

University of Arizona  
**EDP 541: Introductory Statistics in Education**

**Course and Instructor Info**

Instructor: Dr. Monica Erbacher	Course Time: MW 4:00pm – 5:40pm
Office: College of Ed. (EDUC) Rm 621	Course Room: Psychology 206
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Office Hours: M 12:30-1:30pm, Th 1:30-2:30pm	TA Office Hours: T 1-2pm, F 10-11am TBD; EDUC 635C

**I. Content, Goals, & Objectives**

This course covers the most common descriptive statistics and inferential statistics students will encounter in Education and Psychology research. Topics range from fundamentals, such as defining variables, samples, populations and null hypothesis significance testing, to analyses for multiple groups and variables, such as ANOVA and parts of regression. Application of these techniques will be carried out in the statistical program R.

At the conclusion of this course, students will be able to do the following:

Descriptive Statistics

- Describe central tendency and variation conceptually to someone unfamiliar with statistics;
- Identify the levels of measurement common in Ed. and Psych. research;
- Match central tendency and variation statistics with the levels of measurement for which they are most appropriate;

Inferential Statistics

- Choose (and justify) the appropriate statistical analysis to answer a specific research question;
- Execute statistical analyses in at least one software program (most likely R);
- Describe how a given statistical technique works to your peers and someone unfamiliar with statistics;
- Explain the results of a given statistical analysis to your peers and someone unfamiliar with statistics;
- Evaluate empirical articles for best practice in statistical techniques;
- Identify best practices for any given statistical technique covered in class;
- Correctly interpret a  $p$ -value and confidence interval;
- Interpret both standardized and raw effect sizes;

General

- Independently seek and find reputable sources for statistics and programming help online;
- Work through statistically-heavy literature (e.g., peer reviewed articles and book chapters).

**II. Student Evaluation**

Students will be evaluated on weekly homework assignments, in-class participation, and exams. Grade breakdown:

<u>Total % of Final Grade</u>	<u>Evaluation Item</u>	<u># of Evaluations</u>	<u>Should Take You</u>
45%	Homeworks*	~ 6-8	A few hours
40%	Exams	2	Less than 10 hours
15%	In-class Participation	32	Class time

\*Note: As this is a graduate course, late homework will not be accepted. If there is an emergency (e.g., last minute travel for family crisis, emergency room visit, ebola), please see me ASAP to discuss exceptions.

Grading Scale:

90 – 100 = A      80 – 89 = B      70 – 79 = C      60 – 69 = D      Below 60 = E

### III. Expectations

#### 1) *Facilitate a collegial, accepting environment.*

Students bring a rich variety of backgrounds to this course. Respect others' perspectives and learn from them. Individuals from other programs may have questions you never thought of. Learning from others' perspectives greatly benefits your career – you never know who your colleagues will be in the future.

#### 2) *Participate in class!*

The concepts we will cover build on one another. Ask if something is unclear. Class time will often be treated as a two-way conversation. Please volunteer answers. If you are anxious about speaking up in class, set a goal for yourself each week. Start with speaking up once a week across all your courses. Gradually increase that goal until you are regularly (at least once a class) contributing to all courses.

#### 3) *Read thoughtfully.*

I have put effort into keeping the required reading each week manageable. Completing readings before class is crucial to progressing successfully through this course.

### IV. Tentative Schedule

The schedule provided below is tentative and may be modified at the professor's discretion.

\*\*\*Homeworks and readings are due at the beginning of the class next to which they are listed.

\*\*\*\***Do not forget to check out the optional supplemental readings!**

Class Date	Topic(s)/Materials	Readings Due	Homeworks Due
Monday 08-20-17	Class structure, levels of measurement, score frequencies L01a_Overview.pdf (slides); L01b_Frequencies.pdf (slides)	Privitera, Chapter 1 pages 1-22 Cohen, Chapter 2 pages 24-47	
Wednesday 08-22-17	Score frequencies lab (R) L02a_IntroToR.R (script); L02b_Frequencies.R		
Monday 08-27-17	Descriptive stats (central tendencies, sd, skew, kurtosis) L03a_DescriptiveStats.pdf (slides)	Privitera, Chapter 3 pages 76-98, Chapter 4 pages 106-128	HW1_Frequencies.doc
Wednesday 08-29-17	Descriptives lab (R) L04a_Descriptives.R		
Monday 09-03-17	NO CLASS – LABOR DAY	*none, but note long ones coming up -->	*none, consider getting ahead on readings!
Wednesday 09-05-17	Review, intro to distributions, NHST; L05_NHST.pdf, Materials for course activity provided in class	Privitera, Chapters 6 and 7	HW2_DescriptScreen.doc
Monday 09-10-17	Normal distribution, z-test, Power, Effect Size, Errors (Type I and II) L06_zScoreszTest.pdf	Privitera, Chapter 8	
Wednesday 09-12-17	z-test lab (R) L07_ztest.R		
Monday 09-17-17	t-distribution, 1-sample t-test	Privitera, Chapter 9 pages 274-286, Chapter 11 pages 334-347	
Wednesday 09-19-17	1-sample t-test lab (R) L09_SingleSamplet.R		
Monday 09-24-17	Paired t-test	Privitera, Chapter 10, Chapter 11 pages 351-356	
Wednesday 09-26-17	Paired t-test lab (R)		HW3_SingleSampletandz.doc
Monday 10-01-17	Independent means t-test, t-distribution	Privitera, Chapter 9 pages 288-296, Chapter 11 pages 349-350	
Wednesday	Independent means t-test lab (R)		

10-03-17			
Monday 10-08-17	One-way ANOVA	Privitera, Chapter 12	
Wednesday 10-10-17	One-way ANOVA lab		HW4_IndAndDept.doc
Monday 10-15-17	One-way ANOVA – Multiple Comparisons	Cohen (2013) Chapter 13	
Wednesday 10-17-17	One-way ANOVA – Multiple Comparisons Lab **Class <i>may</i> be cancelled (NERA conference) - TBD		
Monday 10-22-17	Two-way ANOVA	Privitera, Chapter 14	
Wednesday 10-24-17	Two-way ANOVA Lab <b>Take Home Midterm Exam Assigned</b>		HW5_1wayANOVA.doc
Monday 10-29-17	Types of SS (end of Handout 11), One-way RM ANOVA	Privitera, Chapter 13	
Wednesday 10-31-17	One-way RM-ANOVA lab		
Monday 11-05-17	Correlation		<b>TAKE HOME EXAM DUE</b>
Wednesday 11-07-17	Correlation Lab	Privitera, Chapter 15	
Monday 11-12-17	CLASS CANCELLED: VETERAN'S DAY		
Wednesday 11-14-17	Partial, Semipartial Correlation	TBD (possibly no reading)	
Monday 11-19-17	Partial, Semipartial Correlation Lab		HW6_Correlation.doc
Wednesday 11-21-17	CLASS CANCELLED: Have a great Thanksgiving!		
Monday 11-26-17	Linear Regression – Brief Intro, Continuous vs. Categorical, Coding Categorical Variables	Privitera, Chapter 16	<b>Take Home Final Exam Assigned</b>
Wednesday 11-28-17	Regression Lab		
Monday 12-03-17	Regression continued, Review, debrief, possible next classes in statistics		
Wednesday 12-05-17	Chi-square statistics		<b>TAKE HOME EXAM DUE</b>

## V. Texts and Readings

### Required Textbook:

Privitera, G. J. (2017). *Statistics for the behavioral sciences* (3<sup>rd</sup> ed.). Thousand Oaks, CA: SAGE Publications.

\*Note: you can rent this book on Amazon for about \$48. There *may* also be an option through the book store to gain temporary (i.e., a couple weeks) to each chapter, one at a time, for free.

\*Note: If you find a book with the same name, but that also has “Essential” or “Student Guide” on the cover, you do NOT want that book. These are supplemental materials you can buy for this book. They are not necessary for this course. You want the book that ONLY has “Statistics for the behavioral sciences”, the author’s name, and three baby chickens on the cover.

Other Required Readings \*\*You do NOT need to buy these! They will be provided!\*\* (Articles, Chapters, etc.):

- Cohen, B. H. (2013). *Explaining psychological statistics* (4<sup>th</sup> ed.). Hoboken, NJ: Wiley.

- The instructor has the right to add, drop, or change required readings at any point during the course.

Optional Readings: Don't forget to check these for anything that piques your interest! (\*Highly Recommended)

### **Weeks 1-2:**

Pros and cons of using levels of measurement:

- Fife-Schaw, C. (2006). Levels of measurement. In G. M. Breakwell, S. Hammond, C. Fife-Schaw, & J. A. Smith (Eds.), *Research Methods in Psychology* (50-63). London: SAGE.
- Velleman, P. F. & Wilkinson, L. (1993). Nominal, ordinal, interval, and ratio typologies are misleading. *The American Statistician*, 47(1), 65-72.

How Likert-type scales should be classified (within the levels of measurement):

- Jamieson, S. (2004). Likert scales: How to (ab)use them. *Medical Education*, 38, 1217-1218.
- Norman, G. (2010). Likert scales, levels of measurement and the "laws" of statistics. *Advances in Health Sciences Education: Theory and Practice*, 15(5), 625-632.

### **Weeks 3-5:**

Some pros and cons of null hypothesis significance testing (Cohen is a classic article, highly recommended!):

- \*Cohen, J. (1994). The earth is round ( $p < .05$ ). *American Psychologist*, 49(12), 997-1003.  
An excellent explanation of power, how important it is, and a little on statistical significance:
- Hallahan, M. & Rosenthal, R. (1996). Statistical power: Concepts, procedures, and applications. *Behavioral Research Therapy*, 34(5), 489-499.
- \*Kirk, R. E. (2001). Promoting good statistical practices: Some suggestions. *Educational and Psychological Measurement*, 61(2), 213-218.

### **Week 6:**

Some pros and cons of using change scores:

- Williams, R. H., & Zimmerman, D. W. (1996). Are simple gain scores obsolete?. *Applied Psychological Measurement*, 20(1), 59-69.
- Collins, L. M. (1996). Is reliability obsolete? A commentary on "Are simple gain scores obsolete?". *Applied Psychological Measurement*, 20(3), 289-292.
- Cronbach, L. J., & Furby, L. (1970). How we should measure "change": Or should we?. *Psychological Bulletin*, 74(1), 68.

### **Week 7:**

Original discovery of the independent means *t*-test failing when groups have unequal *n*'s and unequal variances:

- Boneau, C. A. (1960). The effects of violations of assumptions underlying the *t* test. *Psychological Bulletin*, 57, 49-64.

Additional optional readings posted on D2L.

## **VI. Educational Psychology Department (EDP) Diversity Statement**

The Department of Educational Psychology supports and values the variety of social, ethnic, religious, cultural, global, intellectual, and experiential backgrounds and identities individuals bring to our community, curriculum, pedagogy, and scholarship. We encourage individuals to share their unique knowledge of the world throughout coursework and research. It is the shared view of EDP that when taken collectively, each individual's perspective enriches our understanding of current issues in Educational Psychology. We work to provide opportunities for collaboration among all students, faculty, and staff as a means to expand our knowledge and understanding as well as further inform research. The diverse makeup of our department allows for meaningful, impactful advances in education that can be applied across many settings and contexts.

## **VII. Accessibility and Accommodations:**

At the University of Arizona we strive to make learning experiences as accessible as possible. If you anticipate or experience physical or academic barriers based on disability or pregnancy, you are welcome to let me know so that we can discuss options. You are also encouraged to contact Disability Resources (520-621-3268) to explore reasonable accommodation. See <http://drc.arizona.edu/>.

Please be aware that the accessible table and chairs in this room should remain available for students who find that standard classroom seating is not usable.

### **VIII. Adaptations**

The instructor has the right to change course content, policies, expectations, and materials at any point during the course.

### **IX. Academic Integrity**

The University of Arizona upholds a code of academic integrity. In this course, you may only submit your own original work on homework assignments, quizzes, exams, and all other forms of evaluation. For more information on the University's policies, which will be upheld in this course, please see:

<http://deanofstudents.arizona.edu/policies-and-codes/code-academic-integrity>

### **X. Nondiscrimination and Anti-harassment**

You may be in class with individuals different from yourself. I expect every individual in class to facilitate an open, accepting, respectful atmosphere. Any discriminatory actions and remarks and any displays of harassment will be dealt with swiftly and harshly. Please report any discriminatory or inappropriate behavior to the proper offices and officials, or to me so I can contact the appropriate officials:

<http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy>

### **XI. Disruptive Behavior**

The instructor has the right to report and discontinue disruptive behavior from any participant in the classroom. For the University's policy on disruptive behavior, please see: <http://policy.arizona.edu/education-and-student-affairs/disruptive-behavior-instructional-setting>. For examples of what is disruptive behavior, see:

<http://deanofstudents.arizona.edu/accountability/disruptive-student-behavior>

### **XII. Other Policies and Resources of Interest**

Below are links to other policies that may affect or be able to assist you.

- Student Assistance – <http://deanofstudents.arizona.edu/student-assistance/students/student-assistance>.

### **XIII. Frequently Asked Questions**

#### 1) *How is participation graded?*

Participation grades are based on 5 major things:

- a. Do you regularly (once a class) verbally contribute to class?
- b. Do you help those around you (particularly during R/lab class sessions)?
- c. Do you ever disrupt class (continue a conversation past when I have started talking, do things on your phone, distract those around you)?
- d. Do you contribute to a positive, accepting atmosphere (e.g., you don't react negatively to a question you think is not related to your work, you are attentive and engaged, etc.)?
- e. Do you come to class prepared (you read the required reading – this does not mean you have to understand the reading, but you have to have completed it)?

If you regularly contribute to class, help those around you or ask for help from those around you, do not disrupt class, generally help support a positive class atmosphere, and seem to have a very basic understanding of the required reading, you will earn a 100%. If you are lacking in any of these things, you will earn a lower grade. For example, if you are great with b., c., d., and e., but never contribute verbally to class, you may earn something like an 88% or 90% as a participation grade.

In my courses, my expectations for class participation increase throughout the course progression. Try to get used to contributing now. If you continue on to EDP 558, EDP 641, or EDP 646a, all smaller classes, I will expect you contribute to class even more frequently.

2) *Will there be any opportunities for bonus points/extra credit?*

There will often be one or two bonus questions on homework assignments. Bonus points can help you earn a 100% on the homework portion of the course. If you earn higher than a 100% on homeworks throughout the entire course, your final course grade will be calculated using a homework total score of 100%. There are 2 philosophies I subscribe to that explain why I include some bonus points on homework:

a.) You should expect to (and even welcome the opportunity to) fail in life and learn from that failure. Statistics is a difficult field. I do not expect you to get everything correct on the first try. I expect you to make mistakes and learn from them. Bonus points allow you to make and learn from mistakes on homeworks without sacrificing your homework grade. Basically, bonus points put homework assignments in a lower stakes context.

b.) Always aim to go above and beyond on big things (in grad school and in your future job). For example, on exams, I expect thorough, well thought out answers to earn an A. However, going above and beyond on every little thing you do in graduate school (and your future job) is not sustainable. Knowing which tasks to give “just enough” on and which tasks to give 150% on is a critical skill in EVERY job. Thus, if you go above and beyond on the smaller tasks in this course (homeworks), you will earn extra/bonus points, because you are giving more time and effort than you need to.

Both of these philosophies apply to any job you take after graduate school. In a faculty position, for example, you have to demonstrate improvement over the first few years (and ideally past that). Thus, you should expect to make mistakes as you figure out what your advisees need to know, become calibrated to the students in the classes you teach, write your first grants, etc., and you should learn from those mistakes and point out how you have improved in your annual reviews. Additionally, there will be smaller frequent tasks you do adequately/well enough, such as write lectures (and then tweak them every year), create homework assignments, etc. There will also be larger, less frequent tasks you must do exceptionally well (go above and beyond on), such as conducting empirical studies, writing grants, and writing your annual review report. Developing these mindsets and skills in class will help you prepare for using these same strategies in a job.

Note, there will not be any bonus on the exams, because the exams are meant to be a high stakes context (just as you will encounter high stakes contexts in almost any job you pursue).