assignment due dates, and/or assignment directions.

This course utilizes PDF files. In order to access these files, please make sure that you have downloaded Adobe Reader to your computer. Adobe Reader is free.

I strongly recommend that students do not use tablets, iPads or forward their emails to their phones as those systems are unreliable and content is often lost.

I. Course Description
This is a fully-online course (100% online) and is designed to provide preservice teachers with an understanding of teaching science in the K-8 school setting. The major goal is to prepare teachers who can educate students to become scientifically literate. This aim requires preservice teachers to learn about the nature of science, to engage in science investigations, and to construct understanding of natural phenomena, forming an elaborate cognitive framework of scientific concepts. Students’ prior knowledge from
previous courses will be essential to their performance in this course, namely: technology in the classroom, lesson planning, curriculum organization, and student assessment.

II. Course rationale
Pre-service teachers are immersed in science education to enhance their science content knowledge and pedagogical skills. This science methods course aims to lay a foundation of professional knowledge, skills, attitudes, behaviors and dispositions necessary for the teaching profession. This course will span the history of science education, explore the nature of science, and inform the practice of teaching science through inquiry and investigation. In addition, the student will become knowledgeable of the state adopted proficiencies for teachers (science emphasis), state standards for science (science TEKS), as well as, the Next Generation Science Standards (NGSS), the national science education standards. This will be supported by readings and discussions of how children learn and how to teach so children learn science and are actively engaged in investigations and inquiry-based learning.

According to Chiappetta (2011), the challenge has never been greater to educate a society for the electronic/communication/information age of the 21st century. This is especially challenging in a highly multiethnic society with students coming from a variety of cultures and a range of economic backgrounds. Science teachers cannot be too well prepared. They must be very knowledgeable about science and technology, expert in pedagogy, and highly motivated to elevate the scientific and technological literacy of society and to help their students succeed academically.

The importance for science teachers to understand the nature of science cannot be overstated. After all, science is what they are teaching and it is critical to know about this discipline – a clear definition of science; about pseudoscience, junk and corrupted sciences; skepticism; the various methods of science; science facts, laws, and theories; and how science is related to engineering, technology and society. Many practicing science teachers, as well as beginning science teachers, lack an understanding of many of these ideas. Also, most science courses at the K-16 levels teach very little “about” the nature of science, devoting most of the instruction to the content of science. Where is the subject matter balance in these courses?

Teaching science as a body of knowledge results in conveying the abstracted, distilled, polished, and pristine outcomes of the learning process that others have gone through to construct new knowledge. As a consequence, this approach often produces learning outcomes that have little meaning to students, resulting in the “rote” memorization of ideas that are learned poorly. Content with little or no process is not the recommended approach for science education. For these and many other reasons, science teachers should learn a great deal about teaching “science as inquiry” philosophy and related instructional approaches.

III. State Adopted Proficiencies for Teachers
  1. Learner-Centered Knowledge: The teacher possesses and draws on a rich knowledge base of content and technology to provide relevant and meaningful learning experiences for all students.
  2. Learner-Centered Instruction: The teacher collaboratively identifies needs
and implements appropriate pedagogical and assessment strategies using technology and other resources.

3. **Equity In Excellence For All Learners**: The teacher respects, addresses, and validates the needs of diverse learners.

4. **Learner-Centered Communication**: The teacher demonstrates effective professional and interpersonal communication skills and serves as an advocate for all students.

5. **Learner-Centered Professional Development**: The teacher is a reflective practitioner and demonstrates a commitment to learn, to improve the profession, and to maintain professional ethics and personal integrity.

**Texas Education Agency STAAR Proficiencies, TExES Competencies, Texas Science Objectives, Science Common Standards:**

<table>
<thead>
<tr>
<th>State Science Standards/Course Goals</th>
<th>Course Assignments</th>
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| **Standard I.** The science teacher manages classroom, field, and laboratory activities to ensure the safety of all students and the ethical care and treatment of organisms and specimens. | • Article/Reading Reflection  
• [Discussion Board (DB) Posts]  
• Safety Unit  
• Scientific Inquiry Investigations & Reflections  
• Video Assignments |

| **Standard II.** The science teacher understands the correct use of tools, materials, equipment, and technologies. | • Article/Reading Reflection - DB Posts  
• Science Process Skills  
• State Standards (TEKS)  
• National Standards (NGSS)  
• Scientific Inquiry Investigations & Reflections  
• Inquiry Curriculum Unit  
• Video Assignments |

| **Standard III.** The science teacher understands the process of scientific inquiry and its role in science instruction. | • Article/Reading Reflection - DB Posts  
• Scientific Inquiry Investigations & Reflections  
• State Standards (TEKS)  
• National Standards (NGSS)  
• Inquiry Curriculum Unit  
• Inquiry-based Lesson Plan  
• Video Assignments |
Standard IV. The science teacher has theoretical and practical knowledge about teaching science and about how students learn science.

- Article/Reading Reflection - DB Posts
- Inquiry-based Lesson Plan
- Scientific Inquiry Investigations & Reflections
- Synthesis Paper
- Inquiry Curriculum Unit
- Video Assignments

Standard V. The science teacher knows the varied and appropriate assessments and assessment practices to monitor science learning

- Article/Reading Reflection - DB Posts
- Science Journal
- Science Fair Project
- Inquiry Curriculum Unit

Standard VI. The science teacher understands the history and nature of science.

- Article/Reading Reflection - DB Posts
- Scientific Inquiry Investigations & Reflections
- VNOS Assessment
- Synthesis Paper
- Video Assignments

Standard VII. The science teacher understands how science affects the daily lives of students and how science interacts with and influences personal and societal decisions.

- Article/Reading Reflection - DB Posts
- Scientific Inquiry Investigations & Reflections
- Science Journal
- Synthesis Paper
- Inquiry Curriculum Unit
- Video Assignments

IV. Course Objectives/Student Learning Outcomes:
The intended learning outcomes specified for these units will be assessed from summaries of Instructional Objectives and assignments submitted to the course Blackboard (Bb) site, on weekly module quizzes and an end-of-semester synthesis paper.

This course is designed to enable learners to:
1. Characterize the nature of science, scientific knowledge, and scientific inquiry.
2. Read peer-reviewed, scholarly articles on current trends and issues in science education.
3. Identify activities where children learn to utilize science process skills.
4. Explain how children construct science knowledge with reference to theories of cognitive psychologists.
5. Identify instructional models appropriate for teaching inquiry science.
6. Identify the “big ideas” of the grade level science TEKS in planning for inquiry.
7. Design 5-E inquiry-based lessons to promote scientific inquiry.
8. Plan to successfully manage a science classroom.
10. Synthesize the historical development of a scientific concept/theory/law and develop a 5-E lesson plan based on this concept/theory/law.

**Student Learning Outcomes:**
Graduate students will be able to:

1. Explain their answer to these questions – What is Science? What is the Nature of Science?
2. Describe the national science education standards (NGSS) and state science standards (TEKS).
3. Discuss the foundations for teaching science: nature of science, science process skills, how students construct science learning, teaching science as inquiry, and connecting science to other disciplines.
4. Plan, design, and assess science instruction to promote student learning among diverse student populations.
5. Participate in the discourse on current trends and issues in science education.
6. Write a synthesis paper on a scientific concept/theory/law and develop a 5-E lesson plan that incorporates this science concept.

**V. Course Topics:**
The major topics to be considered are: the nature of science, scientific inquiry, science process skills, teaching for conceptual change, instructional models for inquiry science, designing inquiry lessons, managing inquiry lessons, and assessing inquiry lessons.

**VI. Instructional Methods and Activities**
- Classroom Experiences (discussion threads, collaboration, peer review, group work, individual work, online deliveries and reflection).
- Field Experiences: Evaluate a PreK, elementary or middle school student and conduct science instruction for a minimum of 3 hours.

**VII. Evaluation and Grade Assignment**
*The methods of evaluation and the criteria for grade assignment are:*

**I. Weekly Module Assignments (75%)**
Students will complete weekly module assignments on the topics covered in the course outline. Module assignments include:

1. **Blog** (20%)— (1) Introduction/Science Autobiography (2) You will conduct Scientific Inquiry Investigations and post reflections on the blog; (3) You will also evaluate a PreK, elementary or middle school student and conduct science instruction. You will describe process on the blog and respond to all peers’ postings.
2. **Module Videos** (20%) - You will complete video assignments for each module using Pearson’s CourseSmart (Tools). You will receive points for completion.
3. **Discussion Board (20%)** - You will read articles from science education journals, reflect on them with an initial posting, and respond to two peers’ postings.

4. **Quizzes (10%)** - You will take a Syllabus quiz after reading the syllabus, and Module quizzes after reading PPTs and chapters in the textbook.

5. **Journal (5%)** – Weekly class reflections and Final reflection

More specific details about these assignments are provided below:

1. **Blog (20%)**
   (1) Introduction/Science Autobiography (2) You will conduct Scientific Inquiry Investigations and post reflections on the blog; (3) You will also evaluate a PreK, elementary or middle school student and conduct science instruction. You will describe process on the blog and respond to all peers’ postings.

2. **Module Videos (20%)**
   You will complete video assignments for each module using Pearson’s CourseSmart (Tools). You will receive points for completion.

3. **Readings/Article Reviews on Discussion Board (20%)**
   You will be a part of a Professional Learning Community (PLC) by responding to various questions and posts on the discussion board via Blackboard (Bb). The promptness and initiative of participating in threaded discussions done in a timely fashion will demonstrate self-motivation. The delivery of your posts will address your attention to detail in terms of being grammatically correct with rare misspellings. You will make posts that are relevant to the original discussion by staying on topic. By contributing to the professional learning community, you will demonstrate an effort to further the development of a collaborative learning experience. You will write a one-paragraph reflection that addresses a given prompt. Then you will review two other students’ postings and post one response/comment to each student's post (Total of two replies). Your replies to other students’ posts only need to be about 1-2 sentences. You can feel free to provide/post responses to more than two classmates' postings to enhance a discussion; however, you will only receive credit for replying to two classmates’ posts. Remember to be courteous and respectful to all peers and in your responses to postings. Professionalism is expected at ALL times.

4. **Module Quizzes (10%)**
   Students will be assessed over instructional objectives related to: the nature of science, scientific inquiry, science process skills, teaching for conceptual change, instructional models for inquiry science, designing inquiry lessons, managing inquiry lessons, and assessing inquiry lessons.
5. Journal (5%)

Teacher as a reflective practitioner. Students will keep a reflective journal of their weekly experiences in the course and of concepts learned during the week. You should make an entry into your journal at least once per week and reflect on something that “grabbed” you the most from the videos/readings/scientific inquiry investigations/etc. and you fully intend to use in your class (present or future)!! For your Final reflection, you will post a reflection in your journal about Teaching Science.

II. Synthesis Paper & Lesson Plan – Scientific Concept/Theory/Law (25%)

Students will select a specific science concept/theory/law. Students will research this concept/theory/law and make connections to the nature of science (NOS) and scientific inquiry. They will explore the history of this concept and write a 7-10 page synthesis paper (minimum 7 pages, not including reference page). Students will then develop an engaging, inquiry-based science lesson plan (5-E) that incorporates aspects of NOS and the history of this concept/theory/law. Students will designate a specific grade level for their lesson plan based on the state science TEKS. More details about this assignment will be provided on Blackboard (Bb).

Synthesis Paper (15%):

1. **Scientific concept/theory/law must be approved by instructor.**
2. Paper should be a minimum of 7 pages, but no more than 10 pages. Use at least 6 references, with a minimum of 4 peer-reviewed articles from professional educational journals, written within the past five years, and books.
3. The paper must include the following subheadings in bold:
   a) **Title Page** – Include name of concept/theory/law, your name, course name, my name, semester/year (Page 1)
   b) **Introduction** – Discuss your motivation/personal interest for selecting this concept/theory/law; What is the importance of educating students about this concept/theory/law? (Pages 2-3)
   c) **Review of the Literature** – Discuss the historical development of concept/theory/law; What scientist(s) is/are credited for proposing the concept or contributing to the concept; Biographical of the scientist(s) – what type of person was this scientist (discuss childhood through adulthood); What scientific processes did the scientist(s) utilize in proposing this concept?; How did this concept/theory/law affect personal and societal decisions; What were some of the challenges (if any) in society accepting this concept? (Pages 3-7)
   d) **Discussion** - Discuss how students’ understanding of the nature of science will be improved by learning about the historical development of this concept (e.g. teaching science through the history of the discipline); Consider the
connections you can make to the nature of science themes when teaching a lesson on this concept/theory/law, as was discussed earlier in the semester: science is a way of knowing, scientific knowledge is based on empirical evidence, scientific knowledge is open to revision in light of new evidence, science is a human endeavor, science addresses questions about the natural and material world, etc. (Pages 7-8)

e) Conclusion - Explain why it is necessary to incorporate inquiry-based teaching and learning in the science classroom. Make reference to the state TEKS, national science education standards, 5-E instructional model. Also discuss the importance of assessment in inquiry-based lessons. (Pages 9-10)

f) References – Final page of paper (12 pt. font, single-spaced)


5. Paper should be written in Times New Roman, 12 pt. font. double-spaced.

6. Assignment is Due: On or before December 2, 2014 @ 11:30 PM

5-E Lesson Plan (10%):
Students will analyze their current or future classroom practices as they relate to the research-based instructional approaches discussed in the course. They will develop a 5-E inquiry-based lesson plan for a specific grade level, utilizing science process and concept TEKS, and will incorporate the science concept/theory/law researched and make connections to the nature of science and other disciplines, as appropriate. A 5-E lesson template will be provided to the student.

B. Grading Scale

Grades:
A = 92% - 100%
B = 84% - 91%
C = 76% - 83%
D = 68% - 75%

VIII. Course Schedule and Policies
A. A tentative course schedule will be uploaded to Blackboard (Bb) prior to the first day of class.
B. Thurs., Oct. 16 – First day of class.
C. Tues., Dec. 2 – Last day of class.
B. **Class Policies**

**Late assignments**
Late assignments will not receive full credit. A deduction of 10% per day will be applied to any late assignment. Communicating an excuse for a late assignment does not constitute a waiver of the deadline or avoid the deduction.

**Attendance/tardiness**
Regular attendance is best for students enrolled in the course. You will gain from the course what you are also willing to put into the course.

**Late work and Make-up Exams**
Full credit will not be given for late assignments or unexcused missed conference.

**Extra Credit**
Extra credit is not an option for this course.

**X. Textbook(s)**

**Required**

**Recommended**

**XI. Bibliography**

*The knowledge bases that support course content and procedures include:*
Journals:
Selected readings from the professional journals *Journal of Science Teacher Education*, *Journal of Research in Science Teaching*, *School Science and Mathematics*, *Science and Children*, *Science Scope*, *The Science Teacher*, and *Phi Delta Kappan*, will be incorporated into the course content.

XII. Course Policies

*Academic Integrity/Plagiarism*
University students are expected to conduct themselves in accordance with the highest standards of academic honesty. Academic misconduct for which a student is subject to penalty includes all forms of cheating, such as illicit possession of examinations or examination materials, falsification, forgery, complicity or plagiarism. (Plagiarism is the presentation of the work of another as one's own work.) In this class, academic misconduct or complicity in an act of academic misconduct on an assignment or test will result in failure. See website http://judicialaffairs.tamucc.edu/.

TAMU-CC students, undergraduates as well as graduate students, are expected to know what plagiarism is and also how to avoid it. In your scholarly writing for this course, you must credit sources, including articles, books, and web pages, and provide quotation marks for material that is quoted directly.

If you have questions about what plagiarism, I suggest that you consult the following sites:
http://www.plagiarism.org/ http://owl.english.purdue.edu/owl/resource/589/01/
http://www.macloo.com/cheat/general.htm
http://www.utoronto.ca/writing/plagsep.html
http://people.brandeis.edu/~teuber/usemplagiarism.html
http://www.unc.edu/depts/wcweb/handouts/plagiarism.html
http://firstyear.tamucc.edu/wiki/Resources/AboutPlagiarism

*Dropping a Class*
I hope that you never find it necessary to drop this or any other class. However, events can sometimes occur that make dropping a course necessary or wise. Please consult with me before you decide to drop to be sure it is the best thing to do. Should dropping the course be the best course of action, you must initiate the process to drop the course by going to the Student Services Center and filling out a course drop form. Just stopping attendance and participation WILL NOT automatically result in your being dropped from the class. Check the university academic calendar website for dates related to dropping a class with an automatic grade of "W" this term. See website http://www.tamucc.edu/academics/academic_cal.html.
Preferred methods of scholarly citations
Publication Manual of the American Psychological Association, Sixth Edition is the preferred method for citations within papers.

Classroom/professional behavior
All students are expected to act in a responsible manner with consideration of fellow students and toward TAMU-CC faculty and staff members. Specific rules and information is available in the TAMU-CC Student Handbook and available through the website http://judicialaffairs.tamucc.edu/studentcofc.html.

Statement of Academic Continuity
In the event of an unforeseen adverse event, and classes could not be held on the campus of Texas A&M University–Corpus Christi; this course would continue through the use of Blackboard and/or email. In addition, the syllabus and class activities may be modified to allow continuation of the course. Ideally, University facilities (i.e., emails, web sites, and Blackboard) will be operational within two days of the closing of the physical campus. However, students need to make certain that the course instructor has a primary and a secondary means of contacting each student.

Grade Appeals
As stated in University Rule 13.02.99.C2, Student Grade Appeals, a student who believes that he or she has not been held to appropriate academic standards as outlined in the class syllabus, equitable evaluation procedures, or appropriate grading, may appeal the final grade given in the course. The burden of proof is upon the student to demonstrate the appropriateness of the appeal. A student with a complaint about a grade is encouraged to first discuss the matter with the instructor. For complete details, including the responsibilities of the parties involved in the process and the number of days allowed for completing the steps in the process, see University Rule13.02.99.C2, Student Grade Appeals, and University Procedure 13.02.99.C2.01, Student Grade Appeal Procedures. These documents are accessible through the University Rules Web site at http://www.tamucc.edu/provost/university_rules/index.html. For assistance and/or guidance in the grade appeal process, students may contact the Office of Student Affairs.

Disabilities Accommodations
The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please call or visit Disability Services at (361) 825-5816 in CCH 116. See website http://disabilityservices.tamucc.edu/.
If you are a returning veteran and are experiencing cognitive and/or physical access issues in the classroom or on campus, please contact the Disability Services office for assistance at (361) 825-5816.