SCED 561
Using Controversial Biological Topics to Teach Nature of Science

Course Number and Prefix: SCED 561

Equate Title (Credits): Biological Topics (3)

Co-Requisites/Prerequisites: BIO 110 or equivalent

Catalog Course Description: Explores use of scientific “controversies” as a teaching strategy to understand the nature of science. Empirical evidences supporting major biological concepts are integrated with pedagogical strategies.

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Office Hours: By appointment

Required Texts:

Additional scientific articles will be made available via blackboard throughout the course on specific topics.

Purpose of the Course
Some topics that appear to be controversial to the general public are in fact not very controversial within the scientific community. The discrepancy in appearance comes from the fact that the Nature of Science as a way of knowing is often misunderstood or the scientific topics are only taught superficially. This course is designed to help secondary and middle school teachers use these apparent controversial topics as tools for teaching the Nature of Science. Biological topics such as evolution, stem cells, genetically modified organisms, or endangered species were chosen to illustrate the use of controversy as a teaching strategy.
According to the National Science Teacher Association’s (NSTA) position statement, “science is characterized by the systematic gathering of information through various forms of direct and indirect observations and the testing of this information by methods including, but not limited to, experimentation. The principal product of science is knowledge in the form of naturalistic concepts and the laws and theories related to these concepts.” This course will explore the major premises that are important to understanding the nature of science and then will show how each of the potentially “controversial” biological topics fits within these guiding premises.

The scientific topics are explored together with pedagogical strategies appropriate for teaching of these principles to elementary, middle, or secondary students. This course is designed to help in-service teachers meet the “Highly Qualified” teacher status as designated by the Colorado State Board of Education. The course is standards-based. It is intended for teachers who wish to increase their content knowledge in current scientific concepts and integrate this knowledge into their teaching. Additional discussion is devoted to how to help students more effectively use evidence to make informed decisions.

Overall Course Objectives (Student Learning Outcomes)

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<th>Overall Course Objectives (Student Learning Outcomes)</th>
<th>Major Corresponding Assessments</th>
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<td><strong>By the end of the course, the in-service teaching taking this course will be able to:</strong></td>
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<td>1. Define and differentiate both the process and products of science</td>
<td>Graded threads to discussion forums and reflective papers</td>
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<td>2. Convey to students the philosophical tenets, assumptions, goals, and values that distinguish science from other ways of knowing</td>
<td>Graded threads to discussion forums and reflective papers</td>
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<td>3. Describe the empirical evidence supporting biological concepts such as biological evolution, cell differentiation from stem cells, and ecological importance of biodiversity</td>
<td>Graded threads to discussion forums and reflective papers</td>
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<td>4. Develop instructional strategies to help their students understand the nature of science by using controversial issues in biology</td>
<td>Lesson plans and reflective papers</td>
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<td>5. Develop pedagogical strategies for incorporating controversial or complex scientific topics that are appropriate for the K-12 curriculum</td>
<td>Lesson plans and reflective papers</td>
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| 6. Develop improved instructional and professional practices, including:  
  • Supporting the learning of all students  
  • Using higher level questions to increase student understanding  
  • Assessing student thinking and evaluating instructional tasks  
  • Planning and communicating with other teacher participants | Lesson plans and reflective papers |
| 7. Demonstrate competency of content necessary to enable implementation of content addressed in Colorado Academic Standards in Science, National Science Education Standards, Project 2061 Benchmarks, and the Next Generation Science Standards | Graded threads to discussion forums, reflective papers, and lesson plans |
Format of Course

The nature of this class is for inservice teachers to learn about controversial biological topics through a series of online lessons and asynchronous discussions with other members of the course via Blackboard. Many of the lessons will require the participants to make sense of chapters in the textbook or articles and communicate your understanding with their classmates. Since this is a distance learning format, participants will be required to communicate electronically and form networks with other participants. Participants need to have good communication skills.

The course requires some technical knowledge to facilitate the online delivery. Participants should be able to download and upload documents from Blackboard, communicate in MS Word or other word processing software, and send and receive e-mail. Some documents are available in the Adobe PDF format so you must download the free Adobe Reader XI or equivalent.

The overall course is organized into five main sections. Within each section there are 1-4 lessons. Within each lesson there are 1-6 Activities. The activities are the actual assignments whether reading assignments or discussions. The activities are arranged within the lesson to emphasize the BSCS 5-E Instructional Model characterized by engage, explore, explain, elaborate, and evaluate. Each “E” represents a part of the process of helping students sequence their learning experiences to construct their understanding of concepts. It is used in this course both to help the teachers as they learn the content themselves and to illustrate an instructional model for their own teaching.

Outline of Course Content:

Section A: General Orientation
0. Introduction to Course
1. Controversial Issues and the Teaching of Science
2. Critical Analysis of the NSTA Position Statement on the Nature of Science

Section B: Using Evolution to Teach the Nature of Science
3. The Evidence for Biological Evolution
4. Natural Selection, Adaptation, and Genetic Drift
5. Teaching Science in Light of Evolution
6. Contrasting Evolution with Alternative, Non-scientific Explanations

Section C: Exploring Ethical Issues with Topics in Cell Biology
7. Overview of Developmental Biology: Stem cells to organs
8. Genetically Modified Organisms: Using evidence to make informed decisions
9. Medical Applications of Genomics, Proteomics, and Metabolomics

Section D: Exploring Ecological Topics of Social or Economic Concerns
10. Endangered Species, Biodiversity, and Extinction
11. Population Growth and the Power of the Exponent

Section E: Conclusion
12. Course Closure

Grading:
The final grade for the course will be derived from the following activities:

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<th>Method of Assessment</th>
<th>Approximate weight</th>
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<tr>
<td>Active Participation in Online Discussions</td>
<td>40%</td>
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<tr>
<td>Reflective and Summative Essays</td>
<td>30%</td>
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The nature of this course is on-line delivery and participation in the course activities is expected for all students. Failure to participate in discussions or complete assignments impact the overall grade received for the course.

Method of Evaluation

The course will be graded by the standard A-F letter grade. The final course grade is based on your total number of points from all forms of assessments using a 90-80-70-60 scale.

Class Discussion

Class discussion is probably the most important learning environment for this course. Participants are strongly encouraged to form friendships that will enable them to collaborate on assignments as part of the class. All assignments will be submitted via Blackboard and due dates will be posted for each assignment. *Homework assignments will not be accepted late without prior approval. Missed class assignments will receive a zero score.*

Most of the discussions are asynchronous in nature. By that it means that they are not real-time. Participants will post a comment to a leading question and then come back later to add more comments to their peers. It is critical that all the students in this course participate since building a learning community is critical to the overall learning. Being an on-line course, it is different than face-to-face. The discussion forum will last over a few days so each participant will need to come back and see the comments added to their ideas.

For most discussions, participants are expected to add meaningful comments to at least two of their fellow classmates. These comments should add a new insight, idea, or question to the overall discussion and can’t merely say “I agree” or “I disagree”. The advantage of the asynchronous nature of the discussion is each participant will have time to compose his/her responses rather than merely spout them out. Remember that this is a public forum so everyone in the course will see everyone else’s comments.

For some of the readings the participants will be expected to identify a few “Codger Concepts”. These are “big ideas” or “big concepts” that they would expect to remember even when they are old codgers in the nursing home. So another way of putting it is these are the most important points from a given reading or assignment.

Reflective Papers and Lesson/Unit Plans

At the end of the five main sections, there is a reflective paper or lesson/unit plan required. The purpose of these assignments is to synthesize all the information learned in the section and apply it to future teaching.

Using Blackboard

This course will utilize Blackboard, a web-based course supplement, for delivering most of the material and managing on-line assignments and discussion.

Blackboard is accessed at [http://bb.unco.edu](http://bb.unco.edu).
**Disability Support Services**

Any student requesting disability accommodation for this class must inform the instructor by giving appropriate notice. Students are encouraged to contact Disability Support Services at (970) 351-2289 to certify documentation of disability and to ensure appropriate accommodations are implemented in a timely manner.

**Honor Code**

All members of the University of Northern Colorado community are entrusted with the responsibility to uphold and promote five fundamental values: Honesty, Trust, Respect, Fairness, and Responsibility. These core elements foster an atmosphere, inside and outside of the classroom, which serves as a foundation and guides the UNC community’s academic, professional, and personal growth. Endorsement of these core elements by students, faculty, staff, administration, and trustees strengthens the integrity and value of our academic climate.

**UNC’s Policies**

UNC’s policies and recommendations for academic misconduct will be followed. For additional information, please see the Dean of Student’s website.

UNC Student Code of Conduct:

http://www.unco.edu/dos/communityStandards/student_code_conduct/index.html