

Virginia State University
School of Engineering, Science, & Technology
Dept. of Biology
Course syllabus: Spring 2004

Teaching Science in Secondary Schools, Biol 428, 3 sem. hrs.

- Instructor: Larry C. Brown, Ed.D.
- Office: 102 LB
- Telephone: 524-5123
- Office hrs: 8-9, 10-11TR, 1-3 F
- Home Page <http://www.vsu.edu/facultypage/lbrown>
- Departmental Home Page <http://www.vsu.edu/biology>

Course Description:

The course is designed to foster the development and understanding of principles and major concepts of science as they relate to secondary school teaching. It also acquaints prospective teachers or in-service teachers with current theories and practices in science teaching. Concepts of teaching science as inquiry and as methods of investigation are developed. Students will also participate in series of organized observational experiences in a public middle or high school classroom.

Course Text: "Becoming A Secondary School Science Teacher," Leslie Trowbridge & Roger Bybee, 5th ed., 1990, Merrill Publishing Company

Knowledge, Skills and Abilities: See attached pages.

Methodology:

Through the use of lecture and discussion, the concepts of teaching science as inquiry and as methods of investigation will be developed. Students will be given needed background materials in order to keep pace with the changes in science which require new perspectives in the total secondary school program. Efforts will be made to guide students into problem solving situations in which they, as prospective teachers, will identify as their own/or those in which teachers in general are confronted.

Evaluation: Course evaluation will be conducted in terms of:

- | | |
|------------------------------------------------------------------------------------------------------------------------------|------|
| 1. Written Reports | 5 % |
| 2. Completion of on-campus laboratory investigations designed for chemistry, biology, and physics secondary school students. | 10 % |
| 3. Micro-teaching experience | 15 % |
| 4. Mid-term Examination | 15 % |
| 5. Final Examination | 15 % |
| 6. Participation in "in-school" experiences | 15 % |
| 7. Construction of lesson plan and unit plan | 15 % |
| 8. Research paper | 10% |

Grade Scale: 100-90% A, 89-80% B, 79-70% C, 69-60% D, 59-F.

Biol 428
Teaching Science in Secondary Schools
KNOWLEDGE

1. Students will select science curriculum materials appropriate for the educational setting in which they are teaching.
2. Students will describe safety concerns in a laboratory environment.
3. Students will be knowledgeable of the professional and legal obligations in the teaching of science. Students will be able to reference case studies pertaining to liability issues in science teaching.
4. Students will be able to describe and identify the major categories of intellectual activity of the cognitive domain according to Bloom.
5. Students will learn how to guide children through questioning to arrive at a generalization of science.
6. Students will be knowledgeable of the Virginia Standards of Learning for Middle School and High School Science.
7. Students will be able to identify, locate, evaluate and use instructional hardware and scientific software supporting Virginia's Standards of Learning along with other types of instructional objectives
8. Evaluation Strategy: Demonstrations and Unit tests.

SKILLS

1. Students will construct a unit plan utilizing the discovery method of instruction for a set of content, skills and/or attitudes for a selected secondary school grade or developmental level.
2. Students will demonstrate increased competency in applying and skill in defined strategies and techniques of classroom methodology as revealed through a series of micro-teaching experiences. Contemporary research findings will be incorporated into micro-teaching, lesson plans and unit plan assignments.
3. Students will be able to maintain an environment conducive to the teaching and learning of science through appropriate classroom management techniques. Students will evaluate classroom management techniques they observed while making classroom visits in the local public schools. Classroom management techniques will be evaluated during micro-teaching through the use of an evaluation form.
4. Students will demonstrate increased skill in planning, organizing and teaching individual or small groups of students through participation in a series of planned "in-school" experiences.
5. Students will construct an instructional module and/or unit plan utilizing the discovery methods of instruction for a given set of content skills and/or attitudes for an appropriate secondary school grade or developmental level.

6. Students will be able to present a lesson on an assigned topic using a student prepared lesson plan and unit plan. The students will demonstrate how the class will be assessed.
7. Students will be able to prepare a variety of assessment instruments consistent with the goals of the science course to assess student outcome, i.e., worksheets, quizzes, tests, examinations,
8. Students will be able to plan and use lessons involving technological approaches to meet the diverse needs of learners in a variety of educational settings after having made a series of observations in science classrooms in the local public schools.
9. Students will prepare a list of careers that students studying science may pursue. Students will write a report on career choices in a selected area.
10. Students will be able to locate resource persons from the local community to assist in the instructional process.
11. Students will present a rationale either orally or in writing for the inclusion of science as a field of study in the secondary school.
12. Evaluation Strategies: Oral presentations, micro-teaching, written reports, and written unit lesson plans.

ABILITIES

1. Students will identify and take action to eliminate missing competencies in their educational background as are necessary for more effective classroom presentations (i.e., develop skill in writing behavioral objectives, test construction, questioning, etc.)
2. Students will analyze and demonstrate alternatives for teaching science to handicapped students and students with learning disabilities.
3. Students will be able to demonstrate an ability to work with students of different ability, ethnic and cultural backgrounds.
4. Students will be able to use electronic technologies (i.e. Internet) to access and exchange information. Students will be able to integrate technology into instruction through the use computers, interactive programs and telecommunications.
5. Students will be able to prepare a list of safety precautions for the chemistry, biology and physics classroom and laboratory. Students will be able to demonstrate proper safety procedures in the classroom, field, and storage areas.
6. Students will be able to list technological instruction in a classroom that is being used in educational computing and technology

7. Students will identify and analyze specified science and mathematics curriculum improvement projects, especially those associated with their area(s) of specialization.
8. Students will develop a basic knowledge of the legal issues surrounding a science classroom.
9. Students will tend and care for living organisms in the laboratory. Students will maintain aquariums, terrariums, plants, and small animals in a science laboratory environment.
10. Evaluation Strategy: Oral presentations, demonstrations, papers and tests.

COURSE DISCUSSION TOPICS

1. Safety in the laboratory, field and storage areas
2. Qualifications to teach science.
3. Teacher planning.
4. Motivation and learning.
5. Questioning and inquiry teaching.
6. Inquiry and investigations.
7. Individual differences in the classroom.
8. Computers and technology in science classes.
9. Materials for science teaching.
10. Demonstrations and laboratory work.
11. Planning for effective science teaching.
12. Evaluating classroom performance
13. Resolving conflicts in the science classroom.

BIBLIOGRAPHY

- Aldridge, Bill G. and Karen L. Johnson, "Trends and Issues in Science Education," in *Redesigning Science and Technology Education* 1984 NSTA Yearbook, (Washington, D.C.: National Science Teachers Association, 1984).
- American Association for the Advancement of Science – Project 2061. "Science for all Americans." New York: Oxford University Press, 1990.
- American Association for the Advancement of Science – Project 2061. "Benchmarks for Science Literacy." New York: Oxford University Press, 1993.
- American Association for the Advancement of Science – Project 2061. "Blueprints for Reform – Science, Mathematics, and Technology Education," New York: Oxford University Press, 1998.
- Atkin, J.M. and Robert Karplus, "Discovery or Invention?" *The Science Teacher*, 29 (1986), pp. 45-51.
- Baker, D. & M. Piburn, "Constructing Science in Middle and Secondary School Classrooms," Boston: Allyn & Bacon, 1997.
- Bloom, Benjamin, et al., "A Taxonomy of Educational Objectives: Handbook, 1, The Cognitive Domain," (New York: David McKay, 1950).
- Bybee, Rodger, "Science Educators' Perceptions of the Ideal Science Teacher," *School Science and Mathematics*, 78, no. 1 (January 1978), pp. 13-22.
- Collette, Alfred T. and Eugene L. Chiappetta, "Science Instruction in the Middle and Secondary Schools," 3rd ed., 1994, Merrill Publishing Co., New York, NY.
- Carin, Arthus A. and Robert B. Sund, "Teaching Science Through Discovery," 6th ed., 1989, Merrill Publishing Co., New York, NY.
- Carlson, Sybil B., "Creative Classroom Testing," 1985, Educational Testing Service, Princeton, NJ.
- Commonwealth of Virginia Board of Education, Standard of Learning for Virginia Public Schools, Richmond, VA, 1995.
- Commonwealth of Virginia Department of Education, Virginia Standards of Learning Assessments, Richmond, VA, 1998.
- Fornoff, Frank J., "Survey of the Teaching of Chemistry in Secondary Schools," *School and Society*, 98 (1970), pp. 242-243.

Gabel, D. (Ed.) "Handbook of Research on Science Teaching and Learning," A Project of the National Science Teachers Association. New York: Macmillan, 1994.

Gronlund, Norman, "Measurement and Evaluation in Teaching," 5th ed. (New York; Macmillan and company, 1985) pp. 308-309

Harrison, Anna, "Goals of Science Education," *Science*, 217, no. 4555 (July 1982), p. 109

Hasssard, Jack, "Minds on Science – Middle and Secondary School Methods," 1992, Harper Collins Publishers, New York, NY.

Hickman, Faith, "Education for Citizenship: Issues of Science and Society," *The American Biology Teacher*, 44, no. 6 (1982) pp. 358-367.

Hoffman, K. and E. Stage, "Science for All: Getting it Right for the 21st Century," *Educational Leadership*. 50, 5 (Feb. 1993) pp. 27-31.

Lawson, Anton E., "A Better Way to Teach Biology," *The American Biology Teacher*, 50, no. 5 (May 1988), pp. 266-278

Mayer, William, "Biology Teachers Handbook," 3rd Ed., 1978, Wiley & Sons.

Morholt, Evelyn and Paul F. Brandwein, "A Sourcebook for the Biological Sciences," 3rd ed., 1986, Harcourt Brace Jovanovich, Publishers, New York, NY

National Research Council. "National Science Education Standards," Washington, D.C., National Academy Press, 1996.

National Research Council, "Fulfilling the Promise- Biology Education in the Nations Schools," Washington, D.C., National Academy Press, 1990.

Renner, John W. and Michael Abraham, "The Sequence of Learning Cycle Activities in High School Chemistry," *Journal of Research in Science Teaching*, 23, no. 2 (1986) pp. 121-143.

Rowe, Mary Budd, "Teaching Science by Continuous Inquiry," (New York: McGraw Hill, 1979).

Shymansky, James, "BSCS Programs: Just How Effective Were They?" *The American Biology Teacher*, 4, no. 4 (1984), pp 54-57.

Trowbridge, Leslie and Rodger Bybee, "Becoming A Secondary School Science Teacher," 5th Ed., 1990, Merrill Publishing.

Resources

Biology-The Dynamics of Life, "Electronic Teacher Classroom Resources," CD-ROM, 1995, Glencoe/McGraw Hill.

Biology-The Dynamics of Life, "Interactive," CD-ROM, 1995, Glencoe/McGraw Hill.

Gould, James and William T. Keeton, "The Norton Presentation Maker," CD-ROM, 1996, Norton Electronic Media.

Starr, Cecie, "Interactive Concepts in Biology," CD-ROM, 1997, Wadsworth Publish Co.