



Department of Biology

BIO6043 Research Design in Science Education

3 Units

Fall 2023

Thursdays 5:30 pm – 8:30 pm

Balboa Campus

Final Exam: Thursday, 12/14, due by 8:30 pm

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PLNU Mission

To Teach ~ To Shape ~ To Send

Point Loma Nazarene University exists to provide higher education in a vital Christian community where minds are engaged and challenged, character is modeled and formed, and service is an expression of faith. Being of Wesleyan heritage, we strive to be a learning community where grace is foundational, truth is pursued, and holiness is a way of life.

Course Description

This course promotes understanding of both qualitative and quantitative research design in science education with a focus on current trends in the field. The course will promote understanding of both traditional science research as well as science education research and will also prepare students to design and conduct a pilot study.

8.09.23

Program and Course Learning Outcomes

By the end of the course, students will be able to...

- Identify the components of quantitative and qualitative methods, similarities and differences, and some of the arguments for the use of each form of research
- Describe mixed methods approaches to research
- Interpret various statistical techniques, including descriptive (mean, median, mode) and inferential (e.g. t-test, correlation) statistics
- Carry out and communicate various types of data analysis (quantitative and qualitative)
- Develop research questions that are based on and build upon a critical appraisal of existing research
- Design a study to address a research problem
- Analyze primary literature and, based on the data and conclusions presented, determine appropriate questions for subsequent experimentation.
- Explain how bioinformatics and wet-lab are integrated in modern scientific research.
- Query various bioinformatics databases available online and interpret the information obtained from these databases.

Required Texts and Recommended Study Resources

1. This course includes a BIO6043 reader which is available for purchase directly from [Cognella](#) or at the PLNU bookstore.
2. Excel: If you don't have Excel, you can download a free version from here: <https://products.office.com/en-us/student/office-in-education>

Course Credit Hour Information

In the interest of providing sufficient time to accomplish the stated Course Learning Outcomes, this class meets the PLNU credit hour policy for a three unit class delivered over 15 weeks. Specific details about how the class meets the credit hour requirement can be provided upon request.

Assessment and Grading⊕

Sample Assignment Distribution by Percentage:

Weekly assignments	20%
Discussion Boards	15%
Midterm Exam	25%
Research Proposal	15%
Pilot study	25%

Grading Scale:

A=93-100	B-=80-82	D+=67-69
A-=92-90	C+=77-79	D=63-66
B+=87-89	C=73-76	D-=60-62
B=83-86	C-=70-72	F=0-59

Incompletes and Late Assignments

All assignments are to be submitted/turned in by the beginning of the class session when they are due—including assignments posted in Canvas. Incompletes will only be assigned in extremely unusual circumstances.

PLNU Spiritual Care

Balboa Campus:

PLNU strives to be a place where you grow as whole persons. To this end we provide resources for our graduate students to encounter God and grow in their Christian faith. At the Balboa campus we have an onsite chaplain, Rev. Kevin Portillo who is available during class break times across the week. If you have questions, desire to meet with Rev. Portillo or prayer requests you can contact him directly at KevinPortillo@pointloma.edu.

PLNU Copyright Policy

Point Loma Nazarene University, as a non-profit educational institution, is entitled by law to use materials protected by the US Copyright Act for classroom education. Any use of those materials outside the class may violate the law.

PLNU Academic Honesty Policy

Students should demonstrate academic honesty by doing original work and by giving appropriate credit to the ideas of others. Academic dishonesty is the act of presenting information, ideas, and/or concepts as one's own when in reality they are the results of another person's creativity and effort. A faculty member who believes a situation involving academic dishonesty has been detected may assign a failing grade for that assignment or examination, or, depending on the seriousness of the offense, for the course. Faculty should follow and students may appeal using the procedure in the university Catalog. See [Graduate Academic and General Policies](#) for definitions of kinds of academic dishonesty and for further policy information.

During the first week of class, you will be asked to submit an Academic Honesty Verification Statement. Submitting the statement is a requirement of this course. By submitting the Academic Honesty Verification Statement, you will be verifying all assignments completed in this course were completed by you. Carefully review the Academic Honesty Statement below.

Statement: "In submitting this form, I am verifying all the assignments in this course will be completed by me and will be my own work."

Artificial Intelligence (AI) Policy

You are allowed to use Artificial Intelligence (AI) tools (e.g, ChatGPT, iA Writer, Marmot, Botowski) to generate ideas, but you are not allowed to use AI tools to generate content (text, video, audio, images) that will end up in any work submitted to be graded for this course. If you have any doubts about using AI, please gain permission from the instructor.

PLNU Academic Accommodations Policy

PLNU is committed to providing equal opportunity for participation in all its programs, services, and activities. Students with disabilities may request course-related accommodations by contacting the Educational Access Center (EAC), located in the Bond Academic Center (EAC@pointloma.edu or 619-849-2486). Once a student's eligibility for an accommodation has been determined, the EAC will issue an academic accommodation plan ("AP") to all faculty who teach courses in which the student is enrolled each semester.

PLNU highly recommends that students speak with their professors during the first two weeks of each semester/term about the implementation of their AP in that particular course and/or if they do not wish to utilize some or all of the elements of their AP in that course.

Students who need accommodations for a disability should contact the EAC as early as possible (i.e., ideally before the beginning of the semester) to assure appropriate accommodations can be provided. It is the student's responsibility to make the first contact with the EAC.

Language and Belonging

Point Loma Nazarene University faculty are committed to helping create a safe and hospitable learning environment for all students. As Christian scholars we are keenly aware of the power of language and believe in treating others with dignity. As such, it is important that our language be equitable, inclusive, and prejudice free. Inclusive/Bias-free language is the standard outlined by all major academic style guides, including MLA, APA, and Chicago, and it is the expected norm in university-level work. Good writing and speaking do not use unsubstantiated or irrelevant generalizations about personal qualities such as age, disability, economic class, ethnicity, marital status, parentage, political or religious beliefs, race, gender, sex, or sexual orientation. Inclusive language also avoids using stereotypes or terminology that demeans persons or groups based on age, disability, class, ethnicity, gender, race, language, or national origin. Respectful use of language is particularly important when referring to those outside of the religious and lifestyle commitments of those in the PLNU community. By working toward precision and clarity of language, we mark ourselves as serious and respectful scholars, and we model the Christ-like quality of hospitality.

You may report an incident(s) using the [Bias Incident Reporting Form](#).

PLNU Attendance and Participation Policy⊕

Regular and punctual attendance at all class sessions is considered essential to optimum academic achievement. Therefore, regular attendance and participation in each course are minimal requirements.

If the student is absent for more than 10 percent of class sessions, the faculty member will issue a written warning of de-enrollment. If the absences exceed 20 percent, the student may be de-enrolled without notice until the university withdrawal date or, after that date, receive an "F" grade.

Students who anticipate being absent for an entire week of a course should contact the instructor in advance for approval and make arrangements to complete the required coursework and/or alternative assignments assigned at the discretion of the instructor. Acceptance of late work is at the discretion of the instructor and does not waive attendance requirements.

Refer to [Academic Policies](#) for additional detail.

Synchronous Attendance/Participation Definition

For synchronous courses which have specific scheduled meeting times (including in-person, hybrid, and synchronous online courses), absences are counted from the first official meeting of the class regardless of the date of the student's enrollment. For courses with specific attendance requirements, those requirements are outlined in the course syllabus.

Use of Technology

In order to be successful in the online or hybrid environment, you'll need to meet the minimum technology and system requirements; please refer to the [Technology and System Requirements](#) information. Additionally, students are required to have headphone speakers, microphone, or webcams compatible with their computer available to use. Please note that any course with online proctored exams requires a computer with a camera (tablets are not compatible) to complete exams online. Problems with technology do not relieve you of the responsibility of participating, turning in your assignments, or completing your class work.

Assignments At-A-Glance

The course summary below lists our assignments and their due dates. Click on any assignment to review it.

Week	Date	Topic
1 5:30 – 8:30 pm Balboa Campus (in person)	8/31	Introduction to course, performing a literature search, proposal topic selection.
2 5:30 – 6:30 pm Zoom office hour (optional)	9/7	Scientific methods and research methods overview. How to read articles efficiently.
3	9/14	Intro to bioinformatics
4 5:30 – 8:30 pm Balboa Campus (in person)	9/21	JASPAR, whole genome browsers, BLAST sequence alignments
5	9/28	Major biological techniques associated with bioinformatics. Analyzing data from figures of published articles
6	10/5	Hypothesis Testing and testing for parametric data (Para vs. non-para; t- and z-tests)
7 5:30 – 8:30 pm Balboa Campus (in person)	10/12	Parametric statistics (Chi Square and ANOVAs)
8 5:30 – 6:30 pm Zoom office hour (optional)	10/19	Review for midterm Zoom office hour (optional) 5:30 – 6:30pm
9	10/26	Mid-term Due <i>(Exam open from 5:30 - 8:30 pm)</i>
10 5:30 – 6:30 pm Mandatory Zoom	11/2	Qualitative methods – Intro to Qualitative Methodologies
11 5:30 – 8:30 pm Balboa Campus (in person)	11/9	Qualitative methods – Prep for interview, Analysis of research papers
12	11/16	Qualitative Methods – Designing an Interview, Analysis of research papers.
13	11/23	Qualitative Methods – Conduct Interviews, Analyze Interviews.
14 5:30 – 8:30 pm Balboa Campus (in person)	11/30	Pilot Study: Problem, Purpose, and Literature Review
15 5:30 – 6:30 pm Zoom office hour (optional)	12/7	Develop Pilot Study Draft
Finals Week	12/14	Pilot study – Draft one due <i>(Due by 8:30 pm December 14)</i>