

CHEMISTRY 435
METHODS OF TEACHING SECONDARY SCHOOL SCIENCE

- I. Credit,** 3 semester hours;
Prerequisite Education 300 or special permission from instructor
- II. Instructional Materials:**
- A. *Science Instruction in the Middle and Secondary Schools 6th edition* by Chiappetta and Koballa
 - B. *How to Be an Effective Teacher: The First Days of School* by Wong and Wong, and
 - C. Resource book
- III. Catalog Course Description:** “Designed to familiarize teachers with current trends, methods and techniques of teaching science to secondary school students. This course may not be used to satisfy requirements for a major or minor in biology. Students certifying to teach biology will take this course.”
- IV. Rationale for Course:** A science teacher’s role is very important. A person planning to become a science teacher must have knowledge of science and must develop the skills needed to teach science. This course is designed to equip a person planning a future in science teaching with the skills needed such as planning a lesson, presenting a lesson, and evaluating a lesson. The future teacher also needs the skills to enforce discipline and provide a safe learning environment for his/her students. This course will also allow the future educator to research current topics in science education.
- V. Course Objectives:**
- A. Students will create a unit plan that addresses NSTA Standards science content, unifying concepts, personal and technological applications, nature of science, inquiry, issues in science, and science in the local community, state/national standards, and assessment.
 - B. Students will create a safety unit that demonstrates their understanding of the professional knowledge of safety that a science teacher needs to have a safe science classroom.
 - C. Students will create a portfolio that demonstrates the content understanding of NSTA standards 1b, 2a–b, 3a, and 4a. These standards include
 - 1. 1b) Understand and can successfully convey to students the unifying concepts of science delineated by the National Science Education Standards.
 - 2. 2a) Understand the historical and cultural development of science and the evolution of knowledge in their discipline;
 - 3. 2b) Understand the philosophical tenets, assumptions, goals, and values that distinguish science from technology and from other ways of knowing the world;
 - 4. 3a) Understand the processes, tenets, and assumptions of multiple methods of inquiry leading to scientific knowledge;
 - 5. 4a) Understand socially important issues related to science and technology in their field of licensure, as well as processes used to analyze and make decisions on such issues;
 - D. Students will demonstrate their ability to assemble and teach a lesson that involves an inquiry-based activity.
 - E. Students will demonstrate knowledge of the foundational skills necessary for planning, teaching, management, and evaluation in the secondary classroom.
- VI. Academic Integrity:** Students are expected to be honest and to submit their own work on exams and projects.

Adherence to the Mississippi College “Honesty Policy” (see the *Mississippi College Student Handbook*) will be followed.

VII. Methods of Instruction: Presentations of illustrated lectures, class discussions, activities and demonstrations will be utilized.

VIII. Required Practices:

Several short writing and reading assignments pertinent to topics discussed in class will be required. Written assignments must be legible and grammatically correct. Assignments include:

- A. Read the following book: *How to Be an Effective Teacher: The First Days of School* by Wong and Wong. Be prepared to discuss this on the assigned days. You will have some questions from this book on each exam. You will be able to use your notes and the book on the exam.
- B. Teach a concept of your choice. Develop the idea and reinforce it with an inquiry-based activity. Include lesson plans and an evaluation for this concept. 100 points
- C. Three Exams. The format of each exam will short answer/discussion. 100 points each
- D. Exam on safety. 100 points
- E. Complete safety portfolio. 100 points
- F. Complete portfolio that demonstrates the content understanding of NSTA standards 1b, 2a–b, 3a, and 4a.
- G. Complete unit plan. 100 points
- H. Additional assignments will be added. Please turn these in on the date assigned.

IX. Evaluation Methods: Your grade will be determined from these activities: **In order to get full credit, each assignment must be turned in on the assigned day during class period!**

X. Grading Scale:

Final grades will be assigned based on this scale:

- A= 90-100%
- B= 80-89%
- C= 70-79%
- D= 60-69%
- F= 0-59%

XI. Attendance and Make-up Policy: Attendance in class is expected. The student is responsible for any instructions, assignments, or work missed during an absence. Tests missed during an excused absence must be made up as soon as possible. The Mississippi College attendance policy states that anyone who misses 25% or more of the scheduled classes will receive a grade of “F” in the course. See the *Mississippi College Student Handbook*)

XII. Resources

- A. National Research Council (1996) National Science Education Standards. Washington D. C: National Academy Press.
- B. Trowbridge, L.W., and Bybee, Roger, W.(1990) Becoming A Secondary School Science Teacher (5th ed.). Columbus, Ohio: Merrill Publishers.

Special accommodations at Student Counseling Services:

In order for a student to receive disability accommodations under Section 504 of the Americans with Disabilities Act, he or she must schedule an individual meeting with the Director of Student Counseling Services **immediately upon recognition of their disability** (if their disability is known they must come in before the semester begins or make an appointment **immediately** upon receipt of their syllabi for the new semester). The student must bring with them written documentation from a medical physician and/or licensed clinician that verifies their disability. If the student has received prior accommodations, they must bring written documentation of those accommodations (example Individualized Education Plan from the school system). Documentation must be current (**within 3 years**). The student must meet with SCS **face-to face** and also attend two (2) additional follow up meetings (one mid semester before or after midterm examinations and the last one at the end of the semester). Please note that the student may also schedule additional meetings as needed for support through SCS as they work with their professor throughout the semester. Note: Students must come in **each semester** to complete their Individualized Accommodation Plan (example: MC student completes fall semester IAP plan and even if student is a continuing student for the spring semester they must come in again to complete their spring semester IAP plan).

Student Counseling Services is located in Alumni Hall Room #4 or they may be contacted via email at christia@mc.edu or rward@mc.edu. You may also reach them by phone at **601-925-7790**.

Requirements for class

I. **Portfolio requirements that demonstrates the content understanding of NSTA standards 1b, 2a–b, 3a, and 4a.**

The following should be found in your portfolio.

1. Unifying concepts in science
 - a. Using the National Science Education Standards, explain each fundamental concepts of unifying concepts standard.
 - b. Explain how each concept can be incorporated into a science classroom.
 - c. Include one activity that teaches the unifying concepts. Relate the activity to unifying concepts.
2. Nature of Science.
 - a. Using the National Science Education Standards, explain the three components of the History and Nature of Science Standard.
 - b. Explain how each component can be incorporated into a science classroom.
 - c. Complete the case study.
3. Inquiry- Write an essay that contains the following information.
 - a. Explain the types of inquiry:
 - i. Open
 - ii. Structured
 - iii. Guided
 - b. Explain the following models:
 - i. Learning cycle
 - ii. 5e instructional model
 - iii. 7e instructional model
 - c. What are the benefits of each type of learning model?
 - d. Include an activity that incorporates one of the learning models. Relate the model to the activity.
4. Issues in Science
 - a. Complete case study.
 - b. During the case study, you will analyze the problem, consider risks and costs, as well as the benefits of alternative solutions and discuss how well these relate to the goals and values of the community.

Safety Unit

To learn the appropriate knowledge to manage a safe science classroom, the pre-service teacher could create a portfolio of safety information suitable for the age he/she will be teaching. The individual parts should include:

1. Guidelines for students to have for working safely in the science classroom. These could be in the form of a booklet of rules and regulations that should be taught to students
2. A safety quiz/test about the rules of safety in the classroom and what to do in various emergency situations. This quiz would be administered to your students.
3. A design/plan of a typical science classroom/lab that pinpoints safety issues, such as chemical storage, projected traffic of students in the classroom, living organism placement, emergency exit information, eyewash, shower, fire extinguishers, fire blanket and similar information.
4. A safety contract that explains the basic safety procedures and features of the science classroom. This contract should be constructed for the signature of parents and students. This can be patterned after the contract Flinn Scientific has created. Develop your own.
5. An information packet explaining the safe, ethical and humane treatment of living organisms in the classroom as well as in the natural world. This should include a review of rules and regulations for collecting organisms in the field and experimentation in the classroom based on local, state and national laws/regulations. The concepts of protected and endangered species as well as the role of parks and reserves should be included.
6. A safety plan explaining safe storage, handling and disposal of chemicals. A list of typical chemicals for an appropriate grade level should be generated with copies of MSDS sheets for 5 common chemicals used at this level. Explain the safe storage, handling and disposal of these chemicals. List three sources (other than MSDS sheets) that contain information on how to safely store, handle and dispose of chemicals.
7. A plan for behavior management of students in a science classroom. This would include special precautions, special rules for handling chemicals and lab equipment, proper behavior in lab conditions and working with living or non-living organisms, positive/negative consequences for behavior, use of safety equipment and other pertinent information. This is a pro-active plan to prevent behavior that would be unsafe.
8. Review of videos on safety.
9. Describe the principles of liability and negligence. In addition, candidate describes methods for meeting these obligations. These include but are not limited to proper supervision of students, ensuring student knowledge of safe procedures, managing student behaviors, responding to student injuries, and ensuring the safety of students with handicaps and/or medical conditions.
10. Complete the examination on safety with a 70% or higher.
11. Read the label on a fire extinguisher. Explain how to use a fire extinguisher from this label. Describe the types of fire extinguishers. What type is most likely to be found in a science classroom? How often should it be inspected?

Assessment 3, Unit Plan

Unit Plan Assignment

- I. Assignment information
 - a. Be sure to type this unit plan!!!
 - b. It should cover ten days.
- II. Format
 - a. Unit overview (The following should be done just once for the entire unit.)
 - i. Name:
 - ii. Intended grade level:
 - iii. Class (Biology, Chemistry, etc.):
 - iv. Unit:
 - v. Topic:
 - vi. Correlate to National Science Education Standards
 1. Get these from http://www.nap.edu/catalog.php?record_id=4962#toc
 2. List the NSES Standards. Copy and paste the entire statement.
 - vii. Correlate to Mississippi Content standards.
 1. These can be found at <http://www.mde.k12.ms.us/acad/id/curriculum/Science/index.htm>
 2. List the statement and the DOK level.
 - b. Materials & Resources needed for the Entire Unit:

What lab or demonstration materials will be needed? Try to be complete. Be sure to include the “obvious” materials here: If you plan to use an overhead projector, write “overhead projector,” “overhead sheets,” “Vis-à-vis markers,” etc.; if you plan to use the textbook, write “textbook.” There should be a master list that you can use to prepare for an upcoming unit, so rather than having materials broken down by *day*, have them grouped by *type* (e.g., Chemicals from Stockroom; Consumables; Text Materials; Lab Equipment; Demonstration Apparatus; etc.).
 - c. Summative Assessment:

At the conclusion of the unit, how will you determine whether or not your students achieved the NSES and Mississippi Academic Content Standards that you listed above? The Unit Plan must include assessment measures that are tied to the learning objectives. Some assessment measures must also support students’ self-reflection and self-evaluation
 - d. Other assessments
 - i. Include how you will use the results of the assessments to guide and modify instruction.
 - ii. Include opportunities for students to self-assess and regulate their behaviors in such a way as to improve learning associated with this unit plan.
- III. Daily lesson Plans:
 - a. Date
 - b. Daily Topic :
 - c. Objective for day:
 - d. Procedures: Write in terms of teacher and student centered procedures.
 - e. Materials/ Resources needed for Lesson
 - i. What lab or demonstration materials will be needed?
 - ii. Be sure to include the obvious materials such as an overhead projector, and overhead sheets.
 - f. Evaluation
 - i. Include the diagnostic or formative assessment:
 - ii. Concentrate on how you will know whether or not the students are “getting it” during the lesson,

not how you will evaluate them at the end of the unit. This needs to be tied to your instructional objectives for the lesson. Some assessment measures must also support students' self-reflection and self-evaluation.

- g. Safety considerations: List all safety concerns associated with each daily lesson.

Topics to be Covered in the Unit

As you consider the scope and sequence of the unit, and the details of your lessons, keep in mind the following requirements for your Unit Plan:

1. **Science content** must be accurate and grade-appropriate and must apply to students' personal lives.
2. **Unifying concepts (National Science Education Standard) must be addressed in the course of the Unit Plan.**
3. The "**Nature of Science**" (NOS) must be addressed in the course of the Unit Plan
4. Students must be engaged in **scientific inquiry** during the course of the Unit. You will guide your students through the process of developing scientific ideas from observations, data, and experimental results. You can use a discovery or guided inquiry approach.
5. The Unit Plan must address some **societal issue or problem** that is relevant to the science/technology topic being studied. For a societal issue, your students must be able to differentiate scientific aspects of the issue from economic, political, ethical, etc. aspects; and they must be able to articulate arguments for both sides of the issue. For a societal problem, students must be able to analyze various aspects of the problem and compare and contrast at least two different solutions to the problem. The unit plan must include an activity where students are actively engaged in the analysis of problems, including considerations of risks, costs and benefits of alternative solutions.
6. The Unit Plan must be tied to some **local, community-based resource** or reference point. You might do this by planning a field trip (actual or virtual) that enhances the concepts taught in the Unit. You might bring in a community member as a guest speaker (actual or video/teleconference).
7. The unit plan must include an inquiry investigation where students are actively engaged in the analysis of problems, including considerations of risks, costs and benefits of alternative solutions.
8. Technology must be included.