

COURSE PROPOSAL FOR HONORS 199

SCIENTIFIC RESEARCH METHODS

General Information

Meeting Time: Daily 8:00 AM to 8:00 PM
Duration: June 10 through October 31, 1995
Credit Hours: 3 Credit Hours
Instructor: Dr. Joe Shaffer
Office Hours: The Four-Corners Program staff will offer office hours by appointment.

Course Pre-requisites

The course is funded by the U.S. Department of Education and students must be high ability high school students who have been chosen on the basis of a detailed application. For admittance to the course, students must have demonstrated ability in college preparatory mathematics and science courses, maintained a high grade point average in all high school courses, and be highly recommended by two teachers. Student applications are reviewed by course staff, including instructors but also other research scientists and science educators.

Course Description

The proposed course was designed to mimic the process of graduate education and provide rising 10th, 11th, and 12th grade students with an interdisciplinary research experience. Course design and materials were tested during the summer of 1991 Summer of Science programs supported by the National Science Foundation and 1992 and 1993 Four-Corners Program funded jointly by the U.S. Department of Education and the National Science Foundation.

The course has five phases of activities, each phase building on the content and training of the previous phases.

Phase I -- Course Work Emphasizing Interdisciplinary Approaches to Research in Science.

Phase II -- Learning Research Methods Under the Guidance of a Research Advisor.

Phase III -- Conducting Independent Research.

Phase IV -- Data Analysis and Presentation of a Scientific Paper Describing the Completed Research

Phase V -- Saturdays of Science, Study Skills, and Career Counseling

Phase I will be completed in a two-week session that includes a range of lectures, seminars, research experiences, and training in research methods. Throughout this phase, students are also introduced to the history, philosophy, and ethics of scientific research. During the next two-week session (Phase II), students assist scientists conduct their research by investigating a question that is a small part of the professional's larger project. Phase III is a one-week session devoted to data analysis, the writing of a scientific paper, and the presentation of the research

and paper at a scientific conference held at Northern Arizona University (NAU). The final phase of the program (Phase IV), consists of three weekends at NAU between July 15, and October, 31, 1995. During this final phase students are provided: 1) comprehensive assistance in the application process for colleges and universities including financial aid 2) study skills instruction and 3) exposure to careers by attending a Career Fair, Science Lectures and the Flagstaff Festival of Science.

Reading Materials

Course materials include a broad range of readings from the original scientific literature as well as a number of college level science and mathematics textbooks. A complete bibliography is available upon request.

Course Objectives

1. Introduce students to interdisciplinary research.
2. Provide training in the ancillary skills needed to "do" Science (1) technical writing; (2) reading complex literature; (3) experimental design and statistics; (4) acquisition of information in libraries and computer data bases.
3. Develop an understanding of science in a societal context by exploring issues in the history, philosophy, and ethics of research.
4. Provide students with a research internship in one of five discipline areas: (1) biology, (2) chemistry, (3) forestry, (4) geology, or (5) physics/astronomy.
5. Provide students with the skills, and network of professionals, necessary for college/university entrance.

Evaluation Methods

Students will be evaluated by five methods:

1. Use of pre- and post- test assessments of knowledge about science content, mathematics proficiency, understanding of the nature and process of science, and writing ability.
2. Use of student portfolios to assess general quality and overall improvement in writing, analytical, and problem-solving skills.
3. Evaluation of scientific paper written by students after completion of their independent research project.
4. Evaluation of presentation of research at a scientific conference
5. Faculty evaluation of student participation and quality of contributions in classroom discussions and research internships.

This is a graded course.

Topics Covered During Course

1. Experimental Design and Statistics
2. Interdisciplinary Research: An Analysis of Methods of Studying and Publishing Information About Ecosystems
3. Science-Technology-Society: An Analysis of the History, Philosophy, and Ethics of Science in Societal and Technological contexts.
4. Research Methods in:
 - a. Biology
 - b. Chemistry
 - c. Forestry
 - d. Geology
 - e. Physics/ Astronomy
5. Post-Secondary School Application Process
 - a. comprehensive assistance in the application process

b. comprehensive assistance in the identification and application for financial assistance