KINE 303: Statistics and Research Methods

California State University San Marcos | Spring 2021 | CRN: 22831

Instructor:	Devin Jindrich	**Email:**	djindrich@csusm.edu
Office:	UH 310	**Phone:**	760-750-7334
Student Hours:	Thursdays 1:00 – 2:00 and by appointment		3 Units

"All models are wrong, but some are useful" – George Box et al.

COURSE DESCRIPTION

Principles and techniques of measurement, organization, administration, interpretation and evaluation of data used in kinesiology. Includes critical evaluation of data using basic statistical techniques and an evaluation of research design in kinesiology-related studies. Enrollment restricted to Kinesiology majors.

WHO IS THIS CLASS FOR?

Before getting into all of the details, let's establish who this course is for. This course is for YOU, not for the me (the instructor). The purpose of KINE 303 is for you to LEARN, NOT to please an instructor and be judged with a grade.

LEARNING OUTCOMES

1. Understand what science is, and how probability and statistics are essential to the scientific process.
2. Understand and apply basic probability, measurement, and statistical techniques with quantitative data.
3. Create graphical frameworks to help analyze and solve logical and statistical problems.
4. Use spreadsheet software to perform statistical tests and present results with small and large kinesiology and health-related data sets.
5. Understand how to reduce data using descriptive statistics (i.e. mean, median, mode, frequency, proportion).
6. Understand how to communicate statistics, including with graphical representations (i.e. boxplots, histograms).
7. Analyze statistical tests to determine which tests are appropriate for different types of data.
8. Understand how research design can facilitate data analysis and conclusions supported by statistics.
9. Apply steps of hypothesis testing to answer questions related to differences between groups for both continuous and categorical data.
10. Evaluate an independent research question using statistics and research design.

COURSE CONTENT

The primary content for this course will be short-, medium-, and long-term projects. Online lectures and textbooks will be used as resources to find information necessary for in-class activities and discussions, or provide opportunities for review. Each section of the course will address one or more of the questions, as listed in the schedule below.

PROBLEM SOLVING AND QUESTIONS

Problem solving is a part of KINE 303. You will not be provided with step-by-step instructions on how to complete assignments. Instead, one objective of the course is to help you develop a toolbox of understanding and skills that will help to solve scientific problems. Some of the responsibility for figuring out how to use the tools to solve problems will be yours. Therefore, an expectation of this course is that students ask questions when they don't understand something, or need help solving problems. I will provide many opportunities to ask questions: in (virtual) class, in office hours, through email, etc. I encourage and invite questions. However, it is up to you to develop and ask them.

"Critical thinking" does NOT mean being critical! "Critical thinking" is an important component of this course. However, the word "critical," confusingly, has several meanings. "Critical" thinking does NOT mean being negative and captious. Instead, critical thinking involves *analyzing* problems to break them down into simpler components, *understanding* how different pieces of information and concepts are connected, creating *frameworks* to organize and communicate ideas, and using a comprehensive understanding of information to make informed decisions. Critical thinking is therefore a fundamentally POSITIVE process intended to help understanding and decision making.

WEBSITE

Assignments, handouts, online lectures and notes, quizzes, instructor correspondence, grades, etc. will be available through the course website. In addition, we will use the online resource Reasoned Writing/A Framework for Scientific Papers, available at https://sites.google.com/view/reasonedwriting/. If you need help with web access or computer use or have any unique needs, please contact the instructor.

EMAIL

I will only respond to emails about PERSONAL issues (including interactions with other students) that require privacy. Questions about course content, logistics, assignments, etc. MUST be posted to the course discussion forums.

I always make an effort to respond to emails as promptly and thoroughly as possible. To facilitate this it is important for me to be able to easily identify class emails. Consequently, I request that any emails that you send me about the course begin with "KINE303:" in the subject line. For example, a subject could read "KINE303: Appointment Request." I cannot guarantee responses to emails that do not have "KINE303:" in the subject. In the case that I am slow to respond to an email, please feel free to simply re-send the message. My inbox gets out of control sometimes, and emails can get lost or mis-filed, and I appreciate the reminder if I have somehow misplaced a message or failed to respond for any other reason.

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SCHEDULES

The schedules and assignments contained in this syllabus may be subject to change. It is up to you to make sure that you are aware of all announcements concerning changes in the course outline, readings, assignments, exams, and other matters made during class periods whether or not you are in attendance when announcements are made. Some assignments for each class are listed below. Preparing before class is likely to lead to more interesting class time and also facilitate studying.

ACCOMODATIONS FOR DISABILITIES

We will make any reasonable accommodations for limitations due to any disability including learning disabilities. Please arrange an appointment to see me to discuss any needs you might have. All discussions are confidential. Students with disabilities who require academic accommodations must be approved for services by providing appropriate and recent documentation to the Office of Disabled Student Services (DSS). This office is located in Craven Hall 4300 and can be contacted by phone at (760) 750-4905, TDD (760) 750-4909 or by email at: dss@csusm.edu. Students authorized by DSS to receive accommodations should meet with me during my office hours, or in another private setting, in order to ensure your confidentiality. **Note:** Please inform me during the first week of classes about any disability or special needs that you have that may require specific arrangements related to attending the class sessions, carrying out class assignments, or writing papers or examinations.

COLLABORATIVE WORK

You will work in small groups to complete lab assignments, discuss assignments, and compile written and oral presentations. However, some assignments will be submitted individually. Collaborative work is an opportunity to learn from each other, divide labor on assignments, learn through teaching, meet others in the class and major, become accustomed to team-based work, etc. Therefore, collaborative work is an important part of the class and your grade will reflect your contribution to the success of your groups. Evidence of leadership, effort, organization, congeniality and flexibility will favorably reflect on your performance in the class. However, collaborative work is not meant to include sending emails to the entire class with answers to quizzes or tests, which is considered a violation of the honesty and integrity policies.

ASSIGNMENTS

Assignments will assess comprehension of the important concepts presented in the course, and the ability to apply concepts to novel problems. Most assignments will start as in-class activities, and will be due immediately before the next course period. Completing assignments on time is important because later assignments build on previous ones.

TIME EXPECTATIONS

Completing a college courses is traditionally expected to involve 2-3 hours per week per credit hour of effort outside the course. Therefore, a reasonable expectation of this course would be that it will entail about 6-9 hours of effort outside of class time during the normal semester (multiply all these values by 2-3 times in summer, where time is compressed but content is unchanged). The effort required each week may vary, but on average the time might be expected to break down as shown in the table to the right.

ACTIVITY	TIME INVESTED
Completing individual assignments/quizzes	2-3 hours
Review/Exam preparation	1-2 hours
Group Assignments	2-3 hours

Organization is half the battle. In my experience, there is a high correlation between organization and success. Be sure not to fall behind on assignments. Having a weekly schedule, and adding class time into your schedule for each course (as you might for your work and other activities) can greatly improve performance and reduce stress. Completing an assignment early takes as much time as completing it at the last minute, but usually results in higher grades (particularly if you get feedback). I encourage you to work with friends and groups to discuss course material and complete assignments.

CLASS PERIODS

Synchronous class periods will consist of instructor-led explanations, class discussions, group work, and class presentations. However, much coursework will be asynchronous. It is the student's responsibility to organize their time to complete projects.

OFFICE HOURS

I encourage you to make use of office hours, or make appointments to come talk to me if you have questions or concerns. I have observed dramatic improvements in understanding and performance through one-on-one interaction. I also appreciate any and all feedback about the structure of the course, the material, ideas for making things better or clearer, etc. Feedback provided will not factor into grading decisions.

My office is in UH 310. If you arrive for an appointment and my door is closed, please knock. I keep the door open for all meetings with students, without exception.

EXPECTATIONS OF THE INSTRUCTOR

What is the instructor's job? To transfer information from their brain to the students'? To sort and rank students through grades? I would argue that these are not possible or desirable, respectively. Ideally, instructors have several responsibilities:

1) Instructors identify information and concepts about their course topics that are most important for understanding. Based on their knowledge and experience, instructors select relevant topics for study and reflection.
2) Instructors design activities that guide students through the process of discovery and learning, providing encouragement and constructive criticism, identifying important questions and encouraging students to become actively engaged in their own inquiry.

3) Instructors provide examples of the thinking process of their disciplines. Instructors demonstrate the creative process that leads to new ideas (e.g. testable models), and show examples of the evaluation and judgment that are used to come to conclusions.
4) Instructors assess the students in the course. Instructors must determine the level of understanding required, design assessments for students to demonstrate understanding, and clearly communicate the instructor's expectations to students.
5) Instructors are responsible for maintaining academic standards and integrity. Instructors are responsible for ensuring that college-level coursework in each class is appropriate for the field, the class level, contributes to Department and University learning objectives, and is capable of having a long-term impact on students. Personally, I consider it an ethical imperative not to sell students short based on assumptions or potential misperceptions. I assume that ALL students are capable of HIGH QUALITY work. It is the instructor's job to try to find ways to help each individual achieve high performance, and help to motivate students to put in the time and effort necessary for excellence.

Finally, instructors have an added responsibility. Instructors have a responsibility not to spell everything out for the students. Although guidance, clarity, and communication may seem conducive to **knowledge** learning, excessive guidance can actually be detrimental for **skill** learning and higher-order understanding. Improving writing, or analysis, or evaluation skills requires attempting to perform assignments without complete guidance – in the presence of perceived uncertainty both in the desired outcome and the best path to reach the outcome. Skill learning depends on making mistakes: having expectations that are not completely structured and allow for errors, trial and correction, and, yes, even the potential for frustration sometimes.

SOME SUGGESTIONS FOR SUCCESS

There is a lot that can be gained from KINE 303 (in my own humble opinion ;-) Getting the most out of the course will be easiest if you are organized, not overly stressed out, and have enough time to reflect on some of the topics that we cover. Some suggestions:

1. Keep up-to-date on assignments and even get ahead a little. Just like setting your clocks faster by a few minutes can sometimes help getting places on time… if you set personal deadlines ahead of class deadlines, things will seem much easier.
2. Keep a record of areas that are confusing and ask questions. Participate in office hours.
3. Try to understand, not simply memorize, course material. Understanding means putting information in frameworks of other things that are already known, and thinking about connections among different course topics. Compare and contrast different topics from the course, etc.
4. Please Please Please don't be satisfied with poor performance! If a score does not reflect the effort made to learn the material, then participate in office hours, consult peers, take action to improve! I am confident that everyone is capable of outstanding work. Don't sell yourself short and settle for less!
5. Please give me feedback about aspects of the course that you are not satisfied with. I can't change everything this semester, but some things I can!

A DIVERSE AND INCLUSIVE ENVIRONMENT

Your experience in this course is extremely important to me. I strive to create a learning environment and classroom where you will be treated with respect, and I welcome individuals of all ages, backgrounds, beliefs, ethnicities, genders, gender identities, gender expressions, national origins, religious affiliations, sexual orientations, preparation – and other visible and nonvisible differences. At times, we may discuss difficult and complex topics and I welcome and value all perspectives. All members of this class are expected to contribute to a respectful, welcoming and inclusive environment for every other member of the class. I hope to create a learning environment that supports a diverse body of students, diversity of thoughts, perspectives, and experience and that honors your identity. To accomplish this:

- If you have a name or preferred pronouns different from what appears in your official record, please let me know as soon as possible.
- If you feel like your performance is being impacted by experiences, whatever they may be, outside of the classroom, feel free to talk to me and use me as a resource. I am here to support your development in all aspects. Anything you share with me will be kept confidential and anonymous (although I am a mandatory reporter for things such as sexual assault). I can also point you to outside help if that is preferred.
- As many are, I am still learning about diverse perspectives and identities and continue to seek new knowledge and perspectives. If I or anyone else in the class says something that makes you feel uncomfortable, please talk to me about it.

HONESTY AND INTEGRITY

Honesty and integrity are a reflection of your character. Therefore, cheating is considered a serious offense. Students will be expected to adhere to standards of academic honesty and integrity, as outlined in the Student Academic Honesty Policy. All written work and oral presentation assignments must be original work. All ideas/material that are derived from other sources must have appropriate references to the original sources. Any quoted material should give credit to the source and be punctuated with quotation marks.

Students are responsible for honest completion of their work including examinations. There will be no tolerance for infractions. If you believe there has been an infraction by someone in the class, please bring it to the instructor's attention. The instructor reserves the right to discipline any student for academic dishonesty, in accordance with the general rules and regulations of the university.

Disciplinary action may include the lowering of grades and/or the assignment of a failing grade for an exam, assignment, or the class as a whole. Incidents of Academic Dishonesty will be reported to the Dean of Students. Sanctions at the University level may include suspension or expulsion from the University.

Students are expected to conduct themselves in a manner appropriate for class and comply with the rules of student conduct. The rules of student conduct are included in the California Code of Regulations, Title 5, and beginning at Section 41301. A student who violates university policies or regulations is subject to disciplinary action, which can result in a warning, reprimand, probation, suspension, or expulsion. The

Chancellor of the California State University specifies procedures under which the university may take disciplinary action against a student. These procedures are on file in the Office of the Dean of Students, Craven Hall, Room 5306.

GRADING.

I don't like grading – but it has to be done. Ideally, grades are valid assessments of learning. Unfortunately, grades often assess only some aspects of learning and can be influenced by lots of other confounding factors ☹. Moreover, grades often do not assess what I consider most important: **intellectual curiosity, a passion for learning, and dedication to true understanding**.

My honest suggestion is to focus on really understanding the material well and demonstrating to your instructor and peers that you are **driven to learn** and **find value** in EVERY subject that you study. **Initiative, creativity, and questioning** are valuable in EVERY field of study – including the sciences. The students who take control of their learning, challenge ideas to understand them, and integrate coursework into a more comprehensive understanding of the world **always** get very high grades.

Therefore, please don't worry about your grade except to the extent that grades or scores give you information that can help you learn and improve. The course is NOT curved (it is criterion-referenced, not norm-referenced). If everyone gets an "A," then I'll be ecstatic. Grading will involve a hybrid system intended to give you (the students) as much agency and control over your grade as possible, and to link grades directly to learning and improvement.

To PASS the course (i.e. grade of C or higher), involves "Good" performance on course assignments in **ALL** four areas of the course: **INDIVIDUAL ASSIGNMENTS, QUIZZES&EXAMS, GROUP PROJECTS,** and **GROUP CONTRIBUTION**. The criteria for "Good" evaluation are:

INDIVIDUAL ASSIGNMENTS involve problems to be solved. Solving the problems demonstrates understanding of the course material. Assignments will be evaluated as either "Revise," "Good," "Super," or "Exceptional". Assignments given a "Revise" score can be revised and re-submitted ONCE to achieve a "Good," "Super," or "Exceptional," designation.

QUIZZES AND EXAMS will assess understanding of fundamental course concepts and understanding of class reading. "Good" or passing performance involves receiving over 70% of the total points available for quizzes and exams, or by receiving over 60% of the points available for quizzes and over 60% of the points available on the exam.

GROUP PROJECTS will be assessed through written assignments. Group projects involve more in-depth problems to be solved. Solving the problems demonstrates understanding of the course material. Projects will be evaluated as either "Revise," "Good," "Super," or "Exceptional," and returned with comments and feedback. Projects can be revised and re-submitted ONCE to achieve a "Good," "Super," or "Exceptional," designation. Although all students in a group are expected to contribute to the first submission of a project, revisions are **opt-out**. Although all group members have the opportunity to participate in revisions, only group members that wish to participate in a revision need participate.

GROUP CONTRIBUTION will be assessed through peer evaluations. The objective of group work is for all members of the group to help all the other members of the group understand the course material and achieve high performance on assignments. "Good" performance means demonstrated, active contribution to group projects that, in turn, receive "good" or better evaluations.

HIGHER GRADES. Students can achieve higher-than-passing grades by demonstrating exceptional performance ("Super" or "Exceptional" evaluations) on submitted assignments, submitting more assignments, or both.

EXPECTATIONS for "B" GRADES: Most assignments and Group Projects have "Super" evaluation or better. Strong performance on quizzes and exams (e.g. over 75% of the total points available for quizzes and exams, or over 70% of the points available for quizzes and over 70% of the points available on the exam).

EXPECTATIONS for "A" GRADES: Demonstrated involvement in the course leading to comprehensive understanding of the course material. Demonstrated leadership role in group work. All assignments and group projects completed. Assignments with "Super" or "Excellent" evaluations. Exceptional performance on quizzes and exams (e.g. over 80% of the total points available for quizzes and exams, or over 75% of the points available for quizzes and over 75% of the points available on the exam).

Overall, grades are intended to reflect active engagement with course material, demonstrated learning that results in high performance, patience and problem solving, and responsibility/leadership.

At the end of the semester, the final course grade is the **HIGHEST** grade that I can support with **EVIDENCE** from the assignments received from each student.

CLASS SCHEDULE

Subject to change at any time

Synchronous Classes are TR 2:30PM - 3:45 PM

DATE / DUE	*TOPICS*	*QUESTIONS*	*ACTIVITY/ASSIGNMENT*
		INTRODUCTION	
ORIENTATION VIDEOS	**-Logistics** **-Expectations and Potential**	Who is this person? What is this class all about? What are the main questions that YOU have?	**- Read this syllabus carefully** **- Set up Google Sheets, etc.**
		SECTION A. WHY do we need probability and statistics to help us make decisions?	
26 JANUARY	**Course Questions** **Estimating Probability**	1. What are the content and skill objectives of the course? 2. How good are we at estimating probabilities and risks?	**Estimating probability activity.**
28 JANUARY **QUIZ:** Pre-class survey	**Spreadsheets**	3. How do spreadsheets work?	**Spreadsheets activity: references, calculations, plotting, sorting.**
02 FEBRUARY **DUE:** Estimating Probability	**Cognitive biases**	4. What are cognitive biases, and how can they affect decision making?	**Cognitive biases activity.** **Reading:** Tversky&Kahneman (1974)
04 FEBRUARY **DUE:** Spreadsheets	**Spreadsheets Redux**	5. How do spreadsheets work?	**Spreadsheets activity: references, calculations, plotting, sorting.**
09 FEBRUARY **QUIZ:** T&K (1974)	**Resampling**	6. How can resampling help us determine probabilities?	**Resampling by hand.**
11 FEBRUARY **DUE:** Cognitive Biases	**Calculating Probability**	7. How do probabilities add and multiply?	**Calculating probabilities activity.**
16 FEBRUARY **DUE:** Resampling	**Conditional Probability**	8. How does sampling without replacement affect probabilities? 9. How can knowing "prior" probabilities help us make better decisions?	**Non-replacement/Bayesian prob.**
		SECTION B. WHAT are scientific models? How can data lead to scientific understanding?	
18 FEBRUARY **DUE:** Probability	**Section A Recap**	10. Why do we need probability and statistics to help us make decisions?	**Review and application activity.** **Reading:** RW: Reasoned Frameworks
23 FEBRUARY **QUIZ:** RW: Rsnd Frmwrks	**Reasoning**	11. How do we use logic to make decisions? 12. Can thinking about "formal" logic help us make decisions?	**Deductive and inductive reasoning.**
25 FEBRUARY **DUE:** Conditional Probability	**Scientific Models**	13. What is the difference between a model and a prediction? 14. What is science, anyway?	**Using scientific models to develop specific and testable predictions.** **Reading:** AFSP Section 1
02 MARCH **QUIZ:** AFSP Section 1 **DUE:** Reasoning	**Measurements**	15. What do Reliability and Validity mean? 16. Why do different types of measurements matter? 17. What does it mean to "normalize" a measurement?	**Reliability, validity, and measurement types activity.**
04 MARCH **DUE:** Scientific Models	**Samples and Populations**	18. Do samples represent populations? 19. Can resampling help determine if a sample represents a population?	**Sampling populations activity.**
09 MARCH **DUE:** Measurements	**Descriptive Statistics**	20. How can the concept of "expected value" be useful? 21. What does a mean mean? 22. How can we reduce data and still express variability?	**Data Reduction and Descriptive Statistics activity.**
11 MARCH **DUE:** Samples&Populations	**Exam 1 Review**	23. How are probability, logic, scientific models, measures, and descriptive statistics similar and different?	**Reading:** Goodstein (2000), Platt(1964)
16 MARCH **DUE:** Descriptive Statistics	**Exam 1 Discussion**	24. How can we complete calculations for the exam?	**Review and application.**
18 MARCH	**EXAM 1**		

23, 25 MARCH	**SPRING BREAK**		
SECTION C. WHY can mathematical models help us test scientific models?			
30 MARCH **QUIZ:** Goodstein (2000)	**Probability Distributions**	25. What are frequency distributions? Probability Distributions? 26. What is the "Central Limit Theorem?"	**Probability distributions activity.**
01 APRIL **QUIZ:** Platt(1964)	**Hypothesis testing**	27. How can we decide if samples suggest that populations do not match our predictions?	**Using resampling for hypothesis testing activity.**
06 APRIL **DUE:** Probability Distributions	**Resampling Applications: Predicting elections**	28. How can "cumulative distributions" help calculate probabilities?	**Resampling to predict election outcome project.**
08 APRIL **DUE:** Hypothesis Testing		29. Can we use resampling make probabilistic predictions about things like election outcomes?	
13 APRIL **DUE:** Election Forecast	**Normal Distributions**	30. What is a "normal" distribution and why is it important?	**Normal distributions activity.**
15 APRIL	**Confidence Intervals**	31. How can we quantify confidence in samples?	**Confidence intervals activity.**
20 APRIL **DUE:** Normal Distributions	**"Parametric" Tests: z tests and t tests**	32. What are "parametric" statistics and how do we use them? 33. What are t-tests? Do t-tests and resampling give the same result?	**Univariate parametric statistics.**
22 APRIL **DUE:** Confidence Intervals	**"Goodness of Fit" & Chi^2 tests**	34. What are Chi-square tests?	**Chi-squared tests activity.**
27 APRIL **DUE:** t-tests	**Logical Fallacies**	35. What are common logical fallacies? 36. Why do logical fallacies affect how we use statistics?	**READING:** RW: Logical Fallacies **Logic and statistics activity.**
29 APRIL **DUE:** Chi-squared tests	**Correlations and Regressions**	37. How can studying variability help answer scientific questions? 38. What is a "correlation" and how can we model correlations?	**Correlations and regressions activity.**
04 MAY **DUE:** Logic and Statistics	**Multiple Factors**	39. How can we relate many possible factors to each other? 40. What is an "Analysis of Variance?"	**ANOVA activity.**
SECTION D. HOW can we design research to help make robust discoveries?			
06 MAY **DUE:** Correlations	**Experimental Design**	41. What are some effective approaches to designing experiments?	**Experimental Design Activity**
11 MAY **DUE:** Mult. factors&ANOVA	**Course Summary and Exam Review**	How do all of the concepts that we covered fit together?	
13 MAY **DUE:** Experimental Design	**Course Summary and Exam Review**	How do all of the concepts that we covered fit together?	
17 MAY	**FINAL EXAM (CUMULATIVE), 6:15PM - 8:15PM PM**		
17 MAY	**ALL OUTSTANDING ASSIGNMENTS DUE**		

"Those who can make you believe absurdities, can make you commit atrocities." -- Voltaire

Map of thinking processes (left) to course content and activities (right)