# PSYC 605: Intermediate Inferential Statistics Fall 2018

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| Location: Lakeview 1104 (Monday & Tuesday); Miller G025 (Thursday)<br>Section 1: Monday 12:45-2:15 p.m.; Tuesday/Thursday 9:30-10:45 a.m.<br>Section 2: Monday 4:00-5:30 p.m.; Tuesday/Thursday 3:30-4:45 p.m. |

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| Instructor | S. Jeanne Horst, PhD; horstsj@jmu.edu; 540-568-7103<br>Office: 1122 Lakeview Hall<br>Office Hours: Mondays 10:30- 11:30; Tuesdays 11 a.m. – 12:30 p.m.; Thursdays 10:45 – 11:45 a.m.(Miller G025); and by appointment |
| Teaching Assistant | Beth Perkins, MS; perkinba@jmu.edu; 540-568-6451<br>Office: 1101 Lakeview Hall<br>Office Hours: Monday 2:30-3:30 p.m. and Friday 12:30-2:00 p.m. in Lakeview 1101 |

## *Course Overview*

### Why take this course?

- How good does evidence need to be before you adopt/change your position on an issue?
- What assumptions do you make about your evidence?
- What are the threats to the evidence on which you rely?

Students with diverse backgrounds enroll in this course for a multitude of reasons. The commonality is the need to understand statistics. Statistics are not only valuable to researchers, but understanding statistics is extremely useful in today's world. It's hard to imagine someone who isn't impacted by political, medical, or educational decisions that are based on quantitative research. Studying statistics also offers students the opportunity to improve their critical thinking, logical reasoning and problem solving skills. As anyone who has them will tell you, statistical skills are marketable and professionally valuable.

Thus, there are many reasons to "dig in" and devote time and energy to learning statistics this semester. Remembering why you are doing it throughout the course will keep you motivated and make the tasks less tedious. We encourage all students to write down their personal goals for the course and review them periodically. Specifically, consider these questions: "What do I want to get out of this course? And "How will this course benefit me?" To support student motivation and learning, we will make an effort to ask students to describe the relevance of the material to their life.

## *Prerequisites for the Course*

**Statistics and Research Methods**
The class is designed for students who successfully completed a previous course that covered the following topics: measure of central tendency (e.g., mean, median, mode), measures of dispersion (e.g., variance, standard deviation, range, outliers), frequency distributions (e.g., skew, kurtosis), probability, displaying data graphically (e.g., histograms, box plots), the normal curve, hypothesis testing, one-sample t-tests, two-sample t-tests (independent and dependent), independent and dependent variables, categorical and continuous variables, and basic principles of research design and methodology. If you find yourself behind in the lectures, it will be your responsibility to return to foundational material and bring in questions to office hours, as needed.

**Math Skills**
Understanding intermediate statistics is largely a conceptual and logical challenge. Even though the statistics we will discuss are intermediate, the math needed to reach understanding of them is still basic. Explicitly, students should be familiar with: order of operations, operations with fractions and positive/negative numbers, solving for a variable using simple algebraic manipulations, the equation of a line, interpreting symbols such as greater than/

less than, absolute value, and square roots. Students are encouraged to consult their previous textbooks, textbooks in the library, or resources widely available on the internet to review these topics.

## *Course Purpose and Objectives*

This course is intended to be a ***second course*** in statistics. Important foundational topics like hypothesis testing, confidence intervals, effect sizes, correlation, and statistical power will be covered at a deeper conceptual level than in an introductory course. Additionally, more complicated statistical models all associated with the General Linear Model will be introduced. Specifically, this course focuses on analysis of variance (ANOVA) statistical models. After illuminating the mathematical and theoretical details behind the basic ANOVA model, students will learn several common types of ANOVAs that are increasingly complex as the semester progresses.

From a macro-perspective, we would like you to approach quantitative analysis problems like a researcher who would use the following steps:

(A) Clean the data,
(B) Identify an appropriate statistical analysis, given the research question,
(C) Check the assumptions of that analysis,
(D) Run the analysis via statistical software, and
(E) Interpret the results.

The specific student learning objectives of the course are as follows:

- **Explain** the logic underlying statistical hypothesis testing.
- **Explain** the importance of sampling distributions in hypothesis testing.
- **Distinguish** between significance tests and effect sizes.
- **Calculate** and **interpret** Pearson correlation coefficients.
- **Calculate** and **interpret** simple linear regression equations.
- **Explain** the logic underlying analysis of variance.
- **Explain** the statistical assumptions underlying ANOVA and the ANOVA model's robustness to their violation.
- **Distinguish** between planned and post hoc ANOVA comparisons.
- **Construct** a planned comparison and test it for significance.
- **Test** a set of post hoc comparisons for significance.
- **Explain** statistical power and its influences.
- **Conduct** a power analysis for one-factor experimental designs to choose an appropriate sample size.
- **Interpret** interaction effects in factorial ANOVA designs.
- **Perform** tests of simple effects to follow up significant interactions.
- **Identify** an effective blocking variable and analyze the data from a treatments by blocks ANOVA design.
- **Identify** an effective covariate and analyze the data from a one-factor analysis of covariance design.
- **Use SPSS** to analyze data from one- or two-factor ANOVA designs containing between-subjects factors, within-subjects factors, or both.

## *Course Philosophy*

In this class, we adopt a holistic philosophy of learning (Fink, 2003) that posits that there are at least six dimensions of learning: 1) foundational knowledge (e.g., your knowledge of statistics), 2) application (e.g., applying what we learn), 3) integration of ideas (e.g., integrating concepts, such as ANOVA and the general linear model), 4) human dimension (e.g., learning about self and others), 5) caring (e.g., we want you to *enjoy* this class), and 6) learning to learn (e.g., metacognitive checks). Although this is a graduate course, many of us find that we have not developed strong meta-cognitive skills when studying subjects, such as statistics. We will work at addressing each of these six areas of learning, including "learning to learn." For example, when reading the textbook, be sure to stop and ask yourself questions. Try explaining the concepts aloud. Can you do so? Complete the practice exercises. What concepts come easily and are there concepts on which you could use more review?

**Student Responsibility for Learning**
***Your effort will be the main determinant of success in this course.*** Take responsibility for your own learning. This means actively engaging in, spending time with, and thinking hard about the material. Even when conducting group work, be mindful of your own learning and be sure to contribute to the group in order to maximize your learning opportunities. To be successful, an adequately prepared student (i.e., understands basic statistical content) will most likely need to dedicate ***at least 6 hours per week*** to the course outside of class. Please consider carefully whether you are "up for the challenge" at the outset.

**Office Hours**
We provide multiple forms of office hours with both the instructor and the teaching assistant. Many students may enter graduate school with a negative view of office hours, considering office hours as only a time for dealing with problems. Our philosophy is that office hour attendance is *positive.* In fact, the most successful students regularly attend office hours, asking deep questions about the readings, videos or class material. ***We value time spent with you in office hours and strongly encourage regular attendance.***

**Workload**
Our role as instructors is to facilitate your learning of the course material. Intentionally, the workload for this course is not light. We assign frequent assignments and assessments that provide multiple opportunities to engage with the material. The purpose of doing so is to increase the probability that you learn, use, and retain the information.

**Expectations for In-Class Behavior**
We expect you to come to class prepared, ready to learn, and to conduct yourself in a professional manner. We hope to create a respectful learning environment that is engaging and interactive. The responsibility for creating such a community falls on both the instructors and the students. Specifically, this means reading in advance of class, getting help with troublesome concepts, asking questions, interacting during class, and conducting yourself in an appropriate and professional manner. ***We expect that cellphones will be silent during class time.***

**Preferences for Out-of-Class Communication**
The instructors for this course have strategically set up office hours so that many times are available to students. We recommend that you come to the office during these time frames to make the most efficient use of time.

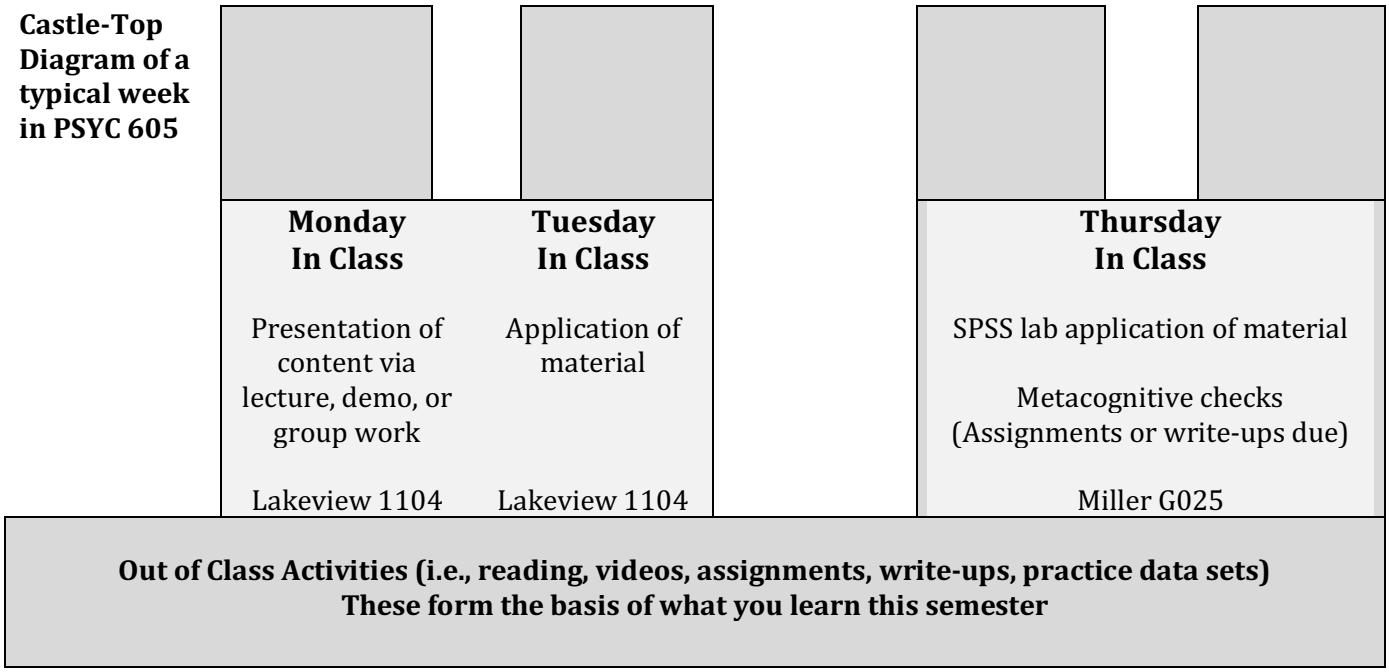
**How to Be Successful in This Class**
- Come to class ready to learn.
- Complete the out-of-class exercises *prior to* each class (e.g., reading, videos, meta-cognitive checks, and assignments).
- If you become confused or don't fully grasp a concept, ask for help or spend more time on it.
- Spend time studying at the beginning of the semester.
    - If you do this, the second half of the course will be much easier than the first; if you don't the second half could be brutal. Once you get statistics language and the concepts down, you'll be set.
    - The mindset of hypothesis testing is often described as "learning a language" or a new way of thinking. This takes time.
- Use the stated course goals and objectives to guide your study time and check your progress.
- Know what is going on: keep up with email, course announcements, and the course schedule.
- Complete all course assignments by the scheduled due date. Try to apply the information to your area of study.

## *Anatomy of a Week in This Course*

Given our learner-centered course philosophy, we believe that the time you spend working with statistics concepts *outside of class* is just as important as the time you spend *inside class.* Therefore, we will assign activities and readings for you to complete outside of the classroom. Before every class, you will complete out-of-class activities (i.e., readings and videos). We expect that you will come to class prepared to engage with the material. Note in the

castle-top diagram (Fink, 2003), below, that we will do lectures, demos or group work within the class period. However, outside of class we will expect that you will exerting the effort necessary to master the concepts.

**Castle-Top Diagram of a typical week in PSYC 605**




## *Course Materials*

**Textbook:**

Field, A. (2018). *Discovering statistics using IBM SPSS Statistics*: *North American edition*. (5th ed.). Thousand Oaks, CA: Sage Publications, Inc. North American Version- Paperback ISBN 9781526436566

The first four chapters overlap with introductory material, as well as introduce SPSS. Students report that this text is accessible and entertaining to read. There are also online resource materials to accompany this text at: https://edge.sagepub.com/field5e

**Readings (Other than Text) and Videos**

We will make additional course readings and videos available on Canvas. Careful reading and completion of sample exercises ***before class strongly recommended***. As you read the assigned readings and watch the videos, it is important that you hone meta-cognition skills. An example of a meta-cognition check as you are reading is to ask yourself whether you could explain the concept to someone else. Stop reading and explain the concept aloud. Or when reading, ask additional "what if" questions and test them out. Often I will open up Excel or SPSS and work through the examples when reading.

**Canvas Site**

Canvas is an online course portal that can be accessed from the JMU home page (www.jmu.edu or canvas.jmu.edu). We will use Canvas extensively throughout this course. Not only will course materials be provided through this site, but assignments will be administered through Canvas. Please let us know if you do not have access to this course through Canvas. ***Another feature of Canvas is that we will provide electronic feedback on your assignments. If you are having trouble seeing the feedback, let us know so that we can help you access it. The philosophy of this class is that we learn best through feedback on our work, so it is crucial that students are able to access that feature of Canvas.***

**Statistical Software**

You will need to use a statistical software program to complete some assignments. The textbook covers how to use SPSS to run all of the analyses we will discuss in this class. Most labs on campus have SPSS installed (check this

link to see JMU labs: http://www.jmu.edu/computing/labs/locations/). You can obtain a free copy of SPSS from JMU at the following link: http://www.jmu.edu/computing/software/ .

**Lectures**
Class will consist of lectures in which concepts are introduced followed by using statistical methods to address substantive research questions by conducting analyses and interpreting the results. ***It is recommended that you read the associated chapters (listed below) before the corresponding lecture. You are strongly encouraged to ask questions in class.***

Lecture slides and handouts will be made available before each class on Canvas (http://canvas.jmu.edu). It is recommended that students print out and bring a copy of the lecture slides and handouts before coming to class. Lectures will augment what is covered in the assigned readings and highlight the most challenging concepts.

## *Description of Coursework Components and Grading*

**In-Class Meta-Cognitive Checks**
The scheduled in-class meta-cognitive checks are indicated on the course calendar. These closed-book, paper-pencil, graded assessments will be held during class on Thursdays (see calendar at the end of this syllabus). The in-class metacognitive checks are intended to provide you with feedback on your mastery of the material and to help you hone your own metacognitive skills. ***There will be no opportunity to make up material missed on these assessments.***

**Homework: Assignments and Write-Ups**
Homework will be assigned weekly. Be sure to pay special attention to the course calendar (below) for due dates. There will be two types of homework assignments in this class: 1) Assignments, and 2) Write-Ups. The Assignments are traditional assignments that focus more on the concepts and the mathematics underlying course material. The Write-ups require application of course material to individual datasets using SPSS. The Write-ups include an APA style presentation of the findings.

Notes about Homework:

- Many people learn best when working in a group and collaborative learning is encouraged in this course. Please understand that each student must turn in individual homework assignments, not group work. Papers should be ***written in your own words*** – your text should reflect your understanding of the material. Students who submit group homework assignments will be given zeros. To properly acknowledge the contribution of your collaborators, I asked that you indicate on the cover page of each assignment the names of the people with whom you worked. Students are each responsible for demonstrating a good grasp of the material; therefore, ***all written work must be your own.***
- The penalty for submitting assignments late is 10 percentage points per day, including weekends. For example, if an assignment is due on Thursday and student X submits it on Sunday then 30 percentage points will be deducted from the score. A 92 would become a 62. As such it would behoove you to turn in assignments in a timely manner. Plan accordingly. In a valid emergency appropriate accommodations will be made. It is best, if possible, to contact the instructor prior to the due date.
- Your homework should be neat and well-organized. Show your work and clearly indicate your answers. The grader is a student like you and will not take time to decipher poor handwriting, put pages in order, or read notes scrawled in the margins. You may type your assignments (Note: Write-ups must be typed).
- Be sure to print your name at the top of the first page of your assignment. Put your name or initials at the top of each additional sheet of paper or computer output. Staple your pages together.

**In-Class Tests**
There will be an in-class midterm, and a take-home and in-class final exam in this course. The tests provide opportunity for you to receive feedback on your effort and learning in the course. The exams are designed to ensure that students have an accurate and complete understanding of the overarching and critical concepts and principles presented in the course. Each test will focus primarily on the material most recently presented.

However, given that the material we study in this course builds on itself as we progress, the exams may include statistical concepts covered in prior sections of the course. In addition, topics that students struggled with on the previous test may be included to ensure mastery of the material. Therefore, it is important that you review feedback from previous tests and make sure you have any questions resolved by the next test. The exams are our best way of gauging how well you are learning the material.

**Assessment of Course Objectives**

| Course Requirement | Grade Percentage |
|---|---|
| In-class metacognitive checks | 20% overall |
| Homework: Assignments | 20% overall |
| Homework: Write-ups | 20% overall |
| Mid-term Examination (in-class) | 20% overall |
| Final Examination (take-home and in-class) | 20% overall |

Grades will be assigned based upon the following percentages:

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|---|---|---|
| A = 94-100 | B = 83-86 | F = below 70 |
| A- = 90-93 | B- = 80-82 | |
| B+ = 87-89 | C = 70-79 | |

## *Responsibility for Learning and the Honor Code*

For all work we do in this course, the JMU Honor Code is in effect! Cheating and plagiarism will NOT be tolerated. Any and all violations will be referred to the Honor Council for disposition. See http://www.jmu.edu/honor for information about the Honor Council and the Honor Code at JMU. ***Assignments that have violated the honor code will result in a zero grade for that assignment. All work must be in your own words.***

As a professional, you will have every opportunity to behave in a non-ethical manner. We hope to provide the context and support so that you can develop your statistical skills in conjunction with ethical, professional behavior. Although the chances of getting caught in an ethics violation may be small (e.g., no journal has ever asked us for data so that they could double-check the data analyses reported in a paper), the consequences are severe. If you are struggling with ethical decisions that confront you, or you see others around you struggling, please feel free to consult with either instructor as you work through these issues. Without credibility, any statistical analysis, assessment, or conclusion is on very shaky ground, indeed!

**General statement from JMU**

"Making references to the work of others strengthens your own work by granting you greater authority and by showing that you are part of a discussion located within an intellectual community. When you make references to the ideas of others, it is essential to provide proper attribution and citation. Failing to do so is considered academically dishonest, as is copying or paraphrasing someone else's work. The results of such behavior will lead to consequences ranging from failure on an assignment to failure in the course to dismissal from the university. Please ask if you are in doubt about the use of a citation. Honest mistakes can always be corrected or prevented.

Academic dishonesty is not limited to plagiarism. Other examples of academic dishonesty include cheating on tests or homework, taking an exam or writing a paper for someone else, and selling or uploading unauthorized documents from a class."

## *Additional Information*

**Students with Disabilities:** JMU abides by Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act, which mandate reasonable accommodations be provided for students with documented disabilities. If you have not already done so, you will need to register with the Office of Disability Services, the designated office on campus to provide services for students with disabilities. The office is located in the JMU Student Success Center and you may call 540-568-6705 for more information. If you have a disability and may

require some type of instructional and/or examination accommodations, please contact me early in the semester so that I can provide or facilitate provision of accommodations you may need.

**Adding/Dropping Classes:** Students are responsible for registering for classes and for verifying their class schedules on e-campus. They are also responsible for knowing deadlines for Drop and Add and policies related to receiving a "W". No exceptions will be made to these deadlines or policies. Information may be found on the registrar's webpage (https://www.jmu.edu/registrar/).

**Inclement Weather**
James Madison University is primarily a self-contained campus with a large number of residential students requiring a variety of support services, regardless of inclement weather conditions or emergency situations. For the safety and well-being of its student and employees, the university may close or limit its services based on inclement weather or other emergencies. Refer to the following sources for information on closings or delays: JMU Weather Line (540) 433-5300, JMU radio station 1610 AM, JMU's home page, Area radio and television stations, JMU Office of Public Safety, who in turn is responsible for announcements on Emergency Notification System. For additional information, refer to http://www.jmu.edu/JMUpolicy/1309.shtml.

**Religious Accommodations**
All faculty are required to give reasonable and appropriate accommodations to students requesting them on grounds of religious observation. The faculty member determines what accommodations are appropriate for his/her course. Students should notify the faculty by no later than the end of the Drop-Add period the first week of the semester of potential scheduled absences and determine with the instructor if mutually acceptable alternative methods exist for completing the missed classroom time, lab or activity. Contact the Office of Equal Opportunity at (540) 568-6991 if you have additional questions.

**Attendance**
JMU Policy: "A student's participation in the work of a course is clearly a precondition to his/her receiving credit in that course. Because of the wide variety of courses and teaching methods at JMU, the university recognizes that the nature of a student's participation in the work of a course cannot be prescribed on a university-wide basis. For this reason, classroom attendance is not a matter subject to regulation by the university. Attendance in class and in the laboratory is a matter between the student and the faculty member in that class or laboratory. The attendance policy for specific courses is provided by the class instructor."

**Specific to this Course**
Although I do not record your attendance, I do expect that you will attend class. If you need to miss a class it is your responsibility to gather the material covered in that class period from your classmates. I will not hold a private class or tutoring session in my office. There will be no "make-up" activities if you didn't attend class the day an activity.

References

APA (2008). Reporting standards for research in psychology: Why do we need them? What might they be? *American Psychologist, 63*, 839-851.

American Psychological Association. (2010). *Publication manual of the American Psychological Association* (6th ed.). Washington, DC: American Psychological Association.

Cohen, B. (2013). *Explaining psychological statistics*. (4th ed.). Hoboken, NJ: Wiley.

Cohen, J. (1992). A power primer. *Psychological Bulletin, 112,* 155-159.

Faul, F., Erdfelder, E., Lang, A. G., & Buchner, A. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences, *Behavior Research Methods, 29,* 175-191. http://www.gpower.hhu.de/

Faul, F., Erdfelder, E., Buchner, A., & Lang, A. G. (2009). Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods, 41,* 1149-1160. http://www.gpower.hhu.de/

Field, A. (2018). *Discovering statistics using IBM SPSS Statistics: North American edition.* (5th ed.). Thousand Oaks, CA: Sage Publications, Inc. North American Version- Paperback ISBN 9781526436566

Gravetter, F. J., & Wallnau, L. B. (2012). *Statistics for the behavioral sciences*. (9th ed.) Belmont, CA: Wadsworth Publishing.

Keppel, G. & Wickens, T (2004). *Design & Analysis: A researcher's handbook*. Upper Saddle River, NJ: Pearson Prentice Hall.

Lakens, D. (2013). Calculating and reporting effect sizes to facilitate cumulative science: A practical primer for *t*-tests and ANOVAs. *Frontiers in Psychology, 4,* 1-12.

Mayr, S., Erdfelder, E., Buchner, A., & Faul, F. (2007). A short tutorial of *GPower. Tutorials in Quantitative Methods for Psychology, 3,* 51-59. http://www.gpower.hhu.de/

Nicol, A.A. M. & Pexman, P. M. (2010). *Presenting your findings: A practical guide for creating tables*. Washington, DC: American Psychological Association. (Chapters 5, 7, and 9).

Sullivan, G. M., & Feinn, R. (2012). Using effect size – Or why the *p* value is not enough. *Journal of Graduate Medical Education,* 279- 282.

**PSYC 605 Fall 2018 Calendar (Note: Although I will make every attempt to avoid doing so, all dates are subject to change.)**

| Week | Date Monday | Topic for the week | Monday Lakeview 1104 | Tuesday Lakeview 1104 | Thursday Miller G025 | Assignments/Write-ups Meta-cognitive Checks Due on Thursdays |
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| **Week 1** | 8/27/18 | Inferential stats and SPSS<br><br>Note: We are transitioning into inferential stats & assume knowledge of descriptive statistics. If those concepts are not comfortable, please review.<br><br>**Assigned readings:**<br>Field (2018), Chapters 1 & 2<br>Cohen (2013), Chapters 4 & 5<br>Halpern & Hakel (2005)<br>Shepard (2003) | Field Chapters 1-2<br><br>• Syllabus (30 min.)<br>• Linear Model: Model + Error<br>• Sampling distributions<br>• Standard error of the mean | Cohen Chpt. 4-5<br><br>Hypothesis testing<br>• 1-sample | SPSS lab –<br><br>Intro to SPSS; how to obtain SPSS for personal computer.<br><br>Textbook reference on SPSS is in Field (2018), Chapters 4 & 5, and subsequent chapters | Due on Thursday (8/30):<br><br>**Assignment 1** – Review of introductory statistics content (bring this to class as a hard copy on Thursday) |
| **Week 2** | 9/03/18 | Correlation & Regression – GLM<br><br>**Assigned readings:**<br>Field (2018) Chapter 8 (all) and Chapter 9 (pages 275-294)<br><br>**APA-style resources:**<br>Nicol & Pexman (2010)<br>APA manual (2010) Chpt. 5 | Chapters 8<br><br>Correlation<br>• Lecture | Chapter 9<br><br>Regression (continuous predictor)<br>Lecture | Metacognitive check on general linear model and week 1 material.<br><br>SPSS lab handouts<br>Compare corr & regression | Due on Thursday (9/6):<br><br>**Meta-Cognitive Check** – general linear model; sampling distributions & standard error of the mean(in class)<br><br>**Write-up 1** – Introduction (upload to Canvas) |
| **Week 3** | 9/10/18 | t-tests – GLM, connection between correlation and t-test, distinguish between independent and dependent samples<br><br>**Assigned readings:**<br>Field (2018) Chapter 10<br><br>**Optional (encouraged):**<br>Gravetter – paired t-tests | Chapter 10<br><br>Adding a categorical predictor to the linear model – difference between group means.<br><br>t-tests<br>• independent<br>• dependent (possibly move to the within ANOVA week)<br>• CI's | Hand-calculation<br><br>Handout – same 2 group experiment with two methods. Compare/contrast | SPSS lab<br><br>Adding a categorical predictor to the linear model – difference between group means & t-test examples. | Due on Thursday (9/13):<br><br>**Write-up 2** – Correlation & Regression (upload to Canvas) |

| Week | Date Monday | Topic for the week | Monday Lakeview 1104 | Tuesday Lakeview 1104 | Thursday Miller G025 | Assignments/Write-ups Meta-cognitive Checks Due on Thursdays |
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| **Week 4** | 9/17/18 | Power and effect size; review type I and type II errors<br><br>**Assigned readings:**<br>Field Chapter 3 thru section 3.7<br>Cohen (1992) *A Power Primer*<br>APA JARS (2008) article<br>Lakens (2013)<br>Sullivan & Feinn (2012)<br>Mayr et al. (2007) – G*Power tutorial | Power & Effect Size<br><br>Come prepared to discuss this week's readings – debate over statistical significance vs. effect size. Be able to make your own case about the importance of reporting effect size. | Power & Effect Size | SPSS lab<br><br>Meta-Cognitive Check – NHSST, Power & Effect Size<br><br>**G*Power lab – bring your own laptop with G*Power installed.** | Due on Thursday (9/20):<br><br>**Meta-Cognitive Check** – NHSST, Power & Effect Size<br><br>**Write-up 3 – *t*-tests** (upload to Canvas) |
| **Week 5** | 9/24/18 | One-way ANOVA's<br><br>**Assigned reading:**<br>Field (2018) Chapter 12<br>Keppel Chapter 7<br><br>**APA-style resource:**<br>Nicol & Pexman (2010) Chpt. 9 | Introduce ANOVA conceptually | Hands-on ANOVA | SPSS lab<br><br>One-way ANOVA SPSS analysis and interpretation. | Due on Thursday (9/27):<br><br>**Assignment 2** – G*Power (upload to Canvas) |
| **Week 6** | 10/01/18 | One-way ANOVA's contd.<br><br>**Assigned reading:**<br>Field (2018) Chapter 12<br><br>**Optional reading:**<br>Keppel Chapter 4 | One-way ANOVA follow-ups and planned comparisons | Hands-on practice with planned comparisons | SPSS lab<br><br>Meta-Cognitive Check – ANOVA concepts<br><br>One-way ANOVA follow-ups and planned comparisons | Due on Thursday (10/4):<br><br>**Meta-Cognitive Check:**<br>ANOVA concepts (in class)<br><br>**Assignment 3** – Comparison of *t*-test, ANOVA, correlation, & regression (upload to Canvas) |
| **Week 7** | 10/08/18 | In-class midterm & begin Factorial ANOVA<br><br>**Assigned reading:**<br>Field (2018) Chapter 14<br><br>**Optional Reading:**<br>Keppel Chapter 10 | **In-Class Midterm** | Introduce factorial ANOVA<br><br>Hands-on factorial ANOVA | SPSS lab<br><br>Factorial ANOVA in SPSS | Due on Thursday (10/11):<br><br>**Write-up 4** – One-way BS (Upload to Canvas) |

| Week | Date Monday | Topic for the week | Monday Lakeview 1104 | Tuesday Lakeview 1104 | Thursday Miller G025 | Assignments/Write-ups Meta-cognitive Checks Due on Thursdays |
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| **Week 8** | 10/15/18 | Factorial ANOVA (NERA)<br><br>**Assigned reading:**<br>Field (2018) Chapter 14 | Factorial ANOVA lecture, contd. | Morning: office hours during the A.M. section. No P.M. meeting. (conference) | ***NERA (no class)***<br><br>Meta-Cognitive Check – Factorial ANOVA concepts (on Canvas) **DUE** | Due on Thursday (10/18):<br><br>**Meta-Cognitive Check (computer-based – on Canvas):**<br>Factorial ANOVA concepts |
| **Week 9** | 10/22/18 | Factorial ANOVA<br><br>**Assigned reading:**<br>Field (2018) Chapter 14 | Factorial ANOVA | Factorial ANOVA | SPSS Lab<br><br>Factorial ANOVA – three-way interaction | Due on Thursday (10/25):<br><br>**Assignment 4** – Factorial ANOVA (Upload to Canvas) |
| **Week 10** | 10/29/18 | ANCOVA<br><br>**Assigned Reading:**<br>Field (2018) Chapter 13 | ANCOVA concepts and adjusted means | ANCOVA and the general linear model | SPSS lab<br><br>Conduct & interpret ANCOVA in SPSS | Due on Thursday (11/1):<br><br>**Write-up 5** – Factorial ANOVA (Upload to Canvas) |
| **Week 11** | 11/05/18 | Within-Subjects One-Way<br><br>**Assigned reading:**<br>Field (2018) Chapter 15 | Repeated measures (within-subjects) concepts | Hands-on activity | SPSS lab<br><br>Meta-Cognitive Check<br><br>Repeated measures data file set-up | Due on Thursday (11/8):<br><br>Meta-Cognitive Check –Within-Subjects concepts<br><br>**Assignment 5** – ANCOVA |
| **Week 12** | 11/12/18 | Within-Subjects Factorial<br><br>**Assigned reading:**<br>Field (2018) Chapter 15 | Conceptual – within-subjects factorial | Within-Subjects Factorial, continued | SPSS lab<br><br>Within-Subjects factorial in SPSS | Due on Thursday (11/15):<br><br>**Write-up 6** – RM ANOVA (Upload to Canvas) |
| **Week 13** | **11/19/18** | **Thanksgiving week** | **---** | **---** | **---** | |
| **Week 14** | 11/26/18 | Mixed ANOVA<br><br>**Assigned reading:**<br>Field (2018) Chapter 16 | Mixed ANOVA (aka "split-plot" designs) | Hands-on activity | SPSS lab<br><br>Mixed ANOVA in SPSS | Take-Home portion of final exam assigned (due during the in-class final exam) |
| **Week 15** | 12/03/18 | Chi-Square; Wrap-up/Ethics<br><br>**Assigned readings: TBD** | Chi-Square | Wrap-up | SPSS lab<br><br>Chi-Square | |
| **Week 16** | 12/10/18 | **In-Class Final Exam: Morning section = Tuesday, 12/11/18 8:00-10:00 a.m.; Afternoon section = Tuesday 12/11/18 1:00-3:00 p.m.** | | | | |

Appendix A

# Student Learning Outcomes for JMU Counseling & Supervision Doctoral Program:

The 2016 CACREP student learning outcomes for PSYC 605 Intermediate Inferential Statistics include the following in the area of *Research and Scholarship*:

4. RESEARCH AND SCHOLARSHIP
   a. research designs appropriate to quantitative and qualitative research questions
   b. univariate and multivariate research designs and data analysis methods
   d. emergent research practices and processes
   g. research questions appropriate for professional research and publication
   h. professional writing for journal and newsletter publication

| CACREP STANDARDS INCLUDED IN COURSE | 4.a | 4.b. | 4.d. | 4.g. | 4.h. |
|---|---|---|---|---|---|
| Overall Standards | x | x | x | x | x |
| ASSIGNMENT: In-class metacognitive checks | | X | X | X | |
| ASSIGNMENT: Mid-term Examination (in-class) | | X | X | X | |
| ASSIGNMENT: APA-Style Write-ups | X | X | X | X | x |
| **KPI 4 ASSIGNMENT (I): Final Examination (take-home and in-class)** | X | X | X | X | |
| Level of KPI indicated by: I = Introductory; R= Reinforcement; M= Mastery | | | | | |