Research Methods in Exercise Science

Kinesiology and Applied Physiology graduate program
Course # 16:572:505; 3 credits

GENERAL COURSE DESCRIPTION

Science careers require a lot more than knowing how to run an experiment. They also require a "thick skin" and a lot of grit. More often than most students realize, studies don't work, grants aren't funded, and papers are rejected. A key factor to reducing these failures is knowing the many 'intangibles' of an academic career AND having the ability think and communicate in clear and organized ways. The overarching goal of this course is to improve the chances of success by broadening knowledge of fundamental scientific roles (papers, grants, bios) and sharpening written and oral communication skills. Students will learn to balance scientific writing (clear, concise, and precise) with the art of storytelling (to demonstrate significance and innovation) and how to write to 'your audience'. Students will be required to write and share documents; the class will publicly, but professionally critique them. The course will be dynamic and adaptive based on the interests, skills, and weaknesses of the students.

COURSE OBJECTIVES

Upon completing this course, each student will be able to:

1. Construct well-written scientific arguments for manuscripts, grants, and other scientific formats.
2. Deliver and receive critiques of scientific logic and written expression in a professional manner.
3. Interpret critiques, respond to critiques, and edit to address critiques (even when they seem wrong).
4. Characterize the fundamentals of manuscript and grant submissions.

COURSE CALENDAR OUTLINE

Week 1: Welcome. Introductions. Expectations. Plotting our course.
The class will start with a review of sentence structure and paragraph construction, differences between creative writing and scientific writing, and differences between written and spoken English.

ASSIGNMENT 1 – Write a letter of recommendation for a real or imagined undergraduate student who wants to go to graduate school. You believe that this student will do well in the program to which they are applying.

Week 2: What we know.
We will discuss literature searches (cherrypicking vs comprehensive), search terms, types of studies, scientific databases, as well as reference management (what, when, and how) and what a librarian *actually* can do

ASSIGNMENT 2 – Find 3 articles that you think are interesting but not directly tied to your dissertation/ongoing research. These should be articles that you have NOT read yet.

Week 3: What we think of what we know.
The class will read and critique a variety of published articles. What does good writing look like? How easy is it to follow the logic? How strong were the findings and did the discussion under or overstate them? If you were reviewing the article, what would you write? We will discuss the content and stylistic fundamentals of writing a professional manuscript review.

ASSIGNMENT 3 – Read article and write a critique.

Week 4: What we want to know.
We will discuss types of experiments [clinical trials, human experimental, animal, cell; public databases, data repositories; types of reviews, meta-analyses; retrospective vs prospective; longitudinal vs cross-sectional; pre-registration of methods or whole studies]

ASSIGNMENT 4 – Design an experiment, real or imagined and explain it to the class.

Week 5: Asking for permission.
IRB tutorial and something about animal research ethics? eIRB, CITI cert, who must do this.

ASSIGNMENT 5 – Complete your CITI training or IACUC training; or, if you have, you get the week off!

Week 6: Finding the answer.
How do you start with a question and translate it into an experiment. What are the factors that must be considered. What is power? What is your statistical plan (and does it answer your question)? How long will it take? What are the details you must not forget? How do you plan, staff, and purchase to make to run smoothly? What are pilot studies and when are they needed? When to ask for help – and how to find collaborators.

ASSIGNMENT 6 – Translate a big idea into a statistical plan.

Week 7: A little bit o' stats.
Before you do that t-test, you better know what your data look like. Graphical analyses, descriptive stats, and remembering that you better understand what you mean when you say that the group's average health was a 6.5. Variable centered vs person-centered. Covariates (when, why, and how).

ASSIGNMENT 7 – Dataset assignment.

Week 8: Sharing your answer.
How do you pick a journal to submit to? How do you actually submit something?
We'll discuss authorships (order and inclusion), journal selections, editorial boards. Impact factors and rating metrics. Formatting, sections and subsections, titles and title pages, funding, disclosures and acknowledgments; the inclusion of graphs and tables. Why reference managers matter, and best practices for citing supporting literature. Also open science framework.

ASSIGNMENT 8 – Select a journal in your field and tell us when and why you'd publish there.

SPRING BREAK

Week 9: Your best self
We will first look at CVs, resumes and discuss formatting and content. When is too much too much, and when is it not enough? Then we will discuss what to do at professional conferences when someone asks you 'what do you study'? Finally, we will work on an NIH biosketch. We will discuss what does and does not belong in the personal statement section and how to structure the scientific contributions sections of the application. The value of service, professional experience, and collaborations will be highlighted. As time and interest permits, we will also discuss developing the Candidate Sections in F and K series grants.

ASSIGNMENT 9 – Complete your biosketch and develop an 'elevator pitch'.

Week 10: Editing thyself and others.
We will read and critique each other's biosketches, learn how to clearly & professionally provide criticism, and how to understand and professionally respond. Often times, there is little more than 'a direction' that is saved from a first draft…. Be prepared.

ASSIGNMENT 10 – Submit a revised biosketch.

Week 11: Grant writing: From the "big" idea to the fundable project
All research studies must start with a testable idea. To be fundable, these ideas must be testable, quantifiable, and understandable! The class will learn how to shape a scientific question to be answerable, decide what to hypothesize, and how to create the experiment to test the hypothesis.

ASSIGNMENT 11 – Grant idea assignment.

Week 12: Grant writing: Funding considerations
Before you write your million-dollar masterpiece, there are some things to consider. Who will fund you? How much should you ask for, and how do you determine such things? Grant applications are much, much more than a good idea. Let's dig into the minutia about grant funders, grant reviewers, study sections.

ASSIGNMENT 12 – Find a call for proposals that you can tailor your grant idea to.

Week 13: Grant writing: Actually writing the damn thing
We will review the sections – the science and all the peripherals. We will read successful and unsuccessful applications and try to determine if we can spot their 'hooks' and 'fatal flaws'. The majority of time researchers spend on grant applications focuses the Research Plan, but there are many other sections and forms that are needed before a grant is ready for submission. The class will round out the semester with a discussion of the "other" sections of a grant, such as human subjects, inclusion of women and minorities, inclusion of children, Resources and Environment, Equipment, Resource Sharing, Letters of Support, Enrollment Table.

ASSIGNMENT 13 – Find an abstract that is relevant to your research on NIH RePORTER, be prepared to discuss why you think it was funded.

Week 14: The Review

To understand what makes a successful grant, an understanding of how grants are reviewed is necessary. The review process will be discussed and the class will learn the rubric used by review groups for scoring applications. Examples of summary statements will be reviewed.

ASSIGNMENT 14 – Read a grant and prepare a critique.

Week 15: Now what.
What happens if you get a good score? What is the timeline to startup and what should you be doing during that time? How do you stay on track? What is a progress report? What happens if the study fails? How to talk to a program officer.

ASSIGNMENT 15 – Complete an NIH review.