

Canyon Crest Academy: Research Methods

Level of Difficulty	Estimated Homework	Prerequisites
<input checked="" type="checkbox"/> Moderate <input type="checkbox"/> Difficult <input type="checkbox"/> Very Difficult	0-30minutes per day* *This is a general guideline for planning and scheduling purposes. A student's ability level may affect actual preparation time needed.	Department Completion or concurrent enrollment in Biology Completion or concurrent enrollment in Integrated Math 1

Course Description

This course serves as the Tier 1, foundational course for QUEST Research pathway.

The course is designed to prepare students to conduct scientific research. Students will be provided with the necessary strategies and techniques to read and evaluate research studies. They will learn fundamental concepts of research design and basic statistical procedures for analyzing data. Throughout the course emphasis will be on understanding the basic concepts underlying different skills and approaches to research design and analysis. Students will understand, design, and conduct preliminary analyses of research investigations related to applied topics.

Research Methods meets practical art graduation requirements.

Learning Objectives: Some objectives are dependent on materials, equipment and time availability. Objectives are to serve as a list of skills will gain during the course, not a timeline of events.

Scientific Method

- Outline the process of science
- Distinguish between accuracy vs. precision
- Demonstrate safety in science
- Debate ethics in Research
- Evaluate current research and issues in science
- Use and evaluate online/print resources
- Cite sources using proper format (guidelines given by instructor)
- Demonstrate how to organize data

Equipment and Procedures

- Recognize and identify lab equipment
- Prepare solutions and dilutions
- Use the spectrophotometer
- Demonstrate proper disposal methods of waste
- Use Material Data Safety Sheets

Data Collection

- Conduct biotech techniques (PCR/Gel Electrophoresis, DNA microarray, Gene Therapy/Expression, Cell culture)
- Conduct bacteria identification
- Conduct water quality testing
- Conduct soil testing
- Use identification keys (Insects, Birds, Tide pools, Fish)
- Complete ecological surveys (random vs. selected, quadrants, transects and mark and capture)

Analysis

- Determine appropriate graphing method for data
- Analysis data using appropriate statistics
- Examine mathematical models

Research Proposal (Adapted from © 2003 The Research Foundation of State University of New York)

Select a general area of interest

- Pursue background research on several potential general areas of interest
- Select one general area of interest
- Explain (in writing) why you selected the general area of interest
- Research and narrow the topic
- Pursue in-depth research in the area of interest—including primary, secondary, and tertiary sources in scientific journals
- Explain (in writing) the relevance/importance/potential applications of this topic
- develop a research question
- Study additional background on your topic with a particular emphasis on primary resources
- Develop a tentative and original research question
- Discuss your research question with your peers and instructor
- Select a research question that has potential for original research
- Explain (in writing) the relevance/importance of your research question

Design a research hypothesis

- Write a review of the literature for the your research project
- Develop a hypothesis
- Summarize (in writing) the reasoning and research that led to this hypothesis

Design a research plan

- Draft a tentative research plan to test your hypothesis through experimentation (data collection) and analysis
- Summarize your tentative research plan using a design matrix
- Prepare a list of needed materials and resources
- Determine the feasibility of the research, including time, materials, and cost
- Describe (in writing) the proposed method or procedures for your project
- Clearly indicate how you manipulate the independent variable, measure the dependent variable, and control other potential variables
- Determine that you have included sufficient numbers in both control and experimental groups to be statistically valid
- Discuss your research plan with your peers and instructor
- Develop a realistic timeline for each component of your research plan
- Develop data tables for recording raw and derived data
- Determine that your research plan meets the safety and ethical guidelines (for

appropriate research involving human subjects, non-human vertebrate animals, pathogenic agents, controlled substances, recombinant DNA, and human or non-human animal tissue)

Write a research proposal

- Review the guidelines for writing a research paper provided by your teacher
- Write a 250-word research proposal summary that includes the purpose of the experiment, procedures and possible research applications
- Write a rough draft for each section of the research paper including title page and table of contents, introduction, literature review, materials and methods, acknowledgements, references and bibliography. (follow the guidelines provided by your teacher)
- Seek feedback on each section of your rough draft from your peers and instructor
- Use feedback and self-evaluation to make revisions to each section of the research paper
- Prepare a final draft of your research proposal
- Prepare a 100-word easily understandable summary of your project in layperson's terms that includes research question, background, procedures, and relevance.

Prepare a poster visual display (time permitting, to be determined by the instructor)

- Review guidelines for creating an effective presentation (provided by your teacher)
- Prepare a display that is organized, clear, concise, correctly presented, well-constructed, and eye-catching.
- Practice speaking freely and confidently about your display to demonstrate that you have a good grasp of your project
- Present your display to classmates and engaged in discussion and answering questions related to your work
- Complete peer reviews on visuals and presentations

Links

QUEST Homepage <http://teachers.sduhsd.net/ccquest/>

Supplemental Information

10 Credits

Meets high school graduation requirement for practical art

Meets UC/CSU subject area “g” requirement