

College of Health and Human Performance
Applied Physiology and Kinesiology Department

Research Methods: APK 4050, Section 01F6; Summer A 2018

- ✚ Professor: James H. Cauraugh, Ph.D.
- ✚ Office: 132-F FLG; Office Hours: Tuesday and Thursday 5:00 – 6:00 PM
- ✚ Other times by appointment: **cauraugh@ufl.edu**; Office phone: 294-1623
- ✚ Classroom and Schedule: CSE, room E119; Monday – Friday 6th period; 3:30 – 4:45 PM

Course Description and Learning Objectives

The purpose of this course is to explore, discuss, and learn established rules for conducting experiments and drawing valid conclusions. Scientific problem solving serves as a basis for asking important questions, generating hypotheses, writing clearly, understanding experimental designs and statistics, evaluating internal and external validity threats, and accepting the responsibilities of "playing the game that scientists play."

Students will practice developing (a) critical thinking capabilities, (b) complex reasoning, and (c) determining scientifically sound findings. RM knowledge used in situations on various science topics includes research guidelines, problem-solving procedures, experimental designs and statistical analyses, evaluating journal articles, writing critiques, and persuasive arguments.

Required Texts

1. **Strunk, W., & White, E. B.** (2000). *The elements of style* (4th ed.). New York: Macmillan (eBook).
2. **Cauraugh, J. H.** (2017). *Research Methods: Functional Skills – Second Edition*. ISBN: 978-1-939337-34-4 (eBook).

The **Research Methods: Functional Skills (Second Edition eBook)** is at three electronic sources. Cut and paste a source into your browser.

1. Smashwords:

<http://www.smashwords.com/books/search?query=cauraugh>

- a. Download a free Kindle app to your laptop computer, iPad, or iPhone.
- b. Download a version to read on your Kindle app.
- c. Marking and searching the text will be easy on the Kindle app.

2. Apple iBooks; For Apple iPad/iPhone/iPod Touch, download the free Apple iBooks app and buy on the eBook your iTunes account.

<https://itunes.apple.com/us/book/research-methods-functional/id591138108?mt=11&ign-mpt=uo%3D4>

3. Amazon – Kindle or Kindle Fire app reading:

<http://www.amazon.com/dp/B00AUZPSSY>

Course Requirements

1. An active learning process involves students answering questions, solving problems, and

discussing science topics. Prepared students read the required *Research Methods eBook* and integrate the information into their APK interests. Expect at least one question a day.

2. **No Friday lectures.** Every Friday during the semester is an individual learning day to watch, read, and write on the assigned *TED* talk, YouTube, or article. For each topic, write a short summary paragraph and critically evaluate the topic. These journal entries of your thoughts and writings should be saved in a file for review later in the semester.
3. Serve as a reviewer for a classmate's science journal entries. Share positive suggestions for improving the entries. Reviewing suggestions are in the *RM eBook*.
4. **Complete three examinations on the scheduled dates. No make-up exams are scheduled. A missed exam equals zero points earned.**

Evaluation of Course Requirements

	<u>Points</u>
Science Journal Entries	4
Exam 1: May 24, Thursday	32
Exam 2: June 7, Thursday	32
Exam 3: June 21, Thursday	32
Total	100

Grade Scale (minimum total points earned)

**A = 93; A- = 90; B+ = 89; B = 83; B- = 80;
C+ = 79; C = 73; C- = 70; D+ = 69; D = 63; D- = 60; E ≤ 59**

Academic Integrity

Academic integrity policies for the University are summarized in the undergraduate catalog. *We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity by abiding by the Honor Code.*

<https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/>

Informational Items

1. Official UF holiday; no classes or exams: **Memorial Day, Monday, May 28, 2018**
2. Requirements for class attendance and assignments are consistent with university policies. See the online catalog: <https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>
3. UF's current grading policies for assigning grade points are displayed in the online catalog: <https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

Recording Lectures

No photos, pictures, audio recordings, or video recordings may be taken during lectures. The purpose of my lectures is to be a stimulus as well as confirmation for your readings in *Research Methods: Functional Skills*. Further, the content of this course may not be used for any commercial purpose. Students found in violation of these policies may be subject to discipline under UF's Conduct Code.

Classroom Accommodation

Students requesting classroom accommodation must first register with the Dean of Student Office. The

Dean of Students Office will provide documentation to the student who must then provide this documentation to the instructor when requesting accommodation.

UF Counseling Services

University counseling services and mental health services are available at 392-1575 and <http://www.counseling.ufl.edu/cwc/Default.aspx>

Online Course Evaluation

Please provide feedback on the quality of instruction in this course. You may answer the 10 questions online. Near the end of the semester, use any computer or technology device with Internet access to complete an evaluation. The Web address is <https://evaluations.ufl.edu>

A Brief Motivational Perspective

Your Research Methods experiences will be meaningful given that you actively use the information in the *eBook* as well as the presented and discussed lectures. Enjoy this exposure to the scientific arena. The teaching style of this course is primarily reciprocal interaction with frequent, relevant questions used to generate discussion. You must be able to use this knowledge in different situations. Our frequent research interactions will be more enjoyable if you relax and expect that I will ask you at least one question every class. In this flipped classroom, you must read the *eBook* before class and be prepared to speak about scientific concepts while supporting your statements with logical thinking and empirical evidence. Student answers and questions are encouraged at any time during our interactions. However, I may not have all the right questions for some of your answers. Regardless, the information for this course is readily learned when students give sincere efforts and embrace the topics. Be a student who attains her or his intellectual potential. Monitor the course throughout the semester and share some of your positive experiences on the course evaluation in June. Do well!

Research Methods: Pledge

OATH FOR SCIENTISTS

As I embark on my career as a scientist, I willingly pledge that I will represent my scientific profession honorably,

that I will conduct my research and my professional life in a manner that is always above reproach,

and that I will seek to incorporate the body of ethics and moral principles that constitute scientific integrity into all that I do.

I will strive always to ensure that the results of my research and other scientific activities ultimately benefit humanity and that they cause no harm.

With this affirmation, I pledge to acknowledge and honor the contributions of scientists who have preceded me, to seek truth and the advancement of knowledge in all my work, and to become a worthy role model deserving of respect by those who follow me.

Craig, C.R., et.al. *Science* 2003; 299.

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Reading Schedule and Content for Each of Three Exams: Summer A 2018

May 14 – May 24

Preface

I. Introduction

- 1.1 An Approach to Science
- 1.2 Research Methods: Components and Orientation
- 1.3 Causal Relationships
- 1.4 Why Study Research Methods?
- 1.5 Science, Statistics, Experimental Design, and Variability
- 1.6 Polya's Problem Solving Suggestions
- 1.7 Attend College or Accept a Thiel Fellowship
- 1.8 Types of Research, Variables, and Relationships
- 1.9 Sir Isaac Newton: A Supreme Problem Solver
- 1.10 Real World Research (RWR) Example I: Controlling Movements
- 1.11 RWR Example II: Proteins, Cell Signals, and Microarrays

II. Experimental Design

- 2.1 Independent Variables, Main Effects, and Interactions
- 2.2 RWR Example III: Alcohol, Tylenol, and Liver Functions
- 2.3 Suggestions for Visually Displaying a Two-Way Interaction:
Rules for Constructing and Interpreting Data Figures
- 2.4 Six Possible Two-Way Interactions
- 2.5 Comprehension Check: Main Effects and Interactions
- 2.6 Two Statistical Tests: t and F

III. Experimental Design Criteria and Five Designs

- 3.1 Designs Vary by Three Criteria
- 3.2 Design I: One Independent Variable with Two Levels
- 3.3 Design II: One Independent Variable with Three Levels
- 3.4 Design III: Two Factors with at Least Two Levels of Each Factor
- 3.5 Design IV: Two Factors with at Least Two Levels of Each Factor:
A Special Case
- 3.6 Design V: Three-Way ANOVA
- 3.7 Comprehension Check: Three Designs

IV. Hypothesis Testing and Statistical Significance

- 4.1 Statistical Significance
- 4.2 One-Tailed and Two-Tailed Hypothesis Tests
- 4.3 Tests of Significance: Reminders

V. Statistical Decisions: Parametric and Nonparametric Approaches

- 5.1 Correlation: Pearson Product Moment Correlation
- 5.2 Two-sample *t* Tests Versus One-Way ANOVA
- 5.3 Analysis of Variance Assumptions
- 5.4 Statistical Review Questions: *t*-tests and *F* tests
- 5.5 Multiple Comparison Procedures: Post hoc Tests
- 5.6 RWR Example IV: Ergogenic Aids
- 5.7 Hypothesis Testing: Truth Table

Strunk, W., & White, E. B. (2000). *The elements of style* (4th ed.). New York: Macmillan (eBook).
Read the whole book for writing questions on the first two exams.

Exam 1: May 24, Thursday; 32 points

May 25 – June 7

V. Statistical Decisions: Parametric and Nonparametric Approaches

- 5.8 Statistical Power
- 5.9 Gaussian Distribution
- 5.10 An Abbreviated Random Numbers Table
- 5.11 Nonparametric Statistic: Chi-Square Test: χ^2
- 5.12 Other Nonparametric Tests
- 5.13 Comparisons: Parametric vs. Nonparametrics
- 5.14 Surveys and Questionnaires

VI. Ethics and Science

- 6.1 Office of Research Integrity
- 6.2 Ethics of Science are Synonymous with Ethics of Life
- 6.3 Authorship Considerations
- 6.4 IRB Requirements
- 6.5 Motivational Perspective II: Success and Happiness
- 6.6 Advancing Science
- 6.7 Reviewing Articles
- 6.8 Science, Statistics, Experimental Design, and Variability

VII. Writing Suggestions

- 7.1 Helpful Books on Writing
- 7.2 Writing Suggestions and Notable Quotes
- 7.3 Resist Proliferating the Overwhelming Misuse of *Bring*
- 7.4 Increase Your Vocabulary by Substituting Words for *Get*
- 7.5 RWR Example IV: Rocking Chairs and Dementia
- 7.6 Feel Good Education

VIII. Experimental and Quasi-Experimental Designs

- 8.1 Campbell and Stanley
- 8.2 Internal Validity Threats
- 8.3 External Validity Threats
- 8.4 Addressing Threats to Internal and External Validity:
 Three True Experiments
- 8.5 Three Pre-Experimental Designs
- 8.6 Supplementary Questions about the Six Designs

Exam 2: June 7, Thursday; 32 points

June 8 – June 21

IX. Covariate Analysis, Meta-Analysis, and Multivariate Analyses

- 9.1 Analysis of Covariance
- 9.2 Meta-Analysis
- 9.3 Simple Regression Analysis
- 9.4 Multivariate Analyses
- 9.5 Multiple Regression: Examples I & II
- 9.6 RWE VI: Elm, Chinese Taloe, and Pine Trees
- 9.7 Science, Statistics, Experimental Design, and Variability

X. Cornucopia

- 10.1 Four Axioms: Implications for Research Methods Wisdom
- 10.2 Thoughts as Principled Arguments
- 10.3 Persuasive Arguments
- 10.4 Research Proposal: General Guidelines
- 10.5 Research Proposal: Evaluation Criteria
- 10.6 Seven Questions on Progress
- 10.7 Questions for Reviewing Drafts Written by Colleagues
- 10.8 Science, Statistics, Experimental Design, and Variability:
 Sports Job Weekly
- 10.9 RWE VII: Radical Reform for College Athletics
- 10.10 Thesis and Dissertation: General Thoughts and Suggestions
- 10.11 Manuscript Review: Rating Scale
- 10.12 Glossary

Exam 3: Final Comprehensive Exam, June 21, Thursday, 32 points

Please note that the schedule may change depending on our progress.

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Science Journal: Watching, Reading, Thinking, and Writing
Semester Schedule: TED Talks and YouTube Lectures

- Lectures will be given only Monday through Thursday
- *No lectures will be given on any Friday*
- **Five Fridays during the semester are individual learning days**
- Use your new RM knowledge while **Watching, Reading, Thinking, and Writing**
- Writing and thinking about science and research methods outside of class is productive
- Here is an example of an interesting science journal entry:

How do we initiate, control, and terminate movements? Various movements such as walking, riding a bicycle, driving a car, writing, and exercising seem automatic with no apparent thought going into the exact sequence of movements before or during execution. When driving a stick shift car, I automatically push the clutch down, depress the brake pad, release the clutch, and move my right foot from the brake pad to the gas pedal. Seldom do I stall at traffic lights or fail to push the clutch in at the right time. Yes, today's cars are easier to drive than the column-manual shift I first drove on a back road. The required movements and car's response appear natural now. How did I reach an automatic phase of learning with a stick shift? How do motor control and neuroscience researchers investigate these types of learning and control questions?

Create a science journal file and save each entry. In June, you will send your file to a classmate for reading and a cursory review. At the same time, you will read a set of journal entries. The evaluation criteria are writing style and organization. **By June 18, 2018, Monday**, you should upload your science journal file to Canvas to **earn four points**.

1. May 18: Summarize a TED Talk (Ideas Worth Spreading)
 - a. Steven Johnson: **Where good ideas come from**
http://www.ted.com/talks/steven_johnson_where_good_ideas_come_from
2. May 25: Summarize a TED Talk
 - a. Margaret Heffernan: **Dare to disagree**
http://www.ted.com/talks/margaret_heffernan_dare_to_disagree
3. June 1: Summarize a TED Talk
 - a. Shawn Achor: **The happy secret to better work**
http://www.ted.com/playlists/171/the_most_popular_talks_of_all
(Number 17 on list of 20 most popular talks of all time)
4. June 8: Summarize YouTube Talk
 - a. Bob Sallis, former ACSM President: **Exercise as Medicine**
https://www.youtube.com/watch?v=luPzvjY55_8
5. June 15: Summarize a TED Talk
 - a. Siddhartha Mukherjee: **Soon we'll cure diseases with a cell, not a pill**
https://www.ted.com/talks/siddhartha_mukherjee_soon_we'll_cure_diseases_with_a_cell_not_a_pill