George Mason University  
College of Education and Human Development  
Secondary Education Program  

EDCI 573 SECTION 001: TEACHING SCIENCE IN SECONDARY SCHOOLS  
Spring, 2005

Professor: Kabba E. Colley, Ed.D.  
Classes held at A412 Robinson Hall  
Office: A322 Robinson Hall  
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COURSE DESCRIPTION

EDCI 573 is the first course in a two-part sequence of science methods courses for science teacher candidates. The course is designed to build basic knowledge, skills and dispositions in methods of teaching, assessing and management of students’ science learning at the secondary level. Candidates enrolled in this course will have the opportunity to plan, implement and evaluate a student-centered, standard-based instructional unit for diverse learners. Field experience is a required part of this course and candidates will be expected to conduct and document 15 hours of field experience at a local school site over the course of the semester. Prerequisite or co-requisite: EDUC 522.

GOALS

Given instruction and an opportunity to practice, science teacher candidates will be able to:

1. Gain awareness of the requirements, expectations and implications of becoming a secondary science teacher in the Commonwealth of Virginia.

2. Demonstrate knowledge and understanding of the nature of science and how students learn science.

3. Demonstrate knowledge and application of the current methods of teaching and assessing science at the secondary level.

4. Demonstrate knowledge and understanding of state and national science education.

5. Design a student-centered, standards-based science unit of study for a specific grade at the secondary level that meet the needs of diverse learners.

6. Gain awareness of equity issues in teaching and learning of science and the strategies for addressing them in the secondary science classroom.
7. Demonstrate knowledge of classroom management strategies that will nurture students’ love for science learning and shared responsibility in the learning process.

8. Apply knowledge of science laboratory safety in the design of their science unit plans.

REQUIRED TEXT


REQUIRED ONLINE RESOURCES


MATERIALS/TOOLS/TECHNOLOGY REQUIRED

1. Writing materials
2. Three-ring binder or large folder to store reading materials and course work
3. Transparency pens and transparency sheets for presentation
4. Four plain manila folders
5. Internet access

RELATIONSHIP TO PROGRAM GOALS AND PROFESSIONAL ORGANIZATIONS

EDUC 573 is the first course in a two-course sequence of science methods courses for candidates seeking a secondary school teaching license in biology, chemistry, earth science or physics. The course is designed to meet state and national standards as outlined by the Commonwealth of Virginia Department of Education, National Council for Accreditation of Teacher Education (NCATE), the National Science Teachers Association (NSTA), and the Interstate New Teacher Assessment and Support Consortium (INTASC).

TEACHING/LEARNING METHOD

This course will be conducted using a project-based approach. This means that questions generated by the both professor and candidates will be used to drive classroom activities and projects. Candidates are expected to conduct projects and participate fully in all related discussions. Readings and videos on selected topics in science education will be used to stimulate and drive classroom discussion.
COLLEGE EXPECTATIONS AND UNIVERSITY HONOR CODE

The College of Education and Human Development (CEHD) expects that all candidates will abide by the following:

1. Candidates are expected to exhibit professional behavior and dispositions. See gse.gmu.edu for a listing of these dispositions.

2. Candidates must follow the guidelines of the University Honor Code. See http://www.gmu.edu/catalog/apolicies/#TOC_H12 for the full honor code.

3. Candidates must agree to abide by the university policy for Responsible Use of Computing. See http://mail.gmu.edu and click on Responsible Use of Computing at the bottom of the screen.

4. Candidates with disabilities who seek accommodations in a course must be registered with the GMU Disability Resource Center (DRC) and inform the instructor, in writing, at the beginning of the semester. See www.gmu.edu/student/drc or call 703-993-2474 to access the DRC.

POLICY ON INCOMPLETES

If circumstances warrant, a written request for an incomplete must be provided to the instructor for approval prior to the course final examination date. Requests are accepted at the professor’s discretion, provided your reasons are justified and that a major percentage of your work has already been completed. Your written request should be regarded as a contract between you and the professor 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.

EVALUATION

Since this is a graduate level course, high quality work is expected of all candidates. Attendance at all classes for the entire class is a course expectation. Each candidate will be evaluated on the basis of participation and satisfactory completion of all projects. In order to qualify for a final grade of A+, a candidate enrolled in EDCI 573 must (in addition to scoring the maximum possible points) participate in all class discussions, activities and projects. When absent from class, candidates are responsible for obtaining the material covered in class and handing in any work that is due. Each project will be assessed using a scoring rubric. All projects are due at the beginning of class on the day they are due. Projects that are late will automatically receive a one third reduction in total points earned. Unit plans and field experience reports are only accepted at the time they are due. The grades in this course will be distributed as follows:

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participation</td>
<td>10%</td>
<td>20 points</td>
</tr>
<tr>
<td>Unit Plan Design &amp; Presentation</td>
<td>35%</td>
<td>70 points</td>
</tr>
<tr>
<td>Field Experience</td>
<td>25%</td>
<td>50 points</td>
</tr>
<tr>
<td>Science Education Philosophy</td>
<td>5%</td>
<td>10 points</td>
</tr>
<tr>
<td>Equity in Science</td>
<td>10%</td>
<td>20 points</td>
</tr>
<tr>
<td>Final Examination</td>
<td>15%</td>
<td>30 points</td>
</tr>
</tbody>
</table>
Total Points Possible | Possible Grade
--- | ---
200 | A+ 
199-195 | A 
194-190 | A- 
189-185 | B+ 
184-180 | B 
179-175 | B- 
174-170 | C+ 
169 -0 | F 

COURSE REQUIREMENTS

1. Participation

This is defined as full attendance, active participation in class discussions and activities, demonstration of positive and collaborative disposition towards colleagues, and satisfactory completion of all project work on time.

2. The Unit Plan

The unit plan is one of the gateways for the Secondary Education Program. You will need to successfully complete this project in order to continue in the program. Your unit plan will reflect your ability to incorporate practical and theoretical aspects of teaching ranging from methods, inquiry-based activities, assessment, materials/technology, classroom management, equity issues and safety. It should focus on a topic or theme that you are interested in and will teach someday (perhaps during student teaching or when you have your own classroom). In addition, it must emphasize inquiry-based instructional approaches, address local, state and national learning standards and equity issues in teaching and learning. You will be required to develop a four-week unit plan, including two weeks (10 hours) of daily lesson plans. To help you prepare your unit plan, you will be provided with instruction and an opportunity to engage in a series of in-class curriculum development activities that will provide you with the skills to design, produce and present your unit plan. Your unit plan will include the following components: title page, acknowledgement (optional), table of contents, introduction, unit statement, audience, description of unit, learning standards, major unit questions and sub-questions, learning objectives, learning activities and instructional methods/strategies, assessment plan, materials and tools required, instructional technology plan, safety plan, unit schedule, evaluation plan, appendices and references.

3. Field Experience
a. The purpose of the field experience is to provide you with the opportunity to (a) relate the goals of EDCI 573, science education theories, concepts and research findings to classroom/school practice, (b) to study and practice in a variety of classroom/school communities, with diverse student populations and (c) to promote critical, self-reflection about your current and future teaching practice.

b. Your field experience should focus on two or more of the following: (a) the teaching process and teacher practices, (b) implementing specific lesson plans, (c) preparing and testing instructional materials with diverse learners, (d) students’ learning styles, (e) student-student and student-teacher interactions, (f) planning, implementing and evaluating specific assessment instruments with diverse learners, (g) teaching and learning with technology, (h) students’ behavior in a specific teaching/learning context, (i) specific classroom management strategies, (j) teacher interaction with students with special needs, (k) teacher interaction with difficult students, (l) parent/caregiver-teacher interactions and (m) observing/participating in after-school/extra-curricular activities (optional).

c. You are required to observe and log-in a total of 15 hours, spread over the semester. During your field experience, you are required to keep detailed field notes, a log sheet indicating dates, times, subject area, grade levels, teachers’ or principals’ signatures and collect any relevant data. At the end of your field experience, you are required to analyze your field notes as well as any other relevant data you collected and prepare a Field Experience Report. Your Report must describe and discuss your guiding study question, background and context, procedure/method of study, data collection and analysis technique(s), summary of findings and implications for policy and practice. When possible you should volunteer as a science fair judge at a local science fair as a part of your 15 hours of field observation (not to exceed 3 hours).

d. Your Field Experience Report must be between 4-5 pages in length excluding cover page, references and appendices. In addition, it must adhere to the following: Margins: 1” on all sides and double spaced. Font: Palatino or times. Font size: 12. Typeface: plain. All pages must be numbered.

4. Science Education Philosophy

The purpose of this project is to provide you with the opportunity to reflect on your past science learning experience and the factors that motivated you to want to become a science teacher. By reflecting on your past experience, accomplishments and challenges in science learning, it is hoped that you will learn something about yourself that will help you become a reflective and lifelong learner. Your science education philosophy must include the following:

a. Your belief system about science, science teaching and learning.
b. Your level of knowledge and confidence in science.
c. Your disposition towards science, science teaching and learning.
d. What informed your belief system about science, science teaching and learning?
e. What do you see as your role and responsibilities as a secondary science teacher?
f. The challenges you anticipate in science and how you hope to address them.
g. Any other related information.
Your science education philosophy must be descriptive and analytical. It should be 1-2 pages in length, 1.5 spacing, font size 12 points, Times, Palatino, Courier or similar fonts. Use headings and paragraph to organize your paper. Put your name, course title, number, section and due date on the upper left hand corner of the first page.

5. **Equity in Science**

The purpose of this project is to help you become aware of equity issues in teaching and learning of science, their implications and how to address them in the science classroom. Working as a team, you will conduct a short on-line research on equity issues in teaching and learning of science at the local, state and national levels. You will identify national, state and local data on disparities in educational attainment, employment, income, housing, poverty and criminal justice by race/ethnicity, gender, class, national origin, disability status, religion and sexual orientation in the U.S. Then you will analyze, summarize and present your data graphically or visually for peer review. Finally, you will submit a 2-3 page report on your equity project.

**The following questions will guide your presentation:**

a. Which groups are most advantaged?
b. Which groups are most disadvantaged?
c. Explain the disparities or inequalities between and within groups?
d. How do these disparities or inequalities relate or influence science teaching and learning at the secondary school level?
e. What could be done to address the disparities or inequalities at the teacher, classroom, school and community level?

**Recommended Websites:**
- [www.census.gov](http://www.census.gov) US Census Bureau
- [www.nces.gov/nationsreportcard](http://www.nces.gov/nationsreportcard) National Center of Education Statistics, US Department of Education
- [www.penk12.va.us](http://www.penk12.va.us) Commonwealth of Virginia Department of Education
- [www.google.com](http://www.google.com)

6. **Final Examination**

The purpose of the final examination is to assess you knowledge and understanding of science education concepts, theories and best practices covered in EDCI 573. The final examination will count for 15% of your final course grade. There will be a review prior to the final examination.
**TENTATIVE COURSE SCHEDULE** (Please note that this course schedule is flexible and may change as the need arises)

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic/Project Work</th>
<th>Project Due Dates</th>
<th>Reading/Supporting Materials</th>
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</thead>
</table>
| **1**  1/24 | Introduction to Course  
•Discussion of the course objectives, teaching/learning method, requirements, readings, activities, assignments and evaluation;  
•Preparing a Field Experience Plan | | Syllabus  
•Outline for preparing a field experience plan  
•Rubric for FEP |
| **2**  1/31 | •State and National Science Education Standards; VADOE, NSTA, NCATE and INTASC  
•Standards and Expectations of Becoming a Secondary Science Teacher  
•Review of Field Experience Plan  
•Formulating a science education philosophy | | Handout  
•Activity sheet on analyzing and interpreting standards  
•Activity sheet on standards and expectations of a secondary science teacher  
Text  
•National Science Education Standards Online  
•Science Standards of Learning for Virginia Public Schools; Science Standards of Learning Curriculum Framework |
Video: A Private Universe |
| **4**  2/14 | •Instructional methods and strategies for teaching secondary school science  
•Matching knowledge, skills and dispositions to instructional methods/strategies | Science Education Philosophy | Handouts  
•Lecture notes on methods and strategies of teaching science at the secondary level |
| **5**  2/21 | •Methods and strategies of assessing students’ science learning at the secondary level  
•Review of standards-based science assessments | | Handouts  
•Lecture notes on methods and strategies of assessing students’ science learning at the secondary level |
|  | **5**  2/21 | Unit Planning-Part I  
•Formulating a unit statement  
•Describing unit audience  
•Defining unit theme, identifying and selecting unit questions  
•Aligning unit questions to learning standards | | Handouts  
•Worksheets for Unit Planning I  
•Rubric for Unit Plan  
Text  
•National Science |
<table>
<thead>
<tr>
<th>6/28</th>
<th>Unit Planning Part II</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Methods and strategies for implementing unit plan</td>
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<tr>
<td></td>
<td>Developing a lesson plan</td>
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<tr>
<td></td>
<td>Identifying and selecting tools and materials</td>
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<tr>
<td>7/07</td>
<td>Unit Planning-Part III</td>
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<tr>
<td></td>
<td>Developing a unit assessment plan</td>
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<tr>
<td></td>
<td>Developing a technology plan</td>
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<td>Developing a unit safety plan</td>
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<td>Developing a unit schedule</td>
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<td>Developing an Evaluation Plan</td>
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<td>3/21</td>
<td>Equity in science</td>
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<td></td>
<td>Managing the science classroom</td>
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<tr>
<td>3/28</td>
<td>Equity in science</td>
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<tr>
<td>4/04</td>
<td>Presentation of Unit Plans</td>
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<tr>
<td>4/11</td>
<td>Presentation of Unit Plans</td>
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<tr>
<td>4/18</td>
<td>Reporting of Field Experience</td>
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<tr>
<td>4/25</td>
<td>Reporting of Field Experience</td>
</tr>
<tr>
<td>5/02</td>
<td>Review for Final examination</td>
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<tr>
<td>5/09</td>
<td>Final Examination</td>
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</tbody>
</table>

**Handouts**
- Worksheets for Unit Planning II
- Lesson plan template
- Lecture notes on methods and strategies teaching secondary science
- Worksheets for Unit Planning III
- Samples of standards-based assessments
- Lecture notes on methods and strategies for assessing secondary science
- Guidelines for preparing equity project
- Rubric for equity project Online
- www.census.gov
- www.nces.gov
- www.penK12.va.us
- www.google.com

BIBLIOGRAPHY


**RECOMMENDED WEBSITES**

http://www.nsta.org (National Science Teachers Association)
http://www.nctm.org (National Council of Teachers of Mathematics)
http://www.nsf.gov (National Science Foundation)
http://www.narst.org (National Association for Research in Science Teaching)
http://www.ascd.org (Association for Supervision and Curriculum Development)
http://www.edweek.org (Education Week)
http://www.nysed.gov (New York State Education Department)
http://www.ed.gov (US Education Department)
http://www.nara.gov (National Archives and Records Administration)
http://www.epa.gov (US Environmental Protection Agency)
http://www.doe.gov (US Department of Energy)
http://www.neh.gov (National Endowment for the Humanities)
http://www.nih.gov (National Institute of Health)
http://www.negp.gov (National Education Goals Panel)
http://www.csteep.bc.edu/TIMSS (Third International Mathematics and Science Study Center)
http://www.spacelink.nasa.gov (NASA)
http://www.un.org (United Nations)
http://www.unesco.org (UNESCO)
http://www.unep.org (UN Environmental Program)
http://www.who.org (UN World Health Organization)
http://www.esrc.ac.uk (UK Economic and Social Research Council)
http://www.sciencenews.org (Science News)
http://www.enc.org (Eisenhower National Clearinghouse for Science and Mathematics Education Reform)
http://www.nctp.com (National Center for Technology Planning)
http://www.iste.org (International Society for Technology in Education)
http://www.concord.org (Concord Consortium-an Research & Development organization that focuses on science, mathematics and technology education)
http://www.terc.edu (Research & Development organization that focuses on science, mathematics and technology education)
http://www.vernier.com (Vernier Software-a company that develops microcomputer-based laboratory materials and tools)
http://www.pasco.com (a company that develops microcomputer-based laboratory materials and tools)