Methods of Teaching Science

Course Description

This course is designed to provide pre-service teachers with an understanding of the teaching of science in a K-12 school setting. 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.

In this course, we will critically investigate methods for teaching K-12 science. Through readings, modeling, and discussion, we will develop an understanding of the nature of science, inquiry, and scientific literacy. We will explore methods for developing students’ scientific understanding, problem solving skills, and inquiry skills. You will articulate theoretical bases for methods of teaching science and model specific classroom strategies for teaching science. You will communicate how your understanding of theory and methods for teaching science informs your personal teaching and research philosophy.

Prerequisite or concurrent enrollment: EDCI 5306 Planning/Teaching/Learning Processes.

Course Format

The majority of the class will be face-to-face meetings once a week. Some classes may be scheduled as an asynchronous distance class utilizing Blackboard or other instructional technologies. These dates will be discussed and agreed upon as a class prior to scheduling.

The class will be a combination of seminar format with structured discussions, team interactions with team tasks, and lecture. Students are expected to bring prior knowledge, personal expertise, and discussion points prepared from the readings to class with the objective of contributing knowledge and understanding to the group.

Learning Objectives

- Become aware of and familiar with state and national standards for science education
- Identify and develop formative assessment classroom techniques (FACTs) for the science classroom
- Identify and integrate elements of how people learn with methods of teaching science
- Develop an understanding of the *nature of science* (NOS)
- Identify and model teaching methods for facilitating students’ understanding of the *nature of science*
- Develop an understanding of *scientific literacy*
- Identify and model teaching methods for facilitating students’ *scientific literacy*
- Develop an understanding of *scientific inquiry*
- Identify and model teaching methods for facilitating students’ *inquiry skills*
- Articulate a statement of your personal teaching philosophy grounded in theory and evidence related to methods for teaching science

**Major Course Requirements**

**Assignments:**

- Model lesson: Explicit Shifts – Adapting a lesson to include NOS  15%
- Model lesson: Subtle Shifts – Adapting a lesson for Inquiry  15%
- Reading Responses/Summaries  10%
- Class Attendance  10%
- Class Participation (includes the following)  40%
  - Individual Readiness Assurance Tests
  - Team Readiness Assurance Tests
  - Team Application Exercises
  - In-class assignments/activities
- Final Exam (open-response format)  10%

**Total**  100%

**Model lesson: Explicit Shifts – Adapting a lesson to include NOS:**

The purpose of this assignment is to practice skills in identifying elements of the NOS in existing materials for science labs or class activities. You will select a lab or activity specific to your content and grade-level interest. You will identify elements of NOS in your selected lab/activity. You will revise the lab/activity to include explicit identification of and skill practice with the NOS elements. You will create (1) a revised lesson plan, (2) a formative assessment instrument for the lab/activity, and (3) a poster to compare/contrast the original lesson with the revised one. The poster will serve as a visual display for the purpose of communicating the information to the class.

A rubric will be provided to clarify scoring criteria. (15 percent of the final grade)

**Model lesson: Subtle Shifts – Adapting a lesson for inquiry:**

The purpose of this assignment is to practice skills in identifying ways to shift existing materials for science labs or activities to include an increased level of student-directed inquiry. You will select a lab or activity specific to your content and grade-level interest. You will revise or add to the lab or activity steps or options that will increase the degree of inquiry skills required. You will (1) create a revised lesson plan, (2) create a formative assessment instrument for the lab/activity, and (3) model instruction of the revised lab/activity for the class.
A rubric will be provided to clarify scoring criteria. (15 percent of the final grade)

Reading Responses/Summaries:
There will be substantial out-of-class reading assigned for this class. The purpose of out-of-class readings is to prepare you to participate and contribute to in-class discussions and activities. Reading responses/summaries will be completed in the form of a short essay as a Blackboard discussion post or as an in-class formative assessment. The purpose of the writing assignments is to require you to synthesize information from multiple sources, articulate your understanding of the course objectives and/or concepts, and to provide practice in formal writing skills. (10 percent of the final grade)

Class Attendance:
Attendance is required. Attendance is 10 percent of your overall grade. In addition, any in-class participation grade(s) will be recorded as a zero for days you have an absence from class that is not a university approved absence. (10 percent of the final grade)

Class Participation:
In-class participation is required. This class utilizes Team-Based Learning Strategies™. The class participation grade will be calculated as a combination of individual work, individual readiness assurance tests (quizzes), team readiness assurance tests, and team application exercises. (40 percent of the final grade)

Final Exam:
There will be a comprehensive summative final exam during the week of May 7, 2012. The exam will be in a short open-response (essay) format. Completion of peer evaluations (2) and a final course evaluation (anonymous) will contribute 6 possible points to the final exam score. (10 percent of the final grade)

Required or Recommended Readings
Readings will be assigned on a weekly basis from articles, web pages, and from the following required textbook:

ISBN: 978-07879-72981

Articles will be available for electronic access either through the TAMUCC library or through postings to Blackboard.
Course Policies

Attendance/tardiness

Attendance is required. However, you will be allowed ONE absence each semester. After that, each unexcused absence from a scheduled class meeting will reduce your final course grade.

Tardiness is not acceptable. Two unexcused late arrivals will reduce your final course grade. Four unexcused late arrivals will place you in jeopardy of failing this course.

It is the student’s responsibility to sign in every class meeting on the attendance sheet.

**Notification of an absence by email, phone call, etc. does not constitute a university approved excused absence or late arrival. Written documentation must be provided to support an excused absence or late arrival.

Late work and Make-up Exams

NA

Extra Credit

NA

Cell Phone/Electronic Device Usage

The use of electronic devices for unrelated activities (i.e. phone calls, text messaging, instant messaging, checking e-mail, internet surfing, etc) is prohibited.

Fostering Open and Expressive Discussion/ Professional Behavior

The study of education in America allows us a dialogue and an exchange of ideas and mores that may differ from our individual ideas and perceptions. I provide and expect respect, courtesy, and open-mindedness among all of us.

Students should exhibit mature online and in-class discussion behavior. Online classroom responses should not be considered “chat room” activities. A classroom level of formality should be maintained in all email and discussion board communication. Students should refrain from text messaging style of writing or “chat speak”.

While the nature of this course requires the expression of divergent opinions; discrimination, abuse, harassment, or disorderly conduct in any form that inhibits or interferes with our ability to engage in open discourse will not be tolerated in the classroom or online.
\textit{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 may result in failure.

\textit{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 \textbf{\textit{WILL NOT automatically result in your being dropped from the class.}} Friday March 30\textsuperscript{th} is the last day to drop a class.

\textit{Methods of scholarly writing and citation}

It is important that written assignments for this class be completed in a formal manner. Sources should be cited throughout and a bibliography presented at the end using APA guidelines. Written assignments will be marked, not only for content, discussion, and incisiveness, but also for correct grammar, sentence structure and presentation of its argument at a graduate level of competence.

\textit{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 \url{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 Driftwood 101.

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.
Syllabus (15 Weeks)

Note: Even though I reserve the right to alter this syllabus, assignments, and due dates, I will provide you with ample notification of any changes. Please check course postings on Blackboard for course content, assigned readings, other assignments, discussions, and due dates.

Week 1  What is Scientific Literacy?
         How People Learn
         Introduction to Team-based Learning (TBL) Strategies

Week 2  Developing Scientific Literacy
         Modeling of a TBL cycle
         Consensus on percent allocations for class participation grade

Week 3  The Nature of Science (NOS)
         TBL series I

Week 4  Developing scientific understanding – explicit focus to NOS

Week 5  Formative Assessment Classroom Techniques (FACTs)
         TBL series II

Week 6  Explicit Shifts – Adapting a lesson to include NOS - Due
         In class Poster Gallery: NOS revised lessons

Week 7  Inquiry-based Learning: Theory and Practice
         Team Peer Evaluations (formative - completion adds 2 points to your final exam)

Week 8  Inquiry-based Learning: Subtle shifts

Week 9  Spring Break

Week 10 Scientific Visualization
         Information Technology (IT) and Student use of data

Week 11 State and National Standards for Science Education
         TBL series III

Week 12 National Trends in STEM education
         Content Focus versus Process Focus in the standards
         College and Career Readiness – Factors influencing college science success

Week 13 Assessment and Accountability
         TBL series IV

Week 14 Subtle Shifts – Adapting a lesson for inquiry – Due
         Modeling of student revised lessons – Part I

Week 15 Closure, wrap-up, review, and course evaluation (anonymous – completion adds 2 points to your final exam)
         Modeling of student revised lessons – Part II
         Team Peer Evaluations (summative – completion adds 2 points to your final exam)

Final Exam  Week of May 7th, 2012