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

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

Professor: Kabba E. Colley, Ed.D.  
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Phone: 703-993-4817  
Email: kcolley@gmu.edu

Classes held at A412 Robinson Hall  
Time: Monday, 7:20-10:00 p.m.  
Office Hours: Monday 5:00-6:00 p.m.  
Wednesday 7:30-8:30 p.m.  
or by appointment

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 TEXTS


REQUIRED ONLINE RESOURCES


RECOMMENDED TEXT


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. Two 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 workshop-based approach. This means that classroom activities and projects will be the driving force for teaching and learning. Major topics in science education such as nature of science, how students learn science, science education standards, methods of teaching science, methods of assessing science learning, equity issues in science and how to manage diverse learners in the science classroom will be presented and discussed. Activities and project work will focus on three main areas: development and presentation of a unit plan, implementation and presentation of a field experience project and microteaching. The role of the professor will be that of a facilitator, leader, participant observer and mentor. Candidates are expected to conduct projects and participate fully in all related classroom discussions and activities. Readings and videos on selected topics in science education will be used to stimulate and drive classroom discussion. This course can be accessed at http://blackboard.gmu.edu and familiarity with BlackBoard is therefore expected.

PROFESSOR’S EXPECTATIONS AND COURSE POLICY

1. Since this is a graduate level course, high quality work is expected of all candidates. Attendance to all classes is a course expectation.

2. When absent from class, candidates are responsible for obtaining the material covered in class and handing in any work that is due.

3. 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.

4. 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.

5. 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 (> 80%) 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.

6. Plagiarism in all its forms is unacceptable and will automatically lead to an F grade in the course.

7. All submitted course work unless specify, must be typed or word-processed. Course work not typed or word-processed will not be accepted.
8. Collaboration between candidates in conducting activities and projects is encouraged. However, each candidate must submit independent work. Copied work (i.e. when two people submit the same work) will be treated as cheating and will result in a lower grade and/or failure.

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.

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. Participation will be graded based on satisfactory/not satisfactory and timely completion of assigned in-class work, assigned out-of-class work and presentations of work. In this course assigned out-of-class course work will also include a group field trip to the Marian Koshland Science Museum of the National Academy of Sciences in Washington, DC. The field trip will take place on a Saturday morning and will replace one Monday class.

2. The Unit Plan

The unit plan is one of the gateway performance assessments in the Secondary Teacher 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 science education ranging from science teaching 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, equity issues and application of technology.
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, author’s statement of science education philosophy, unit statement, audience, description of unit, learning standards, major unit questions and sub-questions, learning objectives, instructional methods/strategies and learning activities, assessment plan, materials and tools required, instructional technology plan, safety plan, equity issues, unit schedule (including lesson plans), evaluation plan, appendices and references.

Throughout the development of your unit plan, you will be required to reflect on your work-in-progress and share your thought both informally (during class discussions) and formally (at the end of the unit development) in the form of a unit presentation. The unit presentation will focus on a single lesson selected from your unit plan. You will then prepare and teach the lesson to an audience of your peers. Your teaching will be videotaped, then reviewed and discussed with your peers (microteaching). The purpose of this exercise is to prepare you for the task of presenting (delivering) your ideas in front of an audience. In addition, it will help you become reflective by seeing your work through the eyes of your peers. The lesson you will teach should address the needs of diverse learners, at least two SOLs, incorporates technology and integrate science with other subjects. Prior to teaching the lesson, you must submit a copy of your plan to the professor. You should also make enough copies of handouts you want to distribute in class. Your lesson plan should be reduced to 1 page in length and follow the EDCI 573 Lesson Plan Template available at http://blackboard.gmu.edu.

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. Final Examination

The purpose of the final examination is to assess you knowledge and understanding of unit planning, 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.

EVALUATION

The evaluation of candidates in this course will be based on a point-system (i.e. a total of 200 points). Candidates will be provided with instruction, support materials, mentoring, “time-for-project completion” and scoring rubrics to guide them in the preparation of their work. In return, it is expected that candidates will follow all project guidelines and requirements as well as submit high quality work. Each candidate will be evaluated on the basis of participation and satisfactory completion of all projects. The grades in this course will be distributed as follows:

<table>
<thead>
<tr>
<th>Participation</th>
<th>25% = 50 points</th>
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<tbody>
<tr>
<td>Unit Plan Design &amp; Presentation</td>
<td>35% = 70 points</td>
</tr>
<tr>
<td>Field Experience</td>
<td>25% = 50 points</td>
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<tr>
<td>Final Examination</td>
<td>15% = 30 points</td>
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<table>
<thead>
<tr>
<th>Total Points Possible</th>
<th>Possible Grade</th>
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<tbody>
<tr>
<td>200-195</td>
<td>A+</td>
</tr>
<tr>
<td>194-190</td>
<td>A</td>
</tr>
<tr>
<td>189-185</td>
<td>A-</td>
</tr>
<tr>
<td>184-180</td>
<td>B+</td>
</tr>
<tr>
<td>179-175</td>
<td>B</td>
</tr>
<tr>
<td>174-170</td>
<td>B-</td>
</tr>
<tr>
<td>169-165</td>
<td>C+</td>
</tr>
<tr>
<td>164-0</td>
<td>F</td>
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</tbody>
</table>
**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>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><strong>Introduction to Course</strong>&lt;br&gt;•Discussion of the course objectives, teaching/learning method, professor’s expectations and course policy, college expectations and university honor code, requirements, readings, activities, projects, assignments and evaluation;&lt;br&gt;•Preparing a Field Experience Plan</td>
<td></td>
<td>Syllabus&lt;br&gt;•Outline for preparing a field experience plan&lt;br&gt;•Rubric for FEP</td>
</tr>
<tr>
<td>2</td>
<td><strong>Review of Field Experience Plan</strong>&lt;br&gt;•Science Education Standards (VA DOE, NSES, NSTA and INTASC)&lt;br&gt;•Expectations of Becoming a Secondary Science Teacher&lt;br&gt;•Nature of science and how students learn science.</td>
<td></td>
<td>Handout&lt;br&gt;•Activity sheet on analyzing and interpreting standards&lt;br&gt;•Activity sheet on standards and expectations of a secondary science teacher&lt;br&gt;Text&lt;br&gt;•National Science Education Standards Online&lt;br&gt;•Science Standards of Learning for Virginia Public Schools; Science Standards of Learning Curriculum Framework Article&lt;br&gt;•McComas (2004) Article in Science Teacher, Vol. 71, No. 9, pp. 24-27.&lt;br&gt;Video: A Private Universe</td>
</tr>
<tr>
<td>3</td>
<td><strong>Instructional methods and strategies for teaching secondary school science</strong>&lt;br&gt;•Matching knowledge, skills and dispositions to instructional methods/strategies</td>
<td></td>
<td>Handouts&lt;br&gt;•Lecture notes on methods and strategies of teaching science at the secondary level</td>
</tr>
<tr>
<td>4</td>
<td><strong>Methods and strategies of assessing students’ science learning at the secondary level</strong>&lt;br&gt;•Review of standards-based science assessments&lt;br&gt;•Managing the science classroom</td>
<td>One page summary report of the application of Sampson’s SMOP</td>
<td>Handouts&lt;br&gt;•Lecture notes on methods and strategies of assessing students’ science learning at the secondary level Article&lt;br&gt;Sampson (2004) Article in Science Teacher, Vol. 71, No. 10, pp. 30-33.</td>
</tr>
</tbody>
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**September 5, 2005 Labor Day University Closed**
<table>
<thead>
<tr>
<th>Date</th>
<th>Unit Planning</th>
<th>Description</th>
<th>Handouts</th>
</tr>
</thead>
</table>
| 10/03      | Unit Planning-Part I | •Formulating a science education philosophy  
•Formulating a unit statement  
•Describing unit audience  
•Defining unit theme, identifying and selecting unit questions                                                                                           | Handouts  
•Worksheets for Unit Planning I  
•Rubric for Unit Plan Text  
•National Science Education Standards Online  
•Science Standards of Learning for Virginia Public Schools  
•Science Standards of Learning Curriculum Framework  
•Benchmarks for Science Literacy |
| 10/10      | Unit Planning Part II | •Aligning unit questions to learning standards  
•Formulating learning objectives  
•Methods and strategies for implementing unit plan                                                                                                   | Handouts  
•Worksheets for Unit Planning II  
•Lecture notes on methods and strategies teaching secondary science |
| 10/17      | Unit Planning-Part III | •Developing a lesson plan  
•Identifying and selecting tools and materials  
•Developing a unit assessment plan                                                                                                               | Handouts  
•Worksheets for Unit Planning III  
•Lecture notes on methods and strategies for assessing secondary science  
•Lesson Plan Template |
| 10/24      | Unit Planning-Part IV | •Developing a technology plan  
•Developing a unit safety plan  
•Identifying unit equity issues and developing a unit equity statement                                                                               | Handouts  
•Worksheets for Unit Planning IV |
| 10/31      | Unit Planning-Part V | •Developing a unit schedule  
•Developing an Evaluation Plan                                                                                                                                                                                | Handouts  
•Worksheets for Unit Planning V |
| 11/07      | Presentation of Unit Plans |                                                                                                                                                                                                              |                                                                                           |
| 11/14      | Presentation of Unit Plans |                                                                                                                                                                                                              |                                                                                           |
| 11/21      | Reporting of Field Experience |                                                                                                                                                                                                              | Unit Plan                                                                                     |
| 11/28      | Reporting of Field Experience |                                                                                                                                                                                                              |                                                                                           |
| 12/05      | Review for Final examination |                                                                                                                                                                                                              |                                                                                           |
| 12/12      | Final Examination |                                                                                                                                                                                                              | Field Experience Report |
# RECOMMENDED CHAPTER READINGS

<table>
<thead>
<tr>
<th>Week</th>
<th>Chapter Readings</th>
</tr>
</thead>
</table>
| 1 8/29 | Syllabus  
• *Outline for preparing a Field Experience Plan*  
• *Rubric for FEP*  
• *Letter of Introduction for Field Experience* |
| 2 9/12 | Chiappetta and Koballa (2006) Chapter 1, 2, 7 & 9  
Hassard (2005) Chapter 1, 3 & 5 |
Hassard (2005) Chapter 6 |
Hassard (2005) Chapter 8 & 10 |
| 5 10/03 | Chiappetta and Koballa (2006) Chapter 3 & 16  
Hassard (2005) Chapter 4 & 7 |
| 6 10/11 TUESDAY CLASS REPLACES A MONDAY CLASS | Chiappetta and Koballa (2006) Chapter 3 & 16  
Hassard (2005) Chapter 4 & 7 |
| 7 10/17 | Chiappetta and Koballa (2006) Chapter 3, 6 & 16  
Hassard (2005) Chapter 7, 8 & Appendix C |
| 8 10/24 | Chiappetta and Koballa (2006) Chapter 8, 12, 14 & 15  
Hassard (2005) Chapter 2, 10, 11 & 12 |
| 9 10/31 |  |
| 10 11/07 | Presentation of Unit Plans |
| 11 11/14 | Presentation of Unit Plans |
| 12 11/21 | Reporting of Field Experience |
| 13 11/28 | Reporting of Field Experience |
| 14 12/05 | Review for Final Examination |
| 15 12/12 | Final Examination |

# PERFORMANCE BASED ASSESSMENTS

Scoring rubrics for the Field Experience Report, Unit Plan and Presentation will be posted on BlackBoard.gmu.edu by the second week of class.
BIBLIOGRAPHY


**RECOMMENDED WEB SITES**

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.doenergy.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)