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Editorial

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Teaching Statistics: Am I the Lone Dinosaur?

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TEACHING SOCIAL SCIENCE STATISTICS: AM I THE LONE DINOSAUR?

Teaching statistics in a social science department can be a daunting task for the new or part-time faculty member. Students have a wide range of abilities, aptitudes, interests, and motivation levels. Of course, as we all know, many social science students fear statistics. Approximately 80% of the graduate students experience statistics anxiety.[1] Although this anxiety might hinder performance, many survive the course. What I find interesting is that some of these students may go on to teach undergraduate statistics courses as part of their graduate teaching duties. Therefore, teaching statistics certainly can alleviate anxiety as one is forced to know the material well and convey it in a cogent way to undergraduates.

If graduate students fear statistics courses, then it is highly probable that the undergraduates fear statistics as well, if not more so. These anxieties may include fear of asking questions, having difficulty in providing conclusions from the data, and perhaps being intimidated by the faculty member given the topic and knowledge base.[2] The mathematics in this course is fairly simple, yet the concepts may be somewhat abstract. Hence, how does one make an abstract concept easy to digest? Perhaps one way is to provide a real-life example.[3] For example, in my discussion of the Central Limit Theorem, I will explain how the sampling distribution of the mean approaches normality when sample size increases. From a more humorous real-life perspective, I will explain how a supermodel who stands six feet tall and weighs 110 pounds can eat candy bars and milk shakes (which would be akin to sample size) to become more "normal". Not only is this a real-life example that many of us can relate to, but also there is humor. This can be one way to make statistics come alive.

There are almost as many ways to teach statistics as there are statistics professors. For example, in our psychology department, there are three tenured faculty members who teach the majority of the undergraduate sections. One faculty member uses the eyeball estimation method, which is certainly novel. A second professor uses SPSS in her course, which is quite laudable. My approach has been to have students calculate problems by hand. These problems include z-scores, confidence intervals, ANOVA, subsequent tests to ANOVA including range tests, and correlation. However, my philosophy starts on the first day of class in which I explain that statistics is simply telling a story with numbers. Moreover, this story becomes more complete based on advanced testing, if appropriate. These stories transcend disciplines. Although the majority of students are in psychology, there are some in hotel administration, biology, nursing, anthropology, and kinesiology, just to name a few. In order to make statistics relevant for these students, I will provide salient problems that could be of great interest ranging from testing different types of drugs for reduction of Ebola or Zika Virus symptomatology to discussing differences among hotels on the Strip with regard to quality of stay.

There are some statistics that can be difficult for the student to conceive as having any real-life meaning. For example, using the descriptive statistic of z-scores, the student is introduced to examining what percentage of folks score above or below the mean. Although students may have a modicum amount of interest in examining this issue, perhaps showing how one can convert GPA, GRE scores, letters of recommendation ratings (usually from 1-5), and interview ratings (usually from 1-5) into z-scores and then averaging them or providing spe-

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cific weightings for predicting an incoming class of prospective graduate students might foster greater interest. For example, one can provide cutoff scores such that anyone higher than 0 (the mean) to +.5 would be waitlisted, whereas those at +.5 and above would be given acceptance and an assistantship. Those below the mean (z-score of 0) would be given rejection letters. A similar example can be used for job applicants. As a sports aficionado, I also mention that it would be nice if professional athletes used z-scores as part of their contract negotiations. For example, if one is a quarterback, then what is the overall (average) z-score for touchdowns, yards thrown, yards per pass attempt, completion percentage, and interception percentage?

After addressing the real-life situation issues as we go through the course, students usually struggle with standard study habits, that also exacerbates the anxiety. Mnemonics have been used as one possibility for remembering information in statistics.[4] For example, remembering the differing types of measurement, nominal, ordinal, interval, and ratio, one could use No Oil in Rivers[5] or Never Own Impotent Rabbits. Although I rarely use this type of device in my course, I do believe in making information more personal. For example, I usually want my students to remember the t values on infinity degrees of freedom at the .05 and .01 levels (1.96 and 2.58) given that they are equal to z. Obviously, these values come in handy for hypothesis testing using z or confidence intervals around the mean with large sample sizes. I usually tell the students that 1.96 was my undergraduate GPA and 2.58 was my graduate one. Their responses are usually priceless. Likewise, when I discuss orthogonal comparisons, I mention that the word orthogonal means independent. Therefore, if you see me on campus on July 4, I hope that you will wish me a happy orthogonality day. Once again, this technique may not only foster learning, but also alleviates some of the student anxiety.

Sometimes we are so focused on our content, that we may forget the human factor. The human factor may consist of eye contact, smiles, and having enthusiastic inflection, for example. These would be components of immediacy[6] which are behaviors correlating with a psychological closeness.[7] Williams[8] studied this concept in a statistics course and found that immediacy (or lack of) accounted for the majority of anxiety concerning students' fear of statistics teachers. Hence, she concluded that if students like the instructor as a person, then they are likely to feel more comfortable and much of the intimidation and fear may go away. One can take this idea a step further. For example, even when students come by the office for help, I might ask about their future plans or give them a quick introduction as to how to apply to graduate school. This type of humanity might allow students to ask questions in class whereas many are scared to do so for a variety of reasons.

Over the years, I have been asked by students and colleagues alike as to why I do not teach SPSS (or an equivalent) at the undergraduate level and constantly make students perform calculations by hand. My contention is that one needs to get through the anxiety process and provide a rudimentary understanding as to how and why these techniques are important both from theoretical and applied perspectives. Using SPSS may provide an added layer of anxiety coupled with simply pointing and clicking to obtain answers without going through the rigor of the math. This can lead to a total and blind reliance on the program, which may be problematic. For example, Levene and Hullett[9] showed how eta-squared and partial eta-squared were mislabeled by SPSS. Although I realize that this may be an isolated example, nevertheless, it is also interesting to show students how many of these formulas are related on a more logical basis rather than through mathematical derivation.

Finally, it is amazing how many different techniques are used by faculty in statistics classes including small-group cooperative learning,[10] learning projects,[11] and dance.[12] Lesser and Pearl[13] also referenced music, food, cartoons, comic strips, magic, movies, and videos, just to name a few additional techniques. They referenced that techniques such as cartoons may foster learning, reduce anxiety, and increase the human element in the classroom. Although there are excellent books on the topic of teaching statistics[14-16] it seems logical that there are no perfect ways to teach statistics. Teaching statistics should be similar to teaching any course. That is, making sure that students are engaged. Nevertheless, to me, if the student obtains a rudimentary understanding and appreciation of the topic and if I also made it a fairly benign process for them, then that is a reasonable expectation and outcome. However, if they can apply this information to additional courses such as research methods or to their own research, then that outcome would be optimum.

REFERENCES

1. Onwuegbuzie AJ, Wilson VA. Statistics anxiety: Nature, etiology, antecedents, effects, and treatments--A comprehensive review of the literature. *Teaching in Higher Education.* 2003; 8(2): 195-209. doi: 10.1080/1356251032000052447

2. Cruise RJ, Cash RW, & Bolton DL. Development and validation of an instrument to measure statistical anxiety. Paper presented at the annual meeting of the Statistical Education Section. Proceedings of the American Statistical Association. 1985;

3. Neumann DL, Hood M, Neumann MM. Using real-life data when teaching statistics: Student perceptions of this strategy in an introductory statistics course. *Statistics Education Research J.* 2013; 12(2): 59-70. Web site. http://iase-web.org/documents/SERJ/

ISSN 2380-727X Open Journal http://dx.doi.org/10.17140/PCSOJ-2-e003

SERJ12(2)_Neumann.pdf. Accessed March 23, 2016.

4. Hunt N. Using mnemonics in teaching statistics. *Teaching Statistics*. 2010; 32(3): 73-75. doi: 10.1111/j.1467-9639.2009.00402.x

5. Pyrczak F. *Making sense of statistics: A conceptual overview*. Glendale, CA, USA: Pyrczak Publishing; 2006: 1-178.

6. Andersen JF. Teacher immediacy as a predictor of teaching effectiveness. In: *Communication Yearbook 3*. Nimmo D, ed. New Brunswick, NJ, USA: Transaction Books; 1979: 543-559.

7. Gorham J. The relationship between verbal teacher immediacy behaviors and student learning. *Communication Education.* 1988; 37(1): 40-53. doi: 10.1080/03634528809378702

8. Williams AS. Statistics anxiety and instructor immediacy. *Journal of Statistics Education.* 2010; 18(2): 1-18. Web site. http://www.amstat.org/publications/jse/v18n2/williams.pdf. Accessed March 23, 2016.

9. Levine TR, Hullett CR. Human Communication Research. 2002; 28(4): 612-625. doi: 10.1111/j.1468-2958.2002.tb00828.x

10. Garfield J. Teaching statistics using small-group cooperative learning. *Journal of Statistics Education*. 1993; 1(1): 1-9. Web site. http://www.amstat.org/publications/jse/v1n1/garfield.html. Accessed March 23, 2016.

11. Da Silva MPM, Pinto SS. Teaching statistics through learning projects. *Statistics Education Research Journal*. 2014; 13(2): 177-186.

12. Irving LT. Teaching statistics using dance and movement. *Front Psychol*. 2015; 6-50. doi: 10.3389/fpsyg.2015.00050

13. Lesser LM, Pearl DK. Functional fun in statistics teaching: Resources, research and recommendations. *Journal of Statistics Education*. 2008; 16(3): 1-11. Web site. http://eric.ed.gov/?id=EJ841775. Accessed March 23, 2016.

14. Lesser LM, Pearl DK. Functional fun in statistics teaching: Resources, Research and Reccomendations. *Journal of Statistics Education*. 2008; 16(3): 1-10. Web Site. http://www.amstat.org/publications/jse/v16n3/lesser.pdf. Accessed March 23, 2016.

15. Hulsizer MR, Woolf LM. *A Guide To Teaching Statistics: Innovations And Best Practices*. Vol. 10. Chichester, West Sussex, UK: John Wiley & Sons; 2009.

16. Moore TL, ed. *Teaching statistics: Resources for Undergraduate Instructors*. USA: The Mathematical Association of America and The American Statistical Association; 2002.