I. Course Description
Emphasizes inquiry and extensions of theoretical understanding of how children learn. Helps students develop expertise in teaching and assessment and incorporate technology, safety, and issues of culture and gender into the experiences of day-to-day teaching activities. Prerequisite: Completion of elementary education (PK-6) licensure and EDCI 631.

II. Learning Outcomes
This course will enable students to:
A. Further develop your content knowledge base in science through a hands-on, inquiry-based approach that includes investigative problem-solving;
B. Build a repertoire of science teaching and assessment strategies by reading, writing, observing, participating in, and reflecting on the teaching and learning of science;
C. Build a repertoire of science teaching and assessment strategies using technology to help students become scientifically literate, think critically and creatively, understand the nature of science, and see relationships among science, technology, and society;
D. Predict safety issues when preparing for a hands-on classroom experience;
E. Reflect on teaching practices through videotape analysis;
F. Collect a variety of materials for future use in your classroom;
G. Examine science curricula and methods with respect to “Science for All” and standards documents at local, state, and national levels;
H. Critique, adapt, and construct standards-based lessons including assessment and hands-on experiences for the diverse needs of learners including gender equity, cultural diversity, English language learners, high and low achievement, and the physically, socially, and emotionally challenged; and
I. Conduct research on student learning.

III. Relationship to Program Goals and Professional Organizations
The Five Core Propositions of the National Board for Professional Teaching Standards:
I. Teachers are committed to students and their learning.
II. Teachers know the subjects they teach and how to teach those subjects to students.
III. Teachers are responsible for managing and monitoring student learning.
IV. Teachers think systematically about their practice and learn from experience.
V. Teachers are members of learning communities.

ACEI:
2c. Candidates know, understand, and use fundamental concepts in the subject matter of science—including physical, life, and earth and space sciences—as well as concepts in science and technology, science in personal and social perspectives, the history and nature of science, the unifying concepts of science, and the inquiry processes scientists use in discovery of new knowledge to build a base for scientific and technological literacy.

Technology (ISTE NETS):
I. Teachers demonstrate a sound understanding of technology operations and concepts.
II. Teachers plan and design effective learning environments and experiences supported by technology.
III. Teachers implement curriculum plans that include methods and strategies for applying technology to maximize student learning.
V. Teachers use technology to enhance their productivity and professional practice.
### Student Outcomes Referenced to Selected National Standards

<table>
<thead>
<tr>
<th>Learning Outcomes</th>
<th>NBPTS</th>
<th>ACEI</th>
<th>ISTE NETS</th>
</tr>
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<tbody>
<tr>
<td>A</td>
<td>I, II, III, IV, V</td>
<td>2c</td>
<td>I, V</td>
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<tr>
<td>B</td>
<td>I, II, III, IV, V</td>
<td>2c</td>
<td>I, II, III, V</td>
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<tr>
<td>C</td>
<td>I, II, III, IV, V</td>
<td>2c</td>
<td>I, V</td>
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<tr>
<td>D</td>
<td>I, II, III, IV, V</td>
<td>2c</td>
<td>I, V</td>
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<tr>
<td>E</td>
<td>I, II, III, IV, V</td>
<td>2c</td>
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<td>F</td>
<td>I, II, III, IV, V</td>
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<td>G</td>
<td>I, II, III, IV, V</td>
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<td>H</td>
<td>I, II, III, IV, V</td>
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<td>I, V</td>
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<tr>
<td>I</td>
<td>I, II, III, IV, V</td>
<td>2c</td>
<td>I, V</td>
</tr>
</tbody>
</table>

Key:
- ISTE NETS = International Society for Technology in Education National Education Technology Standards 2000
- NBPTS = National Board for Professional Teaching Standards
- ACEI = Association for Childhood Education International

### IV. Nature of Course Delivery

Science is everywhere around us. Turning on our lights at night, baking a cake, throwing a basketball while expecting someone to catch it, and taking care of our bodies are just a few examples of how we use concepts in science on a daily basis. Research on student learning and motivation shows that effective teaching is *grounded in students’ prior experiences* and provides ample opportunities for students to *explore* more of their natural world in a *social* context. Through these opportunities, students gain new conceptual knowledge and skills while increasing their overall interest in the science discipline. In this course you will be exposed to a variety of content, curricula, and methods designed to shape your future teaching practices so that your future students will be motivated learners in your classroom.

Further research on the effects of increased conceptual knowledge and skills shows that education is a tool of *empowerment*. The aim of this course is to provide you with numerous experiences in science teaching to empower you as you strive to become an effective elementary classroom teacher. As you utilize experiences gained in this course while continuing in your life-long learning and development of your teaching practices, you will become more and more capable of providing experiences in your classroom that, in turn, will empower your own students to make informed decisions, seek new opportunities, and continue in their progress as life-long learners.

### V. Required Texts & Readings

**Standards:**

**Textbook:**

**Course Articles:**
Special Needs Website Resources:

- Northwest Regional Educational Laboratory, It’s Just Good Teaching
- Cultural Inquiry Process ([http://classweb.gmu.edu/cip/r/r-ind.htm](http://classweb.gmu.edu/cip/r/r-ind.htm))
- Inclusion in Science Education for Students with Disabilities. [http://www.as.wvu.edu/~scidis/](http://www.as.wvu.edu/~scidis/)

National Science Teachers Association:

- National Science Teachers Association ([http://www.nsta.org](http://www.nsta.org)) Please join NSTA or your subject area national society.

VI. Course Requirements

<table>
<thead>
<tr>
<th>Products</th>
<th>Learning Outcomes</th>
<th>NBPTS</th>
<th>ACEI</th>
<th>ISTE NETS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Science Share-a-thon (20%)</td>
<td>A, C, D, E, F</td>
<td>1, 2, 3, 4, 5</td>
<td>2c</td>
<td>I, II, III, V</td>
</tr>
<tr>
<td>Videotape analysis (20%)</td>
<td>E, I</td>
<td>1, 2, 3, 4, 5</td>
<td>2c</td>
<td>I, V</td>
</tr>
<tr>
<td>Special Needs Action Research Project (40%)</td>
<td>A, B, C, D, G, H, I</td>
<td>1, 2, 3, 4, 5</td>
<td>2c</td>
<td>I, II, III, V</td>
</tr>
<tr>
<td>Mini-Assignments (20%)</td>
<td>A, B, C, D, E, F, G, H, I</td>
<td>1, 2, 3, 4, 5</td>
<td>2c</td>
<td>I, II, III, V</td>
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</tbody>
</table>

1. **Science Share-a-thon**  
   20%  
   Develop teacher notes on content related to the activity to illustrate your knowledge and understanding of fundamental concepts in the subject matter of physical, life, earth, and space sciences. Develop/modify a student sheet that you would use to structure your particular students’ completion of the activity to support science learning. Bring enough copies of this student sheet for everyone in class. Teach the activity in class. Reflect on the following:
   - What are the investigative skills that students are to learn during your selected grade level?
   - How are each of these particular skills used during your activity?
   - What do you like about the activity?
   - What do you not like about the activity?
   - How would you improve the activity?
   - What are the safety hazards involved and what would you do to prevent them?
   Share these reflections briefly in class. Email a copy of your entire assignment to your instructor via email for posting on blackboard.

2. **Videotape Analysis**  
   20%  
   You will videotape yourself teaching twice, once in February and once in March. All videotapes are to be watched by you and analyzed. The first tape will be analyzed in written format (1 double-spaced page). The second tape will be analyzed in written (1 double-spaced page) and oral format as you share one short clip from your last videotape in class. For your written and oral analyses, describe the science being taught, the teaching strategies being used, and the students’ reactions. Focus on what worked, what didn’t, and how to improve next time. Consider including information about the classroom setting and environment, management of equipment and students, the amount of time the students actually spend doing science, and the questions and questioning technique used by you. During your oral analysis, be sure to share:
   - What did you do and how did you do it?
• What worked well?
• What needs to be changed?
• How would you change it?

Written portion of assignment may be submitted via email or by paper.

3. Special Needs Action Research Project  40%

For this project, you will conduct research on adapting instruction to meet the special needs of students in order to extend or improve their understanding of science. You will conduct research on special needs students, adapt a two week unit of study for students with special needs, implement your plans, and assess the students’ understanding of the science taught. The confidentiality of all students and all school personnel will be maintained at all times. No last names will be used. The research findings from your study will be presented in class and all artifacts will be compiled in one notebook that includes a table of contents and tabbed sections. See the schedule for due dates for drafts of your work in progress. The project consists of these parts:

- Gathering Information About Special Needs and Your Students
- Planning for Teaching and Assessing Student Understanding
- Implementing Plans and Data Collection
- Data Analysis
- Collaborative Action Research Presentation and Findings Notebook

Each teacher will conduct research on the learning of four students from different special needs categories - English Language Learners, gifted and talented, learning disabled, socially or emotionally challenged, and physically handicapped.

Gathering Information. You will start your research by gathering information on students to meet their special needs. There are three parts to gathering information. They are:

- Observation – class and students
- Interviews – experts and students
- Readings – texts and other library/online information

The research will start by gathering information. You will observe students in a classroom situation. You will create interview questions for the students and available experts. The interview will be a casual conversation that takes no longer than five minutes depending upon developmental level of the child. Talk to school specialists and experts in the field as they are willing. Further your research by reading text materials and online information.

Planning for Teaching and to Assess Student Understanding. Research indicates that curriculum alignment of the intended, implemented, and attained curriculum leads to increases in student learning. You will outline the unit (~ 2 weeks) being taught for this project and your plan for adaptations in instruction and assessment for special needs students. The unit overview (~ 2 pages) will consist of:

- Description of Students in Class
  In a very brief overview, describe the audience for which the unit of study is designed.
- Theme
  This is the topic for the unit of study during this research.
- Unit Question
  This is the question that the students will be investigating about the theme/unit.
- Sub-questions (~1-2/week)
  List 2-5 sub-questions for the unit.
- National Science Education Standards
  List 1-3 standards from the National Science Education Standards that will be addressed in the unit of study. Also include the code for each standard.
- Standards of Learning for VA Public Schools
  List approximately 3 standards from the Standards of Learning that this unit addresses. Also include the code for each standard.
- Assessment Plan Overview
  Summarize the multiple forms of assessment that will be embedded in the unit. There should be clear connections among the unit question, sub-questions, and what is assessed. Describe how the students’ learning will be assessed both formally (graded) and informally (not graded).
- Adapted Activities
Include a brief description of where the adapted activities that you have developed fit into the unit. Adaptations for the unit will be described in the individual student case studies.

**Implementing Plans and Data Collection.** You will conduct collaborative action research to investigate student conceptual understanding of the science for the unit you are teaching and adapting to special needs students. You will develop instruments to assess student understanding. You will collect samples of student work that you will analyze. For example, you could collect worksheets, laboratory reports, tests, and pre- and post writing samples. In addition, you will create diagnostic, formative, and summative assessment instruments to assess the students understanding of the intended curriculum. These instruments will be planned for all students and further adapted as needed for the special needs students.

**Diagnostic**

3 formats for assessment & multiple question

**Formative**

3 formats for each assessment & multiple question

**Summative**

3 formats for assessment & multiple question

**Confirmatory**

3 formats for assessment & multiple question

The diagnostic, formative, and summative assessment cycle can be embedded into any unit of study whether it is a day, week, month, or yearlong. Diagnostic assessment is done at the beginning before the unit starts and is generally not graded. Formative assessment is short assessments done throughout the teaching of the unit, preferably daily. Formative assessments can be formal or informal, and graded or ungraded. Summative assessment is done at the end of the unit and is generally graded. Confirmatory assessment is done at a later time to see how enduring the learning is. Time is not sufficient to conduct confirmatory assessment as part of this research project. Three formats of questions or tasks on each assessment instrument are ideal for research triangulation. However, common sense needs to align subject matter, pedagogy, time, and resources. Effective questions include higher-level thinking.

Assessment instruments will be created and contain multiple formats designed to demonstrate learning (i.e. drawing, performance, short essay, multiple choice). All assessment data collected needs to be analyzed beyond just grading for evidence of understanding or misunderstanding. You will do your analysis first on the whole class and then specifically for each of the special needs categories you are studying. You will also analyze the effectiveness of the assessment instruments that you created.

**Collaborative Action Research Findings and Presentation.** Data analysis will be done qualitatively and quantitatively, through observation and analysis of student work. It will not only be conducted for each instrument used for assessment, but also across all instruments. You are looking for trends/patterns for what works and what doesn’t. You will also analyze the effectiveness of each instrument in assessing student understanding. (If you know statistical analysis procedures that are appropriate for your data, you are encouraged to use them in your analysis. However, learning statistical analysis and graphical representation of data is not an expectation for this project.)

You will present your collaborative action research findings to the class using PowerPoint. You will be allotted 15 minutes for your presentation. As part of this presentation, you will tell us about your students, explain adaptations that you made for them in your teaching, how you assessed their understanding, how you analyzed the results, and what you learned. You will show samples of student work as appropriate to illustrate your points so that your classmates can see and learn more about special needs adaptations.

Your final report will be in one notebook and have a table of contents and tabbed sections. It will include:

1. printout of PowerPoint presentation
2. unit plan overview
3. case study reports (1 for each special needs student)
   - case study (1-2 pages)
Mini-Assignments  20%
Periodically, you will be asked to bring in articles, samples of student work, written reflections from your textbook and teaching experiences, or provide written reflections in class on a particular topic/theme. According to the instructor, reflections will be submitted by email, written in class, or brought typed to class.

Special Note for All Projects:
Descriptions of expectations for each project can be found in the syllabus and in course documents on Blackboard in “Assignments” when necessary. Project work will be evaluated according to rubric expectations. Projects may be resubmitted based on instructor feedback and resubmitted once for re-scoring. Correct grammar and mechanics are expected of graduate students; work submitted with numerous errors may be returned to the student for editing before grading. APA style is required. All work must be submitted on the date due by 11:59PM unless prior arrangements are made with the instructor. The faculty coordinates due dates, so extensions should only be requested when absolutely necessary. Work that is submitted late without consulting the instructor will have points subtracted.

VII. Course Schedule

<table>
<thead>
<tr>
<th>Session</th>
<th>Topic/Learning Experiences</th>
<th>Readings &amp; Assignments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wednesday, January 25</td>
<td>--Discussion: Syllabus&lt;br&gt;-- NOS Surveys&lt;br&gt;-- Complete information sheet</td>
<td>-- Read The Nature of Science, Benchmarks for Science Literacy.&lt;br&gt;-- Read chapter 1 and 2 of textbook</td>
</tr>
<tr>
<td>Wednesday, February 1</td>
<td>--Discussion: What is NOS?&lt;br&gt;-- Discussion: Investigation at the elementary level and the National Science Standards&lt;br&gt;-- Science Share-a-thon by ________________________&lt;br&gt;--- --First video written analysis due&lt;br&gt;-- Read chapter 4 and 7 of textbook&lt;br--+Bring Science SOLs and Science Curriculum Frameworks to every class</td>
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<tr>
<td>Wednesday, February 8</td>
<td>--- Discussion: Safety&lt;br&gt;-- Discussion: Learning Cycles in Science&lt;br&gt;-- Discussion: Science Curriculum Frameworks (bring to every class)&lt;br&gt;-- Science Share-a-thon by ________________________&lt;br&gt;--- --Second video written and oral analysis due</td>
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<tr>
<td>Wednesday, March 1</td>
<td>--Discussion: Science for all students&lt;br&gt;--Discussion: Assessment&lt;br&gt;-- Science Share-a-thon by ________________________&lt;br&gt;--- --Gathering Information due&lt;br&gt;-- Read NWREL – Lrnng Dis.; CREST – preview; Haycock; and about your students</td>
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<tr>
<td>Wednesday, March 8</td>
<td>--Oral presentations from videotaping&lt;br&gt;--Discussion: Action research&lt;br&gt;NO CLASS – GMU SPRING BREAK&lt;br&gt;-- --Gathering Information due&lt;br&gt;-- Read NWREL – Lrnng Dis.; CREST – preview; Haycock; and about your students</td>
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<tr>
<td>Wednesday, March 22</td>
<td>--Discussion: Action research&lt;br&gt;Discuss readings/interviews&lt;br&gt;Planning/Collaborating&lt;br&gt;Learning Disabilities (LD)&lt;br&gt;NO CLASS – GMU SPRING BREAK&lt;br&gt;-- --Gathering Information due&lt;br&gt;-- Read NWREL – Lrnng Dis.; CREST – preview; Haycock; and about your students</td>
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<tr>
<td>Date</td>
<td>Activity</td>
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</tbody>
</table>
| Wednesday, March 29 | Discussion: Action research  
Discuss readings/interviews  
Planning/Collaborating  
Physical Disabilities – safety  
Social-Emotional  
Gifted and Talented (GT)  
--Science Share-a-thon by
--Plan and Teach/Assess  
--Read – Physical Dis; Social-Emot; NWREL – Gifted; and about your students |
| Wednesday, April 5 | Discussion: Action research  
Multicultural Dialogue and English Language Learners  
--Science Share-a-thon by
--Implementing/Analyzing due  
--Read Gallard; NWREL – Eng. LL; and about your students |
| Wednesday, April 12 | Discussion: Action research  
--Read about your students |
| Wednesday, April 19 | Discussion: Action research  
Gender Equity  
Plan presentation and notebook  
--Data analysis due  
--Read about your students |
| Wednesday, April 26 | Presentations: Action research  
--Presentation: Action research |
| Wednesday, May 3  | Presentations: Action research  
--Course Evaluations and data collection  
--All notebooks due by this date |

VIII. UNIVERSITY POLICIES
The university has a policy that requests students to turn off pagers and cell phones before class begins. The Graduate School of Education (GSE) expects that all students abide by the following:

**HONOR CODE**
To promote a stronger sense of mutual responsibility, respect, trust, and fairness among all members of George Mason University and with the desire for greater academic and personal achievement, George Mason University has set forth a code of honor that includes policies on cheating and attempted cheating, plagiarism, lying and stealing. Students must follow the guidelines of the University Honor Code. See [http://www.gmu.edu/catalog/apolicies/#TOC_H12](http://www.gmu.edu/catalog/apolicies/#TOC_H12) for the full honor code.

**INDIVIDUALS WITH DISABILITIES POLICY**
The university is committed to complying with the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990 by providing reasonable accommodations for applicants for admission, students, applicants for employment, employees, and visitors who are disabled. Students 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](http://www.gmu.edu/student/drc) or call 703-993-2474 to access the DRC.

**ATTENDANCE POLICY**
Students are expected to attend the class periods of the courses for which they register. Although absence alone is not a reason for lowering a grade, students are not relieved of the obligation to fulfill course assignments, including those that can only be fulfilled in class. Students who fail to participate (because of absences) in a course in which participation is a factor in evaluation, or students who miss an exam without an excuse, may be penalized according to the weighted value of the missed work as stated in the course syllabus (GMU University Catalog, pg. 32).

**PROFESSIONAL BEHAVIOR & DISPOSITIONS**
Students are expected to exhibit professional behavior and dispositions. See [www.gse.gmu.edu](http://www.gse.gmu.edu) for a listing of these dispositions.

Students must agree to abide by the university policy for Responsible Use of Computing. See [http://mail.gmu.edu](http://mail.gmu.edu) and click on Responsible Use of Computing at the bottom of the screen.

Approved March 2004