COURSE SYLLABUS Fall 2005

TBTE 446 : Science in Middle Level & High School Education

Course homepage: http://ci.lehigh.edu/

Wednesday 4:00 - 7:00 PM 202 Williams Hall

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This is a Web-enhanced 3 credit graduate course. Some class meetings may occur asynchronously. It is expected that each student have the capability to author a Web page and be able to load a Web page onto your Lehigh server space. Lehigh University's Information Resources offers a variety of short courses on Web page authoring. A variety of Web page authoring tutorials are also available on the course Web site.

Description
The philosophy behind this course is that all students can learn science. The same applies to the teaching of science. You will become a better teacher of secondary school science by improving teaching techniques such as lesson planning, trying out new methods of teaching, integrating instructional technologies into your instruction, reflecting on teaching, and becoming aware of research on how students learn science and the latest science teaching methods. This course is designed to help you examine the perspectives, philosophies, theories, methods and materials for teaching science effectively for all students in grades 7-12 as you become a reflective practitioner. Course activities will focus on instructional techniques for promoting inquiry and discovery in the middle school and high school science classrooms.

Objectives *(By the conclusion of the course, students will demonstrate ability to…)*

1. develop a unit plan linked to the National Science Education Standards or the Pennsylvania Department of Education academic standards for science and technology or for environment and ecology.
2. prepare secondary school science lessons plans.
3. understand inquiry-based methodologies and apply it to secondary school classroom science lessons.
4. be able to locate and use science teaching materials.
5. integrate instructional technology into the secondary science classroom.
6. use assessment techniques in the secondary science classroom.
7. understand the need for organization and management in the busy science classroom.
8. critically review a secondary science education research journal article.

Attention students:
Any student who has a documented disability and is in need of academic accommodations should notify the professor of this course and/or contact Cheryl Ashcroft, Director of the Office of Academic Support Services (758-4152). Accommodations are individualized and in accordance with Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1992.

Pennsylvania Department of Education Program Standards for Secondary Science Teacher Certification and Preparation

Competency	Artifact/activity that demonstrates competency
PERFORMANCE	
II.A. Managing the instructional environment including: creating a climate that promotes fairness; establishing and maintaining rapport with students; communicating clear, challenging learning expectations to each student; establishing and maintaining consistent standards of classroom behavior; creating a safe environment conducive to learning; using time effectively	Trowbridge and Linn text chapters, Course readings, and Website handouts a classroom environment, classroom management, and safety in the science classroom. Course activities including microteaching, inquiry-based classroom lessons, and hands-on science activities. Curricular Resource Unit assignment.
II.B. Planning of instruction based upon subject matter; promotion of higher ordered thinking; needs of local students and the community; Pennsylvania Academic Standards; application in the workplace and career opportunities of secondary science; application of secondary science content to society, economics and in peoples daily lives	Trowbridge and Linn text chapters, Course readings, and Website handouts on inquiry-based teaching methodologies, constructivism, instructional delivery, designing learning environment, Web-based inquiry, STS role-playing simulations, and Project WILD activities. Course activities including microteaching, Web-based inquiry analyses, CBL real-time data collection activities, inquiry-based classroom lessons, hands-on science activities, and Web-based instructional materials located on course Websites. Guided Inquiry Lesson Plan, Web-based Science Activity and Curricular Resource Unit assignments.
II.C. Adapting, assimilating and implementing effective instructional strategies	Trowbridge, Linn and Lynch text chapters, Course readings, and Website handouts on the secondary science classroom. Microteaching course activity.
II.D. Effective use of curriculum resources and technologies in collaboration with educators and other outside resources	Trowbridge and Linn text chapters, Course readings, and Website handouts on incorporating instructional technologies into the curriculum. Course activities including microteaching, Web-based inquiry analyses, CBL real-time data collection activities, inquiry-based classroom lessons using spreadsheets and databases, and Web-based instructional materials located on course Websites utilizing interactive java applets, GIS, QuickTime VR, Flash interactivies, and Web-based data submission forms. Guided Inquiry Lesson Plan, Web-based Science Activity and Curricular Resource Unit assignments.

II.E. Selecting, analyzing and modifying instructional materials to meet the learning needs of diverse learners	Trowbridge, Linn and Lynch text chapters, Course readings, and Website handouts on incorporating instructional strategies, assessment, curriculum resources and technologies to meet the needs of diverse learners. Course activities including microteaching, Web-based inquiry analyses, CBL real-time data collection activities, inquiry-based classroom lessons using spreadsheets and databases, and Web-based instructional materials located on course Website. Guided Inquiry Lesson Plan, Web-based Science Activity and Curricular Resource Unit assignments.
II.F. Monitoring and assessing students' understanding of content through a variety of means, providing feedback to students to assist learning and adjusting instructional strategies	Trowbridge and Linn text chapters, Course readings, and Website handouts on the secondary science classroom. Microteaching course activity.
III. PROFESSIONALISM	
III.A. Professional organizations and journals of science and science education	Research Article Annotated Bibliography assignment.

354.32 MONITORING AND ASSESSMENT	**Artifacts/activities that demonstrates competencies**
(1) The progress of candidates at different stages of the program shall be monitored through performance-based assessments, which shall stipulate the level of competence required to ensure success in the following skill dimensions:	Guided Inquiry Lesson Plan, Web-based Science Activity and Curricular Resource Unit assignments. Course activities including microteaching, assessment and rubric development, inquiry-based classroom lessons, Critical Incidents in Science Teaching assignments, Web-based inquiry analyses, CBL real-time data collection activities, inquiry-based classroom lessons using spreadsheets and databases, evaluating the quality of instructional support instrument with the AAAS/AIBS instrument, and implementation of Web-based instructional activities located on course Websites. Trowbridge and Linn text chapters, Course readings, asynchronous and synchronous class discussions, and Website handouts on assessment and evaluation, classroom environment, classroom management, and safety in the science classroom.
(i) Content mastery	
(ii) Planning	
(iii) Classroom management	
(iv) Organization	
(v) Monitoring student progress	
(vii) Sensitivity to students' needs	
(viii) Problem analysis	
(ix) Strategic and tactical decision making	
(x) Oral and written communication and presentation	
(xii) Mastery of instructional technology	

354.33 PROFESSIONAL COMPETENCY (1)*(i) Instructional*	**Artifacts/activities that demonstrates competencies**
(A) The teacher understands the central concepts, tools of inquiry, and structures of the discipline the teacher teaches and can create learning experiences that make these aspects of subject matter meaningful for all students.	Trowbridge and Linn text chapters, Course readings, and Website handouts on inquiry-based teaching methodologies, constructivism, instructional delivery, designing learning environment, Web-based inquiry, STS role-playing simulations, and Project WILD activities. Course activities including microteaching, Web-based inquiry analyses, CBL real-time data collection activities, inquiry-based classroom lessons, hands-on science activities, and Web-based instructional materials located on course Websites. Guided Inquiry Lesson Plan, Web-based Science Activity and Curricular Resource Unit assignments.
(B) The teacher understands how all children learn and develop, and can provide learning opportunities that support their intellectual, social, career and personal development.	Trowbridge and Linn text chapters, Course readings, and Website handouts on cognitive development and learning theories.
(C) The teacher understands how students differ in their ability and approaches to learning and creates opportunities that foster achievement of diverse learners in the inclusive classroom.	Trowbridge text, Course readings, and Website handouts on incorporating instructional strategies, assessment, curriculum resources and technologies to meet the needs of diverse learners. Course activities including microteaching, Web-based inquiry analyses, CBL real-time data collection activities, inquiry-based classroom lessons using spreadsheets and databases, and Web-based instructional materials located on course Website. Guided Inquiry Lesson Plan, Web-based Science Activity and Curricular Resource Unit assignments.
(D) The teacher understands and uses a variety of instructional strategies, including interdisciplinary learning experiences, to encourage students' development of critical thinking, problem solving and performance skills.	Trowbridge and Linn text chapters, Course readings, and Website handouts on inquiry-based teaching methodologies, constructivism, instructional delivery, designing learning environment, Web-based inquiry, STS role-playing simulations, and Project WILD activities. Course activities including microteaching, Web-based inquiry analyses, CBL real-time data collection activities, inquiry-based classroom lessons, hands-on science activities, and Web-based instructional materials located on course Websites. Guided Inquiry Lesson Plan, Web-based Science Activity and Curricular Resource Unit assignments.
(E) The teacher uses an understanding of individual and group motivation and behavior to create a learning environment that encourages positive social interaction, active engagement in learning and self-motivation.	Trowbridge and Linn text chapters, Course readings, and Website handouts on classroom environment and classroom management. Course activities including microteaching, inquiry-based classroom lessons, and hands-on science activities. Curricular Resource Unit assignment.

(F) The teacher uses knowledge of effective verbal, nonverbal and media communication techniques supported by appropriate technology to foster active inquiry, collaboration and supportive interaction in the classroom.	Trowbridge and Linn text chapters, Course readings, and Website handouts on incorporating instructional strategies, assessment, curriculum resources and technologies to meet the needs of diverse learners. Course activities including microteaching, Web-based inquiry analyses, CBL real-time data collection activities, inquiry-based classroom lessons using spreadsheets and databases, and Web-based instructional materials located on course Website. Guided Inquiry Lesson Plan, Web-based Science Activity and Curricular Resource Unit assignments.
(G) The teacher plans instruction based upon knowledge of subject matter, students, the community and curriculum goals.	Trowbridge and Linn text chapters, Course readings, and Website handouts on inquiry-based teaching methodologies, constructivism, instructional delivery, designing learning environment, Web-based inquiry, STS role-playing simulations, and Project WILD activities. Course activities including microteaching, Web-based inquiry analyses, CBL real-time data collection activities, inquiry-based classroom lessons, hands-on science activities, and Web-based instructional materials located on course Websites. Guided Inquiry Lesson Plan, Web-based Science Activity and Curricular Resource Unit assignments.
(H) The teacher understands and uses formal and informal assessment strategies to evaluate and ensure the continuous intellectual, social and physical development of the learner.	Trowbridge and Linn text chapters, Course readings, and Website handouts on assessment and evaluation. Assessment and rubric development course activities. Guided Inquiry Lesson Plan and Curricular Resource Unit assignments.
(I) The teacher thinks systematically about practice, learns from experience, seeks the advice of others, draws upon educational research and scholarship and actively seeks out opportunities to grow professionally.	Introduction to state and national science education professional organizations. Research Article Annotated Bibliography assignment.

Required Textbooks

Trowbridge, L. Bybee, R. & Powell, J. (2004). Teaching secondary school science. Strategies for developing scientific literacy. 8th edition. Upper Saddle River, NJ: Merrill. 0-13-977372-X

National Research Council (2000). Inquiry and the National Science Education Standards: A guide for teaching and learning. National Academy Press. ISBN Number: 0-309-06476-7
(The contents of this book are available online: http://books.nap.edu/html/inquiry_addendum/)

Project WILD K-12 Curriculum and Activity Guide

Textbooks for Book Review Assignment

Linn, M. and Hsi, S. (2000) Computers, teachers, peers: Science learning partners. Mahwah, NJ: Lawrence Erlbaum Associates, ISBN # 0-8058-3349-9

Or

Lynch, S.J. (2000). Equity and science education reform. Mahwah, NJ: Lawrence Erlbaum Associates, ISBN # 0-8058-3249-1

Optional Textbooks:

Minstrell, J. and van Zee, E. (Eds.). (2000). Inquiring into Inquiry Learning and Teaching in Science. Washington DC: American Association for the Advancement of Science.

National Research Council of the National Academy of Sciences (1996). The National Science Education Standards. Washington, DC: National Academy Press. ISBN Number: 0-309-06998-X
(The contents of this book are available online: http://books.nap.edu/html/nses/html/).

National Research Council of the National Academy of Sciences (2001). Classroom Assessment and the National Science Education Standards. Washington, DC: National Academy Press. ISBN Number: 0-309-05326-9
(The contents of this book are available online: http://books.nap.edu/html/classroom_assessment/)

National Science Teachers Association. NSTA Pathways To the Science Standards: Guidelines for Moving the Vision into Practice - (High School Edition). Arlington, VA: National Science Teachers Association, 1997. ISBN Number: 0-87355-144-3

Course Website and E-mail:

A Website for this course exists and contains class information, course handouts, links to online readings, and other resources. The url is:
http://ci.lehigh.edu/
Each student is assigned an e-mail address at registration. Students are expected to use e-mail as one form of communication with the instructor during this semester.

Course Readings:

We will draw from the list of course readings that are listed within the syllabus. Required and optional readings are listed in the syllabus. Course readings may be found in the Course Website in the **Course Documents** section or accessed directly on the World Wide Web. Additional readings may be added as the semester progresses.

Course Handouts:

Course handouts are located in the Course Website by topic areas in the Course Documents section. It is the student's responsibility to acquire these handouts from the Course Website. Please note that additional handouts are available as Web links in the External Links section of the Course Website.

Web-based Resources:

A variety of Web-based instructional resources are used both in and out of class. Access to these resources are available on the following Websites:
Science Education at Lehigh University: http://www.lehigh.edu/~amb4
Website Science at Lehigh University: http://www.lehigh.edu/~amb4/websci/
Science Education Courses at Lehigh University: http://www.lehigh.edu/~amb4/courses
Web-based Inquiry for Learning Science: http://www.lehigh.edu/~amb4/wbi

Course Readings [Course Website and online]

Bodzin, A. (1999). *Evaluating Science Web Resources*. Online available:
http://www.lehigh.edu/~amb4/websci/evalweb.html

Bodzin, A. & Cates, W. (2002). *Web-based inquiry for learning science (WBI) instrument manual*. Version 1.0. Online available: http://www.lehigh.edu/~amb4/wbi/wbi-v1_0.pdf

Bodzin, A., and Cates, W. (2002). Inquiry *dot* Com. Web-based activities promote scientific inquiry learning. *The Science Teacher 69*(9), 48-52.

Davidson, A. (1999). Contracting for safety. *The Science Teacher, 66*(6), 36-29.

DeBoer, G. (2000). Scientific literacy: Another look at its historical and contemporary meanings and its relationship to science education reform. *Journal of Research in Science Teaching, 37*(6), 582-601.

Enger, S. K. and Yager, R. E. (2001). *Assessing Student Understanding*. Thousand Oaks, CA: Corwin Press. p. 14-33, 62-79.

Eyster, L. (1997). A comprehensive rubric. *The Science Teacher, 64*(4), 19-21.

Jones, M. G. & Carter, G. (1998). Small group and shared constructions. In Mintzes, Wandersee and Novak, eds. *Teaching Science for Understanding: A Human Constructivist View*. San Diego, CA: Academic Press. pp. 261-279.

Luft, J. (1998). Multicultural science education: An Overview. *Journal of Science Teacher Education, 9*(2), 103-122.

Krajcik, J., Blumenfeld, P., Marx, R. & Soloway, E. (2000). Instructional, Curricular, and Technological Supports for Inquiry in Science Classrooms. In Minstrell, J. and van Zee, E. (Eds.) *Inquiring into Inquiry Learning and Teaching in Science*. Washington DC: American Association for the Advancement of Science. pp. 283-315.

Krajcik, J., Czerniak, C, & Berger, C. (2002). How can learning technologies be used to support investigations? In *Teaching Science in Elementary and Middle School Classroom*. Boston, MA: McGraw Hill. p. 167-197.

Leonard, W., Penick, J. & Douglas, R. (2002). What does it mean to be standards-based? *The Science Teacher, 69*(4), 36-39.

Madrazo, G. (1998). Embracing biodiversity. *The Science Teacher, 65*(3), 20-23.

Mistler-Jackson, M. & Songer, N. (2000). Student motivation and Internet technology: Are students empowered to learn science? *Journal of Research in Science Teaching, 37*(5), 459-479.

National Research Council of the National Academy of Sciences. *The National Science Education Standards*. Washington, DC: National Academy Press, 1996. ISBN Number: 0-309-05326-9. Online available: http://books.nap.edu/html/nses/html/
Overview: Chapters 1, 3, 6 (p. 143-204)

National Research Council of the National Academy of Sciences (2001). *Classroom Assessment and the National Science Education Standards*. Washington, DC: National Academy Press. pp. 1-58.
(The contents of this book are available online: http://books.nap.edu/html/classroom_assessment/)

Pennsylvania Department of Education. (2002). *Academic Standards for Science and Technology*. Online available: http://www.pde.state.pa.us/k12/lib/k12/scitech.pdf

Pennsylvania Department of Education. (2002). *Academic Standards for Environment and Ecology*. Online available: http://www.pde.state.pa.us/k12/lib/k12/envec.pdf

Pennsylvania Department of Education. (2002). *Science, Technology, Environment & Ecology (STEE) Assessment Handbook*. The Pennsylvania System of School Assessment, Harrisburg, PA.

Potter, T. (1999). Safety Station Investigation. *The Science Teacher, 66*(6), 25-27.

Rieck, W. (2002). Putting assessment to the test. *The Science Teacher, 69*(2), 46-49.

Strong, E. & Strong, R. (1999). Geodesic Earth. *The Science Teacher, 6*(2), 43-45.

Timmerman, B. (1999). Chemistry of Cooking. *The Science Teacher, 66*(2), 23-25.

West, S., Motz, L., and Biehle, J. (1999). Science Facilities, by Design. *The Science Teacher, 66*(6), 28-31.

Wilkenson, J. & Ward, M. (1997). The purpose and perceived effectiveness of laboratory work in secondary schools. *Australian Science Teachers' Journal, 43*(2), 49-54

Course Requirements

Graded Assignments

Below is a list of assignments that will be graded, along with the percentage of the final grade total for each. The assignments are explained in detail in the "Assignments" section.

Assignment	Percentage	Due Date
Science Lesson Plan	10%	10/05
Classroom Observation Report	15%	10/19
Web-based Science Activity	15%	10/26
Science Instructional Unit Planning Outline	10%	11/09
Book Review	15%	11/16
Science Instructional Unit	35%	11/30

Assignments submitted that have also been submitted for another Lehigh course will not be accepted.

An assignment submitted for one assignment may not count as part of the requirement for another course assignment.

Regular attendance and **timely submission** of assignments are expected of graduate students and are not, therefore, rewarded in the assignment of marks. All assignments are due at the **start** of class on the date indicated on the syllabus. Unless otherwise announced, absent students may **hand deliver** overdue assignments to the instructor's office **by 4:00 PM** on the day following the class that they miss.

Overdue assignments will be marked down 1/2 of a letter grade for each day submitted late. For example, an assignment submitted 1 day late would receive a maximum of an A-/B+ grade. An assignment submitted 2 days late would receive a maximum of a B grade.

Absences

It is difficult to make up absences when a majority of class time will be spent examining, manipulating, and negotiating ideas. Also, class time will be used for the development of graded assignments. Please consider absences very carefully. The instructor reserves the right to lower the final grade 20 points per absence for excessive absences. Please see instructor if arriving to class on time is a problem.

Weather policy – Be advised that I will not cancel class unless the university does so. Canceled classes due to acts of God or war will be rescheduled.

Criteria Employed In Assigning Marks

MARK	WHAT IT REFLECTS
A	Excellent work that demonstrates a clear understanding of the material under study and a superior ability to utilize that material in the assignment submitted. When options for marks are involved, indicates successful completion of the highest level option.
B	A solid piece of work that demonstrates an understanding of the material under study and utilizes that material well in the assignment submitted. Usually either fails to include some pertinent material or utilizes that material less well than would warrant assignment of a mark of A. When options for marks are involved, indicates successful completion of more than the minimal level option.
C	Adequate work that demonstrates a basic understanding of most of the material under study and which utilizes that material to some extent in the assignment submitted. Usually contains errors or omissions involving relevant material. When options for grades are involved, indicates successful completion of minimal level option.
D	Work that fails to demonstrate understanding of the material under study and fails to utilize relevant material in the assignment submitted. When options for marks are involved, indicates failure to complete successfully the minimal level option.
F	Work that is incomplete, inappropriate, completely incorrect, or was submitted late. This mark indicates severe problems that lead to questions about whether the student should be involved in graduate study.

Combined marks (like A-/B+) are used in interim calculations, but are not awarded on final marks, since the university does not utilize them. Minuses attached to marks suggest a slightly lower level of achievement. Pluses attached to marks indicate a slightly higher level of achievement.

In using letter marks to arrive at a final mark, the instructor converts them to grade points and averages them according to th following schedule (GPA=Grade Point Average):

Marks Assigned During Course	
Mark	**GPA**
A	4.00
A-	3.67
A-/B+	3.50
B+	3.33
B	3.00
B-	2.67
B-/C+	2.50
C+	2.33
C	2.00
C-	1.67
C-/D+	1.50
D+	1.33
D	1.00
D-	0.67
F	0.00

Final Mark Determination	
Mark	**GPA**
A	3.80
A-	3.67
B+	3.33
B	3.00
B-	2.67
C+	2.33
C	2.00
C-	1.67
D+	1.33
D	1.00
D-	0.67
F	0.00

Dates and Class topics:

DATE	CLASS	OUT-OF-CLASS ASSIGNMENT * Optional readings
08/24	Course Overview. Goals of science education. History of science education. Conceptions of science teaching. Introduction to Critical Incidents in Science Teaching.	Read Chapters 1-4, 11 (Trowbridge). Reserve readings: National Science Education Standards. *DeBoer. Begin reading Linn & Hsi or Lynch.
08/31	Inquiry. Learning theory. Science education standards and frameworks.	Read Chapters 5, 6, 12-15 (Trowbridge). NRC: Chapters 1-3, 7 Reserve readings: Print out and read Pennsylvania Department of Education's Proposed Academic Standards for Science and Technology and Environment and Ecology. *Jones and Carter; *Wilkenson & Ward Continue reading Linn & Hsi or Lynch.
09/03	*Last day to drop a course without a W.*	
09/07	Instructional models. Developing lesson plans. Goals and objectives of science teaching.	Read: *Chapters 17-18 (Trowbridge); NRC Chapter 6, 8 Reserve readings: Enger, and Yager; Rieck; *National Research Council of the National Academy of Sciences (2001); *Eyster; Continue reading Linn & Hsi or Lynch.
09/12	*Last day to select or cancel pass/fail grading*	
09/14	Science assessment in the secondary school. Concept Maps.	Read Chapters 10 (Trowbridge). Review science education Web-based curricular resources. Work on classroom observation report. Continue reading Linn & Hsi or Lynch.
09/21	Data collection with handheld devices. Preparing for field trips. *Class meets at Sand Island.*	Reserve readings: Bodzin; both Bodzin & Cates; *Mistler-Jackson & Songer. Review science education Web-based curricular resources. Work on classroom observation report. Work on science lesson plan.
09/24	*Web page development session – optional class. Meet in Iacocca Hall Maclab, E106. 1-4pm.*	
09/28	The secondary science classroom. Web-based Inquiry for Learning Science	Read Chapters 19-20 (Trowbridge). Reserve readings: *Luft; *Madrazo; *Timmerman. Work on science lesson plan.

10/05	*Submit Science Lesson Plan.* Microteaching. Interdisciplinary aspects. Individual differences. Multiculturalism in the science classroom.	Read Chapter 22 (Trowbridge). Reserve readings: *Davidson; *Potter; *Strong & Strong; *West et.al. Work on classroom observation report. Work on Web-based Science Activity.
10/12	*NO CLASS (Thursday Classes Meet)*	
10/19	*Submit classroom observation report.* Microteaching. Classroom management. Safety in the science classroom. Unit planning.	Read Chapter 16 (Trowbridge). Work on Web-based Science Activity.
10/26	*Submit Web-based Science Activity.* Project WILD Controversy in the Classroom. STS simulations.	Read Chapter 21 (Trowbridge). Continue reading Linn & Hsi or Lynch. Work on Science Instructional Unit.
11/02	Project WILD Controversy in the Classroom. STS simulations.	Reserve readings: Krajcik, Czerniak, & Berger; *Krajcik, Blumenfeld, Marx & Soloway; Work on Science Instructional Unit.
11/09	*Submit Science Instructional Unit Content and Instructional Sequence Outlines* Critical incidents in science teaching. Introduction to Exploring Life. Science Curriculum. Evaluating the quality of instructional support.	Reserve readings: Krajcik, Czerniak, & Berger; *Krajcik, Blumenfeld, Marx & Soloway; *Leonard, Penick, & Douglas Work on Science Instructional Unit.
11/09	*Last day to withdraw from a course with W.*	
11/16	MBL physics labs. *Class meets at Parkland High School at 4:30 pm.*	Work on Science Instructional Unit.
11/23	Curriculum Resource Unit work session.	Read Chapters *7-9, *23-24 (Trowbridge). Work on Science Instructional Unit.
11/30	***SUBMIT Curricular Resource Unit.*** **<NO LATE SUBMISSION!>** Technology supports in the science classroom. GIS. Course Evaluations	
12/06	*Last day to withdraw from a course with a WP or WF*	

Notes:	There may be additional readings and exercises in the course that are not listed above but which are assigned as the course develops. Absent students are responsible for learning of such assignments and for completing and submitting them on time. We will attempt to comply with this syllabus as much as possible, although our discussions and the ways in which we learn may necessitate changes. The instructor will give you as much advance notice as possible of any changes.

TBTE 446 Assignments

Classroom Observation Report

Option 1 (if you are not an inservice teacher):
You will visit a secondary science school classroom (grades 7-12), **observe 4 different science lessons** and **interview** the classroom science teacher. You will submit a report that describes your observations and your personal reflections and thoughts. Use the questions in the guideline below to focus your observations and interview questions.

Focus on the specific details from the criteria below in your report. Be sure to include insights into classroom implementation and discuss specific pedagogical strategies observed.

Your report is to be completed in the format stipulated below. The report should be word-processed using 12 point, Times font, double-spaced type.

Be sure to include the type of class(es) you observed and the grade level. For example: 11th grade Ecology class, 10th grade Biology 2 class, 11th grade Basic Chemistry, AP Physics, 8th grade Physical Science.

Please include the name of the school and school district.

A. The Classroom:

• How are materials and seating arranged? Why? What materials do students have access to? Do restrictions exist for materials? What are they? Where are lab materials located?

• How does the organization of the classroom contribute to the teaching/learning atmosphere? Is the organization formal or informal? Why? Do students place finished assignments in specific locations? Do bulletin boards, learning centers or stations, or other displays contribute to: motivation? Science curriculum-based topics? Are these areas easily accessed by students? When can students use them?

• Is the room stimulating and exciting? How can you tell? Does the room invite science learning? Is there a classroom library, science resource section, or activity center area? How is it used?

B. Teaching Strategies

• What procedures are routine? For example, how does the science lesson start and end? Is there an order or a sequence for the science activities?

• How and when does the teacher use: the board? visual aids? instructional technologies such as computers and hand-held data collection devices? video and laserdiscs? texts? worksheets?

• When is group work utilized? Are cooperative learning strategies used? What rules exist for group situations?

• How does the teacher utilize questioning? How is discussion encouraged? Does the teacher encourage student reflection and expression of opinions?

• Is previous learning or prior knowledge utilized?

• Does the teacher vary voice inflections or tone? When and why? How does this contribute to motivation, discipline, and emphasis of content?

• How are students engaged in processes of scientific inquiry? Do students explore objects, events, and organisms in their environment? Do students develop and explain concepts in their own words, both orally and by writing and drawing?

• How is content information presented in a developmentally-appropriate and engaging fashion?

• How are learners with special needs accommodated? For example, students with IEPs, gifted students, and English as second language learners?

• How are students provided opportunities to extend and elaborate their understanding and knowledge through independent inquiries?

C. Classroom Management

• What are the stated and unstated rules of this teacher? How can you tell? Are the rules uniformly and fairly applied? List as many rules as you can. Pretend that you need to inform a new student of what is acceptable. Can you do it? What happens if a rule is broken?

• What strategies does this teacher use to obtain student attention to begin and end class? What does the teacher do to use time effectively? How are transition times (moving from one activity to the next) minimized? How does organization of the classroom or of actual lessons contribute to decreasing discipline problems?

• When and how is praise or positive reinforcement used?

• What happens when there is an announcement or an interruption?

• Does the teacher use nonverbal signals or gestures to control student behavior? Which ones? Why? Does the teacher use proximity control (moving closer to a specific student in order to gain attention or stop some in appropriate conduct)? When and why?

D. The Students

• Who are the students? Include ethnicities, cultural backgrounds, and socio-economic status of the community Can you identify students who are motivated or unmotivated to learn science? What can you tell about individual students by watching them? What interests do the students have? Which types of individual behaviors can you predict from certain students? Who is on-task? Who is off-task?

• Do any students appear to have health or emotional problems? Do any have any special needs? How are they accommodated? Interview the teacher to acquire this information.

• Why do any students misbehave? What clues can you discover? Do they seek attention? Try to gain acceptance from peers?

E. Assessment Practices

• What types of formative assessments are used? How does the teacher use that information to inform teaching and/or influence learning? Provide examples. Interview the teacher to acquire this information.

• What types of summative assessments are used? Where do the summative assessment items come from? How is data from these assessments used for purposes of grading and accountability? How are final grades determined? Interview the teacher to acquire this information.

F. Secondary Science Curriculum

In this section of your report, describe the science curriculum. *Interview the teacher to acquire this information.*

• What is the curriculum? Does the school district use a local curriculum? What standards is the curriculum align aligned to? What topics are covered?

• Is the curriculum textbook-centered? What textbook is used? Are materials included in the curriculum? Does the district provide teachers with professional development to learn how to use curricular materials?

• Are there written goals and objectives for each unit?

• Does the curriculum include recommended assessments for each unit? Are teachers required to use these assessments?

• Does the curriculum integrate instructional technology or interdisciplinary activities? Does the curriculum focus on science process skills or the acquisition of science facts? Is a project-based approach to learning science used?

• What does the teacher do to enhance the school-mandated curriculum?

G. Personal Reflection

In this section of your report, reflect on your observations. What features of this classroom reflect a standards-based classroom as described in your course readings and class discussions? Provide specific examples. What types of modifications (including curricular customizations) can be done to make this classroom more aligned to the goals stated in the *National Science Education Standards*?

Option 2 (if you are an inservice teacher and do not have the opportunity to observe other secondary science teachers of science):
Videotape 4 of your science lessons. Watch your lessons. Use the questions in the guideline in Option 1 to focus your observations. You will submit a report that describes your observations and your personal reflections and thoughts regarding your lessons. Your report should include each section from Option 1. The report should be word processed using 12 point, Times font, double-spaced type.

Option 3 (if you are not an inservice teacher and do not have the opportunity to observe other secondary teachers of science due to time constraints with work or other obligations):

Write a 8-10 page research paper on the topic of:

1. implementing inquiry-based science strategies into a science classroom curricula
or
2. implementing authentic science assessment strategies into science classroom curricula.

Your paper must contain a minimum of 8 references. 4 of these references must come from empirical research articles – these articles are written by researchers, not practicing classroom teachers. Examples of journals with empirical research articles include the Journal of Research in Science Teaching, Journal of Science Education and Technology, School Science and Mathematics, Journal of Computers in Mathematics and Science Teaching, and Journal of Science Teacher Education. Articles from *The Science Teacher or other NSTA publications* are **not** considered empirical research articles. The report should be word processed using 12 point, Times font, double-spaced type.

Science Lesson Plan/ Microteaching

You will prepare an inquiry-based lesson plan for a secondary science classroom using the format provided below. You will teach a 15-20 minute section of your lesson to the class. This microteaching should engage the class with hands-on manipulative materials.
During the microteaching, **DO NOT** lecture, show more than a 2 minute video clip, or place students on computers for the entire 15-20 minutes.

Be sure to include student handouts, worksheets, PowerPoint presentation or overhead slides, and / or assessment items with your submission as appropriate. Please note all media sources.

Provide copies of your lesson plan for your classmates when you present your lesson. Provide a copy of your lesson plan to the instructor. He will make comments and return your lesson to you to revise.

Lesson Plan Format

1. Target Grade or Age Level

2. Scientific Process(es) Addressed

   These are processes and skills might include observing, classifying, formulating hypothesis, inferring, etc. Refer to your Martin text for an extensive list of processes if needed.

3. Pennsylvania Science Content Standards or *National Science Education Standards*

   State the standard(s) that your lesson aligns to. Be specific in articulation this standard.

4. Objective(s)

   List objective(s) as described in chapter 6 in the Trowbridge text. State the content and process objectives of your lesson. Begin each objectives with "*Students will ….*". Each objective should align to your assessment items.

5. Description of Introductory Activity (Anticipatory Set) and Discussion

   This is the first 5-10 minutes of your lesson. Provide details on how you will introduce the lesson. This should contain details concerning a your "warm-up activity". This might be showing learners a discrepant event, conducting a demonstration or some other interest-focusing activity.

6. Materials Needed

   A complete list of materials you will need to implement your lesson.

7. Description of Learning Activities

   This section should clearly articulate what you and your students will be doing during the lesson. This section should be written with enough detailed information to provide the reader with a clear picture of what will occur during your lesson implementation.

8. Guiding questions/Typical Discussion Questions

   Questions you will ask students to stimulate their thinking toward the objective(s). What will you ask students during the lesson to ensure that they comprehend the main concepts of your lesson? What responses do expect from your students? Which student responses would indicate a lack of understanding or perhaps a misconception in the intended learning material.

9. Lesson modifications for diverse learners

   Describe how you will modify or customize your lesson implementation for students with special needs. Include modifications for students with learning disabilities and students who are more advanced than the "mainstream students" in your class.

10. Lesson Closure

How will you conclude your lesson to ensure that your learners understood the lesson's concept(s)? Lesson closure should take 2-5 minutes. What will you do to ensure they understood the "take home message" of your lesson?

11. Assessment

How will you assess that leaning has occurred? **Include both formative and summative assessments**. Describe the assessments you will use.
For formative, how will you use that information to inform teaching and influence learning? Be specific.
For summative, include assessment items that would appear on an end-of-the-unit quiz or test. Include a criterion-based assessment if appropriate.
Your assessment items should align specifically to your lesson objective(s).

12. Extension activities

Describe what your students might do to extend their learning in greater depth, exploring additional variations, and keeping their explorations going as they investigate concepts in more detail. These continued explorations may be be used as additional take-home activities.

13. Applications to Real Life Situations

How does this activity or lesson apply to the daily lives of your students? How is this activity meaningful to the student? Think about how you would respond to a student if they asked you: "*Why do we need to learn about this*?"

Web-based Science Activity

Develop a Web-based science activity that will be used by secondary science students (grades 7-12) to engage in a science-specific curricular topic of interest. Your science activity should enable students to use scientific process skills. These may include: observing, classifying, comparing, measuring, predicting, inferring, and communicating. Your science activity may take a variety of forms depending on the maximum points you seek to obtain for this assignment – see chart below. You will create a handout for your activity to be used for assessing student science learning. You will test out your Web-based science activity with a secondary school student or students and/or teacher and provide a brief report on its effectiveness in bringing about science learning.

Activity Type	**Maximum Grade Possible**
Web-based inquiry (WBI) containing all 5 essential features of inquiry	A
Web-based inquiry (WBI) containing 4 essential features of inquiry	A-
Web-based inquiry (WBI) containing 3 essential features of inquiry	B+
Activity that engages learners with authentic data or a simulation	B
Structured guided investigation that uses guiding questions to focus student's explorations	B-

In your submission, be sure to provide the grade level and subject that this activity is intended for.

Your final grade will be determined by the following criteria:

1. Creating a Web-based science activity and loading it on your Lehigh University or other server space. Provide the instructor with the URL (Web page address) and a printed copy of your Web page(s).
[No need to submit Web page copies from externally linked sites.] (75% of grade).

2. Provide a handout to assess student science learning. **Include an answer key** for your assessment. (20% of grade).

3. Test out your Web page with an secondary school student or students and/or teacher. Based on your feedback from your pilot-tester, revise your Web-based activity as needed. Provide a brief report on its effectiveness in bringing about science learning with your pilot-tester and discuss how you revised your site to enhance learning. (5% of grade).

Examples of exemplary Web-based inquiries (WBIs) that contain all 5 essential features of inquiry from students previously in this course can be viewed online at:
http://www.lehigh.edu/~amb4/wbi/

An example of a Web-based inquiry (WBI) containing all 5 essential features of inquiry, "**Dissolved Oxygen**," can be viewed online at:
http://www.leo.lehigh.edu/envirosci/watershed/curricular/oxygen/

Additional examples of WBIs are available in the papers online at:
http://www.lehigh.edu/~amb4/wbi/

Ideas to get you started:

Use specific areas of the WhaleNet Web site (**http://whale.wheelock.edu/)** to have students compare marine mammals migration patterns.

Use the still images and QuickTime Virtual Reality panoramas in the Carolina Coastal Photojournal (**http://www.ncsu.edu/coast/pjournal/index.html**) to have students compare similarities and differences in the amount of sand, visible waves, and plant cover between the ocean side and marsh side of the same barrier island.

Use the Internet to locate photographs of other watershed areas in the world and compare these to the Lehigh River watershed photojournal online at: **http://www.leo.lehigh.edu/envirosci/watershed/pjournal/.** Focus on the presence and absence of "man made" structures. How do these impact the environment?

A Word About File Management
Remember that while you are working on your Website files, you'll want them to be located on the local hard drive of the computer on which you're working. When you finish each day, you'll want to be sure to copy your Website files to diskette or Zip disk. This is especially important when you're working on a computer in a public lab (like the Mac lab), where hard drives are "cleaned" of all non-essential files every day. Once you've copied your Website files to floppy or Zip disk, you should then also be careful to delete any files you've copied to the hard drive of a lab computer to assure that others won't have access to your site.

Naming your files:
For your Web-based science activity, file names should adhere to the following conventions:

- Use **only lower-case letters** in your file names. For example: name a file "volcano.html", not "Volcano.html".
- Do NOT add any blank spaces to your file names. For example, name a file "volcano_places", not "volcano places".
- Use the .html or .htm extension for HTML files (for example, "content.html").

Points to keep in mind:

1. Blinking lights on Web pages are "eye candy". They serve no purpose and can not be viewed by students with disabilities who use special Web browsers.

2. If you turn a graphic on a Web page into a hypertext link, provide a text link or create an alt image tag with a description of the graphic (your Web editor can do this when you insert your image). This will enable students with special Web browsers to understand what you are trying to convey.
Most folks who produce Web pages do not accommodate all students.

For more info, visit Bobby at: **http://www.cast.org/bobby/**

3. Be aware that some students are color blind. Do not go color crazy with your text color(s). Black text works fine on many light colored backgrounds.

4. If your Web site or a linked site requires a special plug-in or application to listen to audio files, QTVR, or video clips, make a note in your exploration to provide users the information they need to use this application. Provide a link to a Web site where users can download the application or plug-in. This information is available for you on the course Web site.

5. When you create a Web page, you become the owner of the content. So, site the copyright. Also, you should provide a link to your e-mail address and state the last updated date.
For example, on the bottom of my Web page I might write:

Comments and suggestions are welcome.
amb4@lehigh.edu
Last updated: September 10, 2005
© 2005 Alec M. Bodzin

6. Some Web sites become very busy and servers can be overloaded. If constructing a guided Web exploration, it is recommended that your Web activity provides multiple Web sites were students can find information in case one of the Web sites becomes busy.

7. On busy Web pages, especially those with multiple frames, be specific where learners need to locate information.

8. Avoid navigation within framed Web sites.

To find the actual page within a frame:

Click and hold down your mouse in that frame. You will get a pop-up menu.
Select "New Window with This Frame".
A new browser window will open up and display the actual Web site.

9. When making Web pages, use the KISS principle. "Keep It Simple Silly." Avoid unobtrusive frills such as

busy backgrounds and flashing lights.

10. Guide students directly to Web pages where they can find the needed information. They should not have to make additional mouse clips to get to the information.

To Activate Your Lehigh Server Space

If you have never set up a Web page on the Lehigh server, you'll need to begin by "activating" your space. If you have already set up a Web page on the Lehigh server DO NOT FOLLOW THESE STEPS (you could lose the pages you have already posted).

1. Open your browser and go to http://www.lehigh.edu/account.
2. Enter your AFS ID and password.
3. Click on *W3Setup*.
4. On the next screen, enter your password again, then click the *Set up Home Page* button.
5. After a few seconds, you'll see a bunch of blue text at the top of the screen that's labeled "Command output." That means it has set you up. You can quit your browser and proceed.

A variety of Web page development tutorials and information on uploading your pages on to Lehigh's server are available online at:
http://www.lehigh.edu/computing/web/building.html

If you have difficulty uploading your Web pages to your server space, contact Lehigh's Help Desk at 610 758-HELP or see Dr. Bodzin during his office hours and he will upload your files for you.

A DreamWeaver tutorial is available in the *Course Documents* section of Blackboard.

Book Review

Computers, Teachers, Peers: Science Learning Partners by Marcia Linn and Sherrie Hsi

Or

Equity and Science Education Reform by Sharon Lynch

Overview

The purpose of this book review is to help you critically analyze a work rather than merely reporting its content. In order to help you achieve this objective, the specific questions which you are to address are provided below in the outline. All reviews are to be completed in the format stipulated and word processed using 12 point, Times font, double-spaced type.

I. General Review of the Work (1-2 pages)

A. What is the major point the author is attempting to present? Is there a major and minor thesis?

B. Was the thesis clearly developed? Why or why not?

C. Was the author's argument(s) supported by data or facts?

II. Salient points (1-2 pages)

What are the implications and relevance of the author's thesis to the course material?

III. Your Individual Reaction (1-2 pages)

What effect, if any, has this work had on your thinking or professional development? In other words, in this section outline your personal reaction to the book. Defend your answer empirically with references to the work or to relevant data from other sources including personal experiences.

Science Instructional Unit / Planning Outline

You will create an instructional resource unit to be used in teaching a science topic in an secondary school science class (grades 7-12). Your instructional unit will contain:

- A comprehensive unit planning outline that serves as a resource for the entire unit
- A minimum of 5 lesson plans,
- At least one lesson that incorporates instructional technology into the unit (Web-based activity, hand-held data collection probeware, hypermedia, software, etc.).
- At least 2 authentic assessment instruments that must include 1 rubric.
- An **end of the unit test** for the unit that incorporates a mixture of traditional assessment type items (i.e. multiple choice test items) and non-traditional assessment items (i.e. design problems). Your test should include a minimum of 10 multiple-choice items, 4 true-false items, and at least 2 open-response items. Include an **answer/scoring key** for this unit summative assessment. Detailed scoring criteria should be included for each open-ended assessment item.

An artifact submitted for other course assignments may not count as part of the requirements for the resource unit.

Your curricular resource unit is to be completed in the format stipulated below. Points will be deducted for not adhering to the assigned format.

Science Instructional Unit Planning Outline

Please submit this assignment in the format stipulated below. (be sure to state grade level)

A. **Overarching understandings**. What **overarching understandings** are desired? What will students understand as a result of this unit?

B. **Essential questions**. What are the **overarching "essential" questions of the unit?** What **"essential"** and **"unit"** questions will focus this unit? List the questions you will ask to determine whether the students understand the material studied and whether they can apply what they have learned.

C. **Assessment methods for gathering evidence.** What evidence will show that students understand _____? List performance tasks, projects, quizzes, tests, academic prompts, and other evidence (e.g. observations, work samples, dialogues) that you will use to assess learner understandings.

D. **Learning objectives**. Given the target understandings, other unit goals, and the assessment evidence identified, what knowledge and skills are needed? Specify what students ***need to know*** (facts, concepts, principles, generalizations) and ***be able to do*** (skills, process, and strategies) to demonstrate their understanding through performance.

Students will understand …….
Students will be able to…..

E. **Learning Experiences**. What teaching and learning experiences will equip students to demonstrate the targeted understandings?
Be sure to **clearly articulate** your activity implementation ideas for each of your intended lessons. Do not just state a title of an activity. Briefly explain what students will do in the activity to learn a science concept. It is recommended that you use a bulleted brief description list for each day of your unit.

For example….

Day 1:
• Present the story of the sailors' "mystery disease" (scurvy).
• Introduce essential and unit questions and key vocabulary terms.
• Present concept attainment lesson on food groups, then categorize foods into groups – fats, proteins, and carbohydrates.

Day 2:
• Have students read and discuss the nutrition brochure from the USDA.
• Present lesson on the food pyramid and identify food in each group.
• Have students test food for the presence of carbohydrates using "the starch test" with iodine.

Day 3:
• Web-based activity on building balanced meals. Students will go to the Burger King Web site and plan a balanced meal based on a given amount of calories, fats, protein, and carbohydrates.

[Continue for each day of your unit.]

F. Consideration of **Safety Precautions**. What, if any, special considerations should be made about safety?

G. Consideration of **Special Students**. Describe variations on the lessons you would implement if you have special students - for example, students with disabilities or gifted students.

H. **Integrated Activities**. Outline integrated activities you may wish to use throughout the unit. For the most part, these activities will be broad-based, covering a range of curricular areas including mathematics, social studies, language arts, and/or art. **Clearly state** how these are integrated into other discipline areas.

I. **Materials and Resources.** It is advantageous to determine necessary materials and resources to assist in the implementation of your unit. This way, you avoid limiting yourself to a few familiar items. Many of these items can be used in activity centers or for extension activities. Resources for your own personal planning use may also be listed.

Be sure to use APA style for each of your references.
A fairly complete list of how to cite materials in APA format is available in the Course Website.

For Internet resources, here is an acceptable format I would expect you to use:

Carolina Coastal Science. (1998). NC State University: Bodzin, Alec M. Retrieved September 28, 2000 from the World Wide Web: http://www.ncsu.edu/coast

For Internet resources, make sure you include the Web site title, published date, publisher, author, date retrieved, and Web address (URL).

a. Printed Resources. Printed Resources. Books, textbooks, curricular enhancement modules, pamphlets, journals, maps, encyclopedias, magazines, booklets, professional journals. (**List at least 3**)

b. Computer and CD-ROM Resources. Educational software, reference works, educational games and simulations related to curriculum, and CD-ROM adaptations of literature. (**List at least 1**).

c. Internet Resources. (**List at least 6**).

d. Audio/Visual Resources. Videos, films, filmstrips, laser discs, movies, slide programs, or overhead transparencies. (**List at least 1**).

Lesson plans

Your resource unit must contain at least 5 lesson plans. The lesson plans must show developmentally sound scope and sequence to the content and concepts that are presented. You may get ideas from other places but do NOT just zerox intact lesson plans from somewhere else.

• Your selected assessments must correlate with your objectives. ***Each lesson plan must clearly articulate both formative and summative assessments***. **Each lesson plan must include summative assessment items from the end of unit test**.

• Be sure to attach student worksheets, data tables, copies of lecture notes, or other handouts to each individual lesson plan as applicable.

The Science Lesson Plan format (refer to the Science Lesson Plan Assignment for specific detail).

1. Target Grade or Age Level
2. Scientific Process(es) Addressed
3. Pennsylvania Science Content Standards or *National Science Education Standards*
4. Objective(s)
5. Description of Introductory Activity (Anticipatory Set) and Discussion
6. Materials Needed
7. Description of Learning Activities
8. Guiding questions/Typical Discussion Questions
9. Lesson modifications for diverse learners
10. Lesson Closure
11. Assessment
12. Extension activities
13. Applications to Real Life Situations

"5 Es" instructional model lesson plan format:

You may also use The "5 Es" instructional model in your lesson plan format (remember: it is okay if your total lesson plan takes more than one class period using this model – just make sure that activities for each day are clearly indicated).

A. Target Grade or Age Level

B. Scientific Process(es) Addressed

> These are processes and skills might include observing, classifying, formulating hypothesis, inferring, etc. Refer to your Martin text for an extensive list of processes if needed.

C. Pennsylvania Science Content Standards or *National Science Education Standards*

> State the standard(s) that your lesson aligns to. Be specific in articulation this standard.

D. Instructional Objectives

> State the content and process objectives of your lesson. Begin each objectives with "*Students will ….*". Each objective should align to your assessment items.

E. Materials Required

1. Engage - Students are engaged by an event or question related to the concept that the teacher plans to introduce.

2. Explore - Students participate in one or more activities to explore the concept. This exploration provides students with a common set of experiences from which they can initiate the development of their understanding.

3. Explain - Students interpret data, construct inferences, make predictions, and build explanations. The teacher clarifies the concept and defines relevant vocabulary as needed.

4. Elaborate - Students elaborate and build on their understanding of the concept by applying it to new situations and problems.

5. Evaluate - Students complete activities that will help them and the teacher evaluates their understanding of the concept using a variety of assessments.
How will you assess that leaning has occurred? **Include both formative and summative assessments**.
Describe the assessments you will use.
For formative, how will you use that information to inform teaching and influence learning? Be specific.
For summative, include assessment items that would appear on an end-of-the-unit quiz or test. Include a criterion-based assessment if appropriate.
These should align specifically to your lesson objective(s).

F. Lesson modifications for diverse learners

Describe how you will modify or customize your lesson implementation for students with special needs. Include modifications for students with learning disabilities and students who are more advanced than the "mainstream students" in your class.