"Every student is a multidimensional human being, a person with a heart, a mind, and a soul, with hopes, dreams, aspirations, and capacities that must be embraced if productive growth and learning is to take place." (Ayers, 2001, p. xiii)

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Office Hours: Tues and Thurs 10:00-12:30

Term: Summer 2008
Class: MC 231
4 credit hours
Mon, Tues, & Thurs 12:40-4:00 pm

Course Description:
The aim of this course is to critically examine the links between current research and practice in science education. There will be a particular focus on the concept of “teaching for understanding”, and exploring the implications of applying this concept in urban settings with diverse student populations. The links between standards, curriculum, pedagogy and assessment will be emphasized.

Goals:
Participants in this course will:
1. Investigate a wide variety of strategies that can be used to facilitate professional learning.
2. Examine leadership issues in science education.
3. Become conversant with current issues in research in science education such as the uses of technology, inquiry-based instruction, nature of science, conceptual change theory, curriculum alignment, problem solving, etc.
4. Develop a clear and coherent personal teaching philosophy statement about teaching for understanding;
5. Investigate a variety of teaching and assessment strategies aligned with the NSES and Ohio Academic Content Standards;
6. Develop proficiency and confidence with all available technologies for enhancing the teaching and learning of science.
7. Reflect critically on the links between their own professional development and improving students’ understanding of mathematics concepts.

Accommodation of student needs:
Students needing special arrangements for test taking, note taking, special print or other considerations for successful completion of the course should contact the instructor as soon as possible.
Required Texts:

Recommended Texts:

Selected Journal Articles and Book Chapters:
Recommended Journals:
*Science Scope
Journal of Research in Science Teaching
*Science and Children
*The Science Teacher
International Journal of Science Education
Science Education
School Science and Mathematics

*National Science Teachers’ Association: Membership of NSTA is a great resource. The membership includes subscription to one of the three journals they produce for teachers (see the asterisked journals in the list above), so pick the one that is right for you. Enroll online at the NSTA website http://www.nsta.org/

World wide web resources

Electronic Course Reserves:
Additional readings for the course to assist you with the research and writing of your short answer papers or research proposal will be available through the Electronic Course Reserves on the CSU library site. Go to this web site http://scholar.csuohio.edu/screens/m_course.html and search for “Jackson”, then click on “EDT 517”

Blackboard
Throughout the course we will utilize the Blackboard learning environment. You can get to the Blackboard gateway at https://wct-app.csuohio.edu/webct/entryPageIns.dowebct We will be using the Blackboard system to share thoughts and reflections about the class. Many other resources will be posted to this web site, and we will review these each week in class.

Resources from Blackboard:
Ohio Resource Center – www.ohiorc.org
National Middle Level Science Teachers’ Association – www.nmlsta.org
National Science Teachers’ Association – www.nsta.org
My web page – http://academic.csuohio.edu/jackson_d
Assessment and Grading

Assignments Summary:
1. Participation and attendance (10%)
2. Choose either: (30%)
   a. Curriculum project
   b. Research project proposal
   c. Short papers
3. Group presentation of strategies from Loucks-Horsely, Love, Stiles, Mundry, & Hewson (25%)
4. Responses on Blackboard (10%)
5. Final paper (25%)

Grading
Students will receive a letter grade at the completion of all course requirements.
NOTE: Students must perform satisfactorily (C or better) on all components to pass the course.

<table>
<thead>
<tr>
<th>Grade Scale</th>
<th>A</th>
<th>100 - 93 %</th>
<th>A-</th>
<th>92 - 90%</th>
</tr>
</thead>
<tbody>
<tr>
<td>B+</td>
<td>89 - 87%</td>
<td>B</td>
<td>86- 83%</td>
<td>B-</td>
</tr>
<tr>
<td>C+</td>
<td>79 - 77%</td>
<td>C</td>
<td>76 - 73%</td>
<td>C-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>F</td>
<td>&lt;70%</td>
<td></td>
</tr>
</tbody>
</table>

NA = Never Attended class
IN = Incomplete. IN “maybe given to students who are unable to complete the last three weeks of a semester because of factors beyond their control. Appropriate documentation is required.”

Assignment Details

1. Attendance
Colleagues must be in attendance at least 80% of the classes (10 of the 12 class sessions) unless you have religious or health reasons preventing you from attending. Attendance and participation are vital aspects of this course. One point will be deducted from your total score for each un-excused absence. Absences for valid medical or religious reasons will be excused with appropriate documentation. Participation will be judged each week by the instructor based on your readiness to contribute to discussions of the assigned readings and your general participation in class activities. Points will be deducted for lack of participation in discussions, lack of preparation of assigned readings, or persistent tardiness. Attendance and participation includes your presence in and contribution to online activities.
Participants will be randomly assigned to one of five groups and be assigned a strategy or group of strategies to present to the class. Presentations will last for approximately 35 minutes, with time at the end of each for a short written evaluation; the rubric can be found on Blackboard. A one-page handout summarizing the presentation should be prepared for the rest of the class. Presentations should include a summary of the material covered in the book, as well as Internet resources to support this model (which will be posted to the Blackboard site). Presentations should highlight the good and bad features of each strategy or group of strategies. Where appropriate and/or possible, local, personal or other relevant examples of the implementation of this model should be presented.

<table>
<thead>
<tr>
<th>#</th>
<th>Topic</th>
<th>Text Reference</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Action Research</td>
<td>pp 161-168</td>
<td>6-23-08</td>
</tr>
<tr>
<td>2</td>
<td>Curriculum implementation, replacement units, development and adaptation</td>
<td>pp 254-264, 312-319, 326-330</td>
<td>6-30-08</td>
</tr>
<tr>
<td>3</td>
<td>Immersion with scientist or mathematician</td>
<td>pp 192-203</td>
<td>7-7-07</td>
</tr>
<tr>
<td>4</td>
<td>Partnerships with scientists in business and industry, professional networks</td>
<td>pp 140-146</td>
<td>7-14-07</td>
</tr>
<tr>
<td>5</td>
<td>Lesson study</td>
<td>pp 184-192</td>
<td>7-21-07</td>
</tr>
</tbody>
</table>

3. Responses on Blackboard
You will be expected to either post a summary of the class activities and assigned readings for a given week, or respond to someone else’s posting. Two or three people will be assigned to be recorders each week, and there are 5 weeks for recording, so you will you will record once. If you are the assigned recorder for that week, include your thoughts and feelings about the assigned readings and class activities, and how these might impact you in your classroom. Feel free to question and challenge the ideas presented – you are expected to be a “critical reader”. Recorders are asked to have their posting completed by the Sunday evening at the end of each week. Responses are due by the next Thursday.

If you are responding to a posting, you should state whether you agree or disagree with the recorders’ statements, and add any comments of your own. You should also reference any incidents that have occurred in your classroom that are related to the week’s reading or activity, whether you are recording or responding. This will assist you in preparing your final paper for this course, which is outlined in the next section. It is hoped that this dialogue will develop a “community of learners” within the group, so that as you change and embrace new ideas, you are supporting one another through constant feedback and dialogue.
4. Final Paper
The purpose of this paper is for you to reflect on the experiences you have had that have impacted or will potentially impact your philosophy of teaching and learning science.

You must include at least one part of this course (EDC 517), and must you must describe three different activities (which may all be from EDC 517, but may include other experiences you have had). There is a ten-page limit (double-spaced) on this paper, so you will need to be prudent in your choice of which activities to focus on.

For each activity you choose, describe in detail the activity, its significance, and its impact (or potential impact) on student learning. If documentation is provided, reference should be made to the appropriate parts of the additional documentation throughout your written description.

You should restrict yourself to activities that have occurred in the past two years if possible. Choose a variety of activities that you can identify as being “turning points” for you in your teaching or in your thinking about teaching, your leadership skills or capacity or readiness to be a leader, or in your general professional development. Remember the focus should be on how the particular activity has impacted or will impact your teaching and on your students learning, either in your own classroom or in the classrooms of your colleagues if you are involved with providing professional development for them.

The documentation you should provide can include quotes from your weekly entries on the Blackboard discussion board, any other papers submitted in this course or other graduate courses, anecdotal evidence from conversations you have had with colleagues in your building, or any other kind of documentation that will enable me to understand how this activity has impacted your teaching or your students’ learning.

At the end of the paper, write a one page interpretive summary linking all three activities you have chosen, describing the overall influence of all three activities combined on the development of your teaching philosophy. The summary should identify patterns and reflect on the significance of your accomplishments taken together. You should restate your philosophy noting which parts have been reinforced or challenged as a result of your participation in the activities you have described.

Choose ONE of the following:

5. a. Curriculum Project

CHOOSE THIS OPTION IF YOU ARE DOING THE GRADUATE CERTIFICATE ONLY
For this project, you may work individually or in groups of up to three people to design a curriculum module firmly grounded in the principles of teaching for understanding. Your topic should address a perceived deficiency in your current curriculum. The module could encompass one strand of the curriculum only (earth and space science, life science, physical science, scientific ways of knowing, scientific inquiry, or science and technology), or be across multiple strands. It may also be inter-disciplinary, integrating both mathematics and science. It should represent approximately eight weeks work, with one week for review and assessment. The module should contain a clear statement of the background to and rationale for the project, science content, proposed learning experiences in the form of mini lesson plans, resources including technology needed to properly implement the unit, assessment strategies, target population, fit with existing courses, prerequisite knowledge, implementation issues such as teacher professional development and production of course materials. A short proposal must be submitted outlining the choice of topic and rationale for this choice by June. The final project is due on June.
5. b. Research Project Proposal

**CHOOSE THIS OPTION IF YOU WOULD LIKE TO COMPLETE A RESEARCH PROJECT AS YOUR EXIT REQUIREMENT FOR YOUR MASTERS DEGREE**

The project you propose can be (a) an initiative relating to curriculum, teaching/learning strategies or assessment; (b) an investigation (such as evaluating the success or failure of an initiative, an analysis of a policy and its implementation, a needs analysis in a particular area); (c) a piece of action research; or (d) a professional development initiative for teachers in your building or district to help them implement the standards. At the end of the semester, you will have completed a comprehensive proposal for your project. You will **not** carry out the project in this class, but you will need to think about the timeline as processing things through committees can create bottlenecks.

The purpose of the project proposal is to convince your committee (your advisor and two other faculty members) that the project has merit (that is, it will make a positive contribution in its area), is likely to succeed, and the cost is reasonable. Different funding sources require different formats for submitting proposals, but all have sections relating to **Aim**, **Significance**, **Methodology**, **Time Plan**, **Proposed Budget**, **Abstract or Summary**. Use these sections in writing your project proposal. Assume that you have a nominal budget of $2,000 for this project.

Your final proposal will consist of all of the components you have constructed throughout the semester, and will be read by two other faculty members. You should discuss this with me, and I will be the supervisor of your project. **The final proposal is due on June 26.**

OR

5. c. Short papers

**CHOOSE THIS OPTION IF YOU ARE DOING A COMPREHENSIVE EXAMINATION AS YOUR EXIT REQUIREMENT FOR YOUR MASTERS DEGREE**

The five short answer questions are listed on a sheet that you should get from the instructor and they will be worth 6% each. The purpose of these is to prepare you for the comprehensive exams you may choose as your exit requirement. Due dates for these are indicated on the course schedule. Each question is based on the readings and texts, and there are additional articles available on WebCT. Please type your paper double spaced, use APA format for all references, and ensure that each paper is thoroughly checked for spelling and typographical errors. All references in this syllabus are in APA format, so you can use these as a guide for your papers. **PAPERS WITH NO REFERENCES, INCORRECTLY FORMATTED REFERENCES, OR NO REFERENCE LIST WILL BE RETURNED UNDGRADED TO BE CORRECTED**
# TENTATIVE DAILY SCHEDULE

### NOTES:
1. Topics/ Class Activities that are highlighted are those in which we will meet in MC 330 with the mathematics teachers.

<table>
<thead>
<tr>
<th>Date</th>
<th>Topic/ Class Activities</th>
<th>Assignments due at this class meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 6/16</td>
<td>Introductions, course aims, and objectives</td>
<td>Louks-Horsley et al, Ch. 1</td>
</tr>
<tr>
<td>MC 330</td>
<td>Introduction to Blackboard Group presentation assignment details</td>
<td></td>
</tr>
<tr>
<td>6/16</td>
<td>Syllabus scavenger hunt Getting to know you</td>
<td>Weld, Ch. 8</td>
</tr>
<tr>
<td>MC 231</td>
<td>▪ Name game ▪ Autobiographical poems ▪ Find the fib ▪ Teaching methods ▪ VNOS</td>
<td>McComas (1996) – group A</td>
</tr>
<tr>
<td>6/17</td>
<td>Nature of science</td>
<td>National Research Council (2000), Ch. 1 &amp; pgs. 48-60 – group B</td>
</tr>
<tr>
<td>MC 231</td>
<td>▪ DAST ▪ Card exchange game ▪ Tricky tracks ▪ Aging president ▪ Ob-scertainers ▪ Water making machine</td>
<td></td>
</tr>
<tr>
<td>MC 231</td>
<td>▪ Mystery cookies</td>
<td></td>
</tr>
<tr>
<td>MC 330</td>
<td>Reform Based Teaching Observation Protocol</td>
<td></td>
</tr>
<tr>
<td>6/24</td>
<td>Graphing Calculators in the Mathematics and Science Classroom</td>
<td>Settlage &amp; Southerland (2007), Ch. 5</td>
</tr>
<tr>
<td>MC 330</td>
<td>Reform Based Teaching Observation Protocol</td>
<td>5a – Proposal 5b – Aim and significance 5c – paper #1</td>
</tr>
<tr>
<td>6/26</td>
<td>Scientific inquiry and 5E lesson planning</td>
<td>Staudt (2005)</td>
</tr>
<tr>
<td>MC 231</td>
<td>▪ Oobleck</td>
<td></td>
</tr>
<tr>
<td>3 6/30</td>
<td>Group 2 Presentation</td>
<td></td>
</tr>
<tr>
<td>MC 231</td>
<td>Using Hand Held Technology in Mathematics and Science Classrooms</td>
<td></td>
</tr>
<tr>
<td>Date</td>
<td><strong>Topic/Class Activities</strong></td>
<td><strong>Assignments due at this class meeting</strong></td>
</tr>
<tr>
<td>--------</td>
<td>------------------------------------------------------------------------------------------</td>
<td>------------------------------------------</td>
</tr>
</tbody>
</table>
| 7/1    | MC 231 Misconceptions in science  
• Minds of their own  
• Fish is fish  
• Bulbs, batteries and wires | Weld, Ch. 5                             |
| 7/3    | MC 231 Conceptual Change Theory  
• Density                                                                 | Stepans, pgs. 1-17  
**5b – Methodology**  
**5c – Paper #2** |
| 4      | 7/7 MC 330 Group 3 Presentations  
Integrating Mathematics and Science through Measurement | Mason, Mittag, & Taylor (2003) |
| 7/8    | MC 231 National science education standards and Ohio academic content standards  
Review: Nature of science, scientific inquiry, standards, 5E, and conceptual change  
Density and buoyancy | Weld, Ch. 1 |
| 7/10   | MC 231 Review of online resources for science teachers  
Managing the reform-based science classroom  
• Drug bust investigation | Jackson & Boboc (2008)  
Hand (2004) – group A  
Schulte (1999) – group B  
**5c – Paper #3** |
| 5      | 7/14 MC 330 Group 4 Presentations  
Equity in science education  
• First Year | Weld, Ch. 6  
Fetters, Pickard, & Pyle (2003) – group A  
| 7/15   | MC 231 Assessment of science learning  
• Genetics                                                                 | Weld, Ch. 11  
Settlage & Meadows (2002)  
Ayala (2005) – group A  
Smith & Wesley (2000) – group B |
| 7/17   | MC 330 Mathematics and Science Experience with High School Students | **5b – Time plan and budget**  
**5c – Paper #4** |
<table>
<thead>
<tr>
<th>Date</th>
<th>Topic/ Class Activities</th>
<th>Assignments due at this class meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Group 5 Presentation</td>
<td>5a – complete curriculum project</td>
</tr>
<tr>
<td>7/21</td>
<td>Assessment of science learning, continued</td>
<td>5b – complete proposal with changes</td>
</tr>
<tr>
<td>MC 330</td>
<td></td>
<td>5c – Paper #5</td>
</tr>
<tr>
<td>7/22</td>
<td>Grant writing for the science classroom</td>
<td>Final paper due</td>
</tr>
<tr>
<td>MC 231</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7/24</td>
<td>Re-visiting getting to know you activities</td>
<td></td>
</tr>
<tr>
<td>MC 231</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>• DAST</td>
<td></td>
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<td></td>
<td>• VNOS</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Teaching methods</td>
<td></td>
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</table>
### Rubric for Group Presentations

<table>
<thead>
<tr>
<th>Question</th>
<th>Category</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Was information clearly presented and easily understood?</td>
<td>/10</td>
</tr>
<tr>
<td>2</td>
<td>Were all group members included?</td>
<td>/10</td>
</tr>
<tr>
<td>4</td>
<td>Was the handout a useful summary of the presentation?</td>
<td>/20</td>
</tr>
<tr>
<td>5</td>
<td>Was the audience actively involved in doing something other than listening?</td>
<td>/40</td>
</tr>
<tr>
<td>6</td>
<td>Were the additional resources listed, accessible and potentially useful?</td>
<td>/10</td>
</tr>
<tr>
<td>7</td>
<td>Were the benefits and challenges of the model made clear?</td>
<td>/10</td>
</tr>
</tbody>
</table>

### Rubric for Final Paper

<table>
<thead>
<tr>
<th>Activity</th>
<th>Requirement</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 from EDC 517 course</td>
<td>Detailed description of activity</td>
<td>/3</td>
</tr>
<tr>
<td></td>
<td>Significance of this activity</td>
<td>/3</td>
</tr>
<tr>
<td></td>
<td>Impact or potential impact on your teaching</td>
<td>/4</td>
</tr>
<tr>
<td></td>
<td>Includes references from what you have done this semester</td>
<td>/3</td>
</tr>
<tr>
<td>2&lt;sup&gt;nd&lt;/sup&gt; from any source</td>
<td>Detailed description</td>
<td>/3</td>
</tr>
<tr>
<td></td>
<td>Significance of this activity</td>
<td>/3</td>
</tr>
<tr>
<td></td>
<td>Impact or potential impact on your teaching</td>
<td>/4</td>
</tr>
<tr>
<td>3&lt;sup&gt;rd&lt;/sup&gt; from any source</td>
<td>Detailed description</td>
<td>/3</td>
</tr>
<tr>
<td></td>
<td>Significance of this activity</td>
<td>/3</td>
</tr>
<tr>
<td></td>
<td>Impact or potential impact on your teaching</td>
<td>/4</td>
</tr>
<tr>
<td>One-page interpretive summary</td>
<td></td>
<td>/7</td>
</tr>
<tr>
<td>Total points</td>
<td></td>
<td>/40</td>
</tr>
</tbody>
</table>
Cleveland State University
Science Education
Lesson Plan Format

Student grade level and course (e.g. 7th grade pre-algebra)

Goals of this unit

Behavioral objectives for this lesson

Pre-requisite knowledge

National, state or local standards addressed

Materials required by students and teacher

Procedures (You may attach a lesson plan you have obtained from elsewhere to explain this part if appropriate)

- Engage
- Explore
- Explain
- Elaborate/Extend

Assessment and evaluation of student learning

Follow up
Choice B Specifics:
Research Proposal

Aim: Due June 26

This section will include:
- a clear statement of the aim of the project;
- putting the problem into context;
- a review of relevant research with appropriate references to literature quoted using APA style;
- definition of all of the variables.

It may be appropriate to begin with a general statement of purpose followed by some background or rationale leading into a specific statement of the aim(s). All variables involved must be clearly defined, probably at a conceptual and an operational level. The review of literature and/or discussion of the nature and success (or otherwise) of related projects indicates that you are thoroughly familiar with what has already been done and justifies your choice of this particular project, and the particular approach you have chosen. Use a reference list at the end of the proposal to include references you have used. Format your references using APA style.

Significance: Due June 26

This section describes the significance of the outcomes of the project in terms of its effects on its target (e.g., mathematics students), effects on the broader community (e.g., other classes in the school) and significance to other teachers/researchers in the field.

Methodology: Due July 3

This section must be very clear, to show that you have carefully considered what you are doing. You need to indicate:

- who will be involved in the project (the project team and the target people). If there is a sample, how will it be chosen?
- how subjects will be used
- exactly how the project will proceed, for example
  - what data will be collected? when and by whom? (you must include a copy of all questionnaires and describe all tests).
  - what materials/instruments are required and where will they come from?
  - how will data be analyzed?
- what self-evaluation will be carried out?
- the risks, benefits, and privacy safeguards for participants
- the guarantee of anonymity or confidentiality for participants
- data collection and maintenance of records regarding confidentiality and anonymity
- the ultimate disposition of audio/videotape data records
- if you are including any special subject populations (children, persons with disabilities)
You must also include an Informed Consent Statement that will:

- Introduce you and your research.
- Provide the subject with a brief, understandable explanation of the research.
- Explain the risks and benefits.
- Explain your anonymity and confidentiality guarantee.
- Mention that participation is voluntary and that the subject may withdraw at any time.
- Include the exact statement about contacting the IRB. (see sample given in class and on website)
- Provide a phone number where the subject may contact you for further information.
- Have a signature and date block for the subject to complete.

**Time Plan: Due July 17**

The time plan simply lists dates and indicates what will be done and how long it will take. The time plan begins at what is a reasonable date to expect funding, (say July, 2004) and finishes with the writing of the project report.

**Budget: Due July 17**

The budget provides a list of realistic (rather than widely hopeful!) requirements to achieve the implementation of the project. Budget items will include things such as:

- Research/other assistance (say $15.00 @ hour)
- Typist or clerical assistance (say $12.00 @ hour)
- Travel (say 35¢ per mile)
- Substitute teachers (say $100.00 per day)
- Consumables (e.g., audio tapes, stationery, etc.) (use actual cost)
- Postage, telephone, photocopying (use actual cost)

**Abstract/Summary of Project** (with all sections revised as per instructor’s comments): Due July 21

Most funding bodies need a concise description of the project for their own records and reports they prepare about the things they spend their money on. It is hard to write up a summary of your project in seven lines, but if you can’t do it, it means you haven’t got it clear in your head yet.
Short Answer Questions and Project Sections Rubric

**Question 1: Due June 26**
1. If you had the time and opportunity to design a lesson to demonstrate best instructional practices and innovations in the teaching and learning in your specific area (science, mathematics, or social studies, etc) for a particular grade level (your choice) that you teach or will be teaching, what would it look like? Provide evidence for the design you decide upon.
2. What are some approaches that you might use to encourage students to generate questions during a discussion to encourage their participation and thinking?
3. How might you integrate instructional technology in your lesson?

**Question 2: Due July 3**
The context of American education has obviously changed; raising challenges of multiculturalism and diversity greater that at any time in the more distant past. Student demographics have shifted dramatically and will continue to shift. The effects of desegregation and other Civil Rights measures put this huge change in student body composition into a distinctive educational context. The emphases and tensions of the American Educational tradition raise a host of fascinating historical, policy, and educational questions.
1. Your task is to answer the following questions related to the statement above.
2. How fully did the focus on diversity, assimilation, multiculturalism dampen (or not) group identities and complicate or simplify curriculum development in the United States?
3. How essential and effective was the diversity education, and the curricula that translated it, in maintaining political stability and in encouraging some individuals to achieve “American” success more rapidly than they could have done without diversity education and awareness?

**Question 3: Due July 10**
Standards-based education (SBE) has been mandated by the No Child Left Behind (NCLB) act and an Inquiry-Based approach is advocated by the National Science Education Standards (NSES).
1. Compare and contrast standards-based instruction and inquiry-based instruction.
2. Describe a science lesson that would incorporate both standards-based and inquiry-based instruction.
   a. What are the benefits of the lesson design?
   b. What are the challenges with the lesson design?
**Question 4: Due July 17**
Find and read a research article from the Journal of Research in Science Teaching (available online through CSU library).
1. What is the research question(s)?
2. Is the research qualitative, quantitative, or action research? Provide evidence for your answer. Does the method “fit” the question? Why or why not?
3. Summarize the context of the research.
4. What methods were used in the research? Are they valid and reliable or trustworthy?
5. Summarize the findings of the research? What do the findings mean to you as a practicing science teacher?
6. Explain the limitations of the research.
7. What conclusions did the authors draw from the findings? Critically evaluate each of the conclusions.

**Question 5: Due July 21**
You are working in a school that is considering the use of handheld computers and related probe ware (e.g., temperature, pH, dissolved Oxygen, motion detectors, etc.). There are members of your department and administration who are opposed to such use, as they no not understand how these would enhance student learning. Design a small-scale research project that would investigate what impact the use of handheld computers might have on student learning. Clearly state your research question, the methods you would use, the population sample you would require, and how you would select that group, and the anticipated outcomes and applications of the research. Include a rationale for each of the sections above.

Short Answer Questions Rubric

<table>
<thead>
<tr>
<th>Description</th>
<th>Score</th>
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</thead>
<tbody>
<tr>
<td>Most aspects not covered or unintelligible</td>
<td>4</td>
</tr>
<tr>
<td>Some arguments made, but unclear or poorly worded. Most readers would not understand the point.</td>
<td>8</td>
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<tr>
<td>Reasonable development, but some major points left out, open to serious interpretation.</td>
<td>12</td>
</tr>
<tr>
<td>Mostly well written, but slightly unclear or some aspect missing, or open to some interpretation.</td>
<td>16</td>
</tr>
<tr>
<td>Fully developed, well written, complete description, easily understood by any reader.</td>
<td>20</td>
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