Statistics for Social Research III

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Professor

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Assignment

### *Developmental Readings*

Review Assignment #3, the course essential elements, assigned readings, and recommended readings to identify selections of books and scholarly articles to identify and select developmental reading sources and entries.

**Essential Elements**

1. Independent Variables
2. Statistical Procedures
3. Post-hoc Analysis
4. Results Interpretation

**Source One (Book #1):** Gravetter, F. J., & Wallnau, L. B. (2014). *Essentials of statistics for the behavioral sciences* (8th Edition). Wadsworth, Cengage Learning.

**Comment 1:** *(from COM 968-52, Statistics for Social Research III)*

**Quote/Paraphrase:** “…descriptive statistics, consists of statistical procedures that are used to simplify and summarize data. Descriptive statistics are techniques that take raw scores and organize or summarize them in a form that is more manageable. Often the scores are organized in a table or a graph so that it is possible to see the entire set of scores… Inferential statistics are methods that use sample data to make general statements about a population. Because populations are typically very large, it usually is not possible to measure everyone in the population. Therefore, a sample is selected to represent the population. By analyzing the results from the sample, we hope to answer general questions about the population” (pp. 7 - 8).

**Essential Element:** This comment is associated with essential element, statistical procedures.

**Additive/Variant Analysis:** This comment is additive to my understanding of the fundamentals of statistics. Gravetter and Wallnau (2014) provide useful overarching statements introducing descriptive and inferential statistics. If a student researcher does not grasp these basic concepts, then he/she or she is not able to progress to more advanced concepts.

**Contextualization:**  The statements have supported my understanding of statistical procedures and allowed me to approach the research process with more confidence. Even as my understanding of statistical techniques evolves, descriptive statistical fundamentals still remain a salient part of my evaluation and assessment of findings. The research cycle seems to being and end with descriptive factors, with the use of inferential procedures applied to do the bulk of the statistical procedural work in between. Social science researchers fully appreciate the inferential process as working with human subjects makes it difficult to carry out true parametric experiments.

**Comment 2:** *(from COM 968-52, Statistics for Social Research III)*

**Quote/Paraphrase:**  The original, unchanged scores that are the direct result of measurement are called raw scores. A raw score by itself does not necessarily provide much information about its position within a distribution. To make raw scores more meaningful, they are often transformed into new values that contain more information. This transformation produces z-scores. We transform X values into z-scores so that the resulting z-scores tell exactly where the original scores are located…A z-score specifies the precise location of each X value within a distribution. The sign of the z-score (1 or –) signifies whether the score is above the mean (positive) or below the mean (negative). The numerical value of the z-score specifies the distance from the mean by counting the number of standard deviations between X and μ.” (pp. 124-125).

**Essential Element:** This comment is associated with the essential element, statistical procedures.

**Additive/Variant Analysis:** This comment is additive to my understanding of statistical analysis. Similar to the progressive concepts of descriptive and inferential statistics is the progression from a raw (X) score to a z-score descriptive. Z-scores bring the raw score to life by providing location within context. It creates a preliminary, yet essential understanding of the value of a data point.

**Contextualization:** It is essential for the student statistician to have grasp the reference to t-scores and z-scores. These scores form the foundation of assessment when capturing and processing data. They utilize the “mean” as a central point of reference. Appreciating the relationship to the mean and standard deviations which will remain pivotal when applying more complex statistical computations.

**Comment 3:** *(from COM 968-52, Statistics for Social Research III)*

**Quote/Paraphrase:** “The t statistic is used to test hypotheses about an unknown population mean when the value of standard deviation is unknown… The only difference between the t formula and the z-score formula is that the z-score uses the actual population variance (or the standard deviation), and the t formula uses the corresponding sample variance (or standard deviation) when the population value is not known (p. 252)…Although the t statistic can be used in the “before and after” type of research, it also permits hypothesis testing in situations for which you do not have a known population mean to serve as a standard.Specifically, the t test does not require any prior knowledge about the population mean or the population variance. All you need to compute a t statistic is a null hypothesis and a sample from the unknown population. Thus, a t test can be used in situations for which the null hypothesis is obtained from a theory, a logical prediction, or just wishful thinking” (pp. 256-257)

**Essential Element:** This comment is associated with the essential element, statistical procedures.

**Additive/Variant Analysis:** The content presented in this comment in additive to my progressive understanding of statistical procedures. It is important to grasp the useful progression from z-scores to t-statistics. Without a population mean and population variance, the researcher would employ the t test. Two key stages in the process of social research are the creation of a sample and the development of hypotheses, as they provide sufficient information for t tests to be applied.

**Contextualization:** Without a meaningful understanding of t-statistics it would be difficult for the researcher to venture into hypothesis testing. The t-test, therefore, becomes a foundational statistical procedure to quantitative assessment. This is critical as social research employs inferential statistics when little information is known about population. The researcher is thus challenged to create a hypotheses and produce a logical pathway to gather a sample.

**Source Two** **(Journal #1):** Juarros-Basterretxea, J., Aonso-Diego, G., Postigo, Á., Montes-Álvarez, P., Menéndez-Aller, Á., & García-Cueto, E. (2024). Post-hoc tests in one-way ANOVA: The case for normal distribution. *Methodology European Journal of Research Methods for the Behavioral and Social Sciences*, *20*(2), 84–99. https://doi.org/10.5964/meth.11721

**Comment 4:** *(from COM 968-52, Statistics for Social Research III)*

**Quote/Paraphrase:** “The analysis of variance (ANOVA) is a standard statistical method in many scientific disciplines and is one of the most used techniques in social and health research. The wide use of ANOVA has been attributed to its usefulness to answer to experimental method ́s and general research problems. The objective of this technique is using a F-statistic to test the null hypothesis (H0) of equality of group means when more than two groups are compared. ANOVA enables not only the individual effect of each independent variable separately, but also the interacting effects of the k independent variables. ANOVA is a parametric test that depends on three distributional assumptions: (a) study groups scores must be independent; (b) distribution of each group scores must be normal (normality); (c) the variances of group scores must be equal or constant (homoscedasticity)” (pp. 84-85).

**Essential Element:** This comment is associated with the essential element, statistical procedures.

**Additive/Variant Analysis:** The information presented in this comment is additive to my understanding of advanced statistical procedures. The authors have provided a clear overview of the ANOVA method including its usefulness and dependency on assumptions. The authors have also highlighted the importance of the F-statistic in the testing of hypotheses as a part of this process.

**Contextualization:** The lessons acquired are immediately applicable when undertaking both experimental and quasi-experimental designs. An important factor to remember is that ANOVA is applicable when more than two groups are compared and applied to a dependent variable. It also gives the researcher the flexibility to measure the effects of each independent variable or the interacting effects of all variables. This provides the researcher with a much greater ability to draw more information from the outputs.

**Comment 5:** *(from COM 968-52, Statistics for Social Research III)*

**Quote/Paraphrase:** “ANOVA detects the presence or the absence of a global effect of the independent variable on the dependent variable. When the null hypothesis is rejected (p ≤ .05), it informs the researcher that there is at least one comparison that is statistically significant, but it does not inform the researcher about which pair of means are significantly different. Thus, post-hoc tests (also called a posteriori analysis or multiple comparison analysis tests) must be used to determine which levels of independent variable means differ significantly from other levels… In order to overcome the multiple-comparison problem and the potential limitations joined to this analysis (e.g., familywise error), different available post-hoc tests have been proposed… Some post-hoc tests considering the difference in homoscedasticity are Fisher’s Least Significant Difference, Bonferroni-Dunn’s test, Šidák’s test, Scheffé’s test, Tukey’s Honestly Significant Differences, Hochberg’s GT2, and Gabri el’s” (P. 85).

**Essential Element:** This comment is associated with the essential element, post-hoc analysis.

**Additive/Variant Analysis:** The author’s content is considered additive to me as it provides a clear explanation of the rationality for use of post-hoc procedures. Post-hoc tests are accepted as providing more specificity to findings and assessments after the study has been concluded. The multiple-comparison analysis can be carried out through different tests depending on which is appropriate for the particular research conditions.

**Contextualization:** Tests post-hoc to the ANOVA procedures will prove useful when the researcher desires to do further assessment of findings. The tests will be able to use the backdrop of the ANOVA results, which indicate an overall difference, and provide information on which specific group means differ significantly. For social research studies, this feature will prove very useful as more researchers would want to have more than two independent variables in the study and would also want to know more details about their relatedness from the post-hoc findings.

Source Three (Book #2): Cohen., J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.).Erlbaum.

**Comment 6:** *(from COM 968-52, Statistics for Social Research III)*

**Quote/Paraphrase:** “The power of a statistical test of a null hypothesis is the probability that it will lead to the rejection of the null hypothesis, i.e., the probability that it will result in the conclusion that the phenomenon exists. Given the characteristics of a specific statistical test of the null hypothesis and the state of affairs in the population, the power of the test can be determined…The power of a statistical test depends upon three parameters: the significance criterion, the reliability of the sample results, and the effect size, that is, the degree to which the phenomenon exists” (p. 4).

**Essential Element:** This comment is associated with the essential element, statistical procedures.

**Additive/Variant Analysis:** The statements presented by Cohen (1998) are considered additive to my understanding of the importance of the power of statistical tests and the way it can be derived/determined. It is a useful tool in measuring the probability of an analysis leading to rejection of the null hypothesis. This strengthens the confidence that the researcher has not mistakenly failed to find a significant result when one actually exists. The identification of the three parameters of dependence is also of value.

**Contextualization:** Cohen (1998) is seen as a seminal text when discussing power and effect. Even though the body of the book continues down paths that are a bit more sophisticated than I would want, the text still provides clear explanations to foundational constructs as it relates to power and effect. The topic helps me, the researcher, have confidence that my results and findings will stand as valid.

**Comment 7:** *(from COM 968-52, Statistics for Social Research III)*

**Quote/Paraphrase:** “Behavioral scientists generally, and particularly psychologists with substantive interests in individual differences in personality, attitude, and ability, frequently take recourse to correlational analysis as an investigative tool in both pure and applied studies. By far the most frequently used statistical method of expression of the relationship between two variables is the Pearson product-moment correlation coefficient, r. r is an index of linear relationship, the slope of the best-fitting straight line for a bivariate (X, Y) distribution where the X and Y variables have each been standardized to the same variability. Its limits are - 1.00 to + 1.00… When used as a purely descriptive measure of degree of linear relationship between two variables, no assumptions need be made with regard to the shape of the marginal population distribution of X and Y, nor of the distribution of Y for any given value of X (or vice versa), nor of equal variability of Y for different values of X (homoscedasticity). However, when significance tests come to be employed, assumptions of normality and homoscedasticity are formally invoked.” (p. 75).

**Essential Element:** This comment is associated with the essential element, statistical procedures.

**Additive/Variant Analysis:** The information in the passage is additive for me as it supports the introduction of concepts of correlation. Correlation, and by extension, the statistical method of the Pearson product-moment correlation coefficient, r, is widely used in parametric studies. The author adds further valued explanation of its use in describing measures of linear relationships between two variables.

**Contextualization:** Correlational procedures are important to me because my intention is to apply this statistical method in my upcoming research. It is important, therefore, for me to be able to understand correlation, and its contrasts to experimental research. I will also be looking for an alternative to the Pearson’s correlation as my process would be more aligned to a non-parametric design.

Source Four (Journal #2): Mondal, D., Vanbelle, S., Cassese, A., & Candel, M. J. (2024). Review of sample size determination methods for the intraclass correlation coefficient in the one-way analysis of variance model. *Statistical methods in medical research*, *33*(3), 532–553. https://doi.org/10.1177/09622802231224657

**Comment 8:** *(from COM 968-52, Statistics for Social Research III)*

**Quote/Paraphrase:** “Reliability is important in many scientific disciplines. All measurement and evaluation processes are subject to measurement error. These errors can have a serious impact on research undermining the conclusions of the study, as well as in daily practice when measurement and evaluation processes are used to make diagnoses or assess the progression of participants, for example. It is therefore essential for measurement instruments to be reliable (i.e., the device/rater is able to distinguish among participants in a population) and valid (i.e., measurements reflect the underlying true values)” (p. 532).

**Essential Element:** This comment is associated with the essential element, statistical procedures.

**Additive/Variant Analysis:** The comment stated by Mondal (2024) is considered additive as it highlights the importance of reliability in statistical procedures. Even as it is understood that no process of measurement is perfect, there are still steps that can be taken to best align the instrument of choice to standards of reliability. I am in agreement and welcome the identification of definitions of “reliable” and “valid” as these will prove useful for any researcher selecting instruments.

**Contextualization:** Features of reliability and validity are critical for me to consider at this stage in the development of my research process. It would be unfortunate for me to carry out what I consider productive data gathering and analysis only to realize that the instrument I used was not considered reliable. This would undoubtedly undermine the findings of my study.

**Comment 9:** *(from COM 968-52, Statistics for Social Research III)*

**Quote/Paraphrase:** “When the outcome measurements are quantitative, reliability can be quantified using an intraclass correlation coefficient (ICC). ICC is defined as the correlation between repeated measurements at multiple occasions made by the same rater/device or by different raters/devices on the same participants. It compares the variability of measurements/ratings within participants to the variability of measurements/ratings between participants. Depending on the design of the study, different forms of ICC should be used” (p. 533).

**Essential Element:** This comment is associated with the essential element, statistical procedures.

**Additive/Variant Analysis:** The content presented by the authors is considered additive as it introduces me to a new measurement of reliability. This intraclass correlational coefficient seems to be an interesting addition to my consideration for how I will proceed with my correlational study. It seems to be useful particularly when data are clustered or grouped, indicating how much outcomes within a group resemble each other.

**Contextualization:** Intraclass correlation, and its coefficient are new to my learning process and will be assessed further in ongoing developmental readings. Of primary interest is the notion of applying repeated measurements at multiple occasions. If this topic shows signs of relevance and usability, it may possibly be included in my Literature Review.

**Source Five (Journal #3):** Wu, Y., Xue, Y., Zhao, X., Han, S., & Wu, W. (2024). Unravelling the veil of appearance anxiety: Exploring social media use among Chinese young people. *BMC Psychology*, *12*, 9. https://doi.org/10.1186/s40359-023-01495-7

**Comment 10:** *(from COM 968-52, Statistics for Social Research III)*

**Quote/Paraphrase:** “China with local outbreaks (of COVID-19) must implement closed management and offer online teaching, while some students require medical observation at designated locations. These measures increase the amount of time that college students spend on social media, exacerbating their reliance on it and possibly affecting their psychological well-being… (The study involved) interviews (that) were conducted with a duration ranging from 1 to 2 h. Efforts were made to extend the interview content based on individual variances and in-depth exploration of participants’ experiences regarding appearance anxiety influenced by social media, thereby acquiring valuable textual information. All interviews were conducted online via internet platforms. The entire interview process was recorded and subsequently transcribed into a Word document” (pp. 1,3-4).

**Essential Element:** This comment is associated with the essential element, statistical procedures – data collection.

**Additive/Variant Analysis:** The procedure presented in the above study was considered variant to my views. I cannot say that I agree with the qualitative method of gathering of data, more specifically, the length of the interviews (1-2 hrs.). My variant view is due to two reasons. It was stated that the subjects were individuals who were already acclimatized to heavy use of social media. This would give some indication that their attention span might be short and interjected. The subjects are also assumed to be in a fragile state of mind (anxious), and therefore placing them in an uncomfortable extended environment may affect responses negatively.

**Contextualization:** I would recommend an adjustment of interview format considering individuals with short, interjected attention spans. Another consideration could be the use of a quantitative approach where participants would be provided with other options for data gathering that might be more appropriate for their mental states.

**Source** **Six (Journal #4):** Waddington, H. S., Villar, P. F., & Valentine, J. C. (2023). Can Non-Randomised Studies of Interventions Provide Unbiased Effect Estimates? A Systematic Review of Internal Replication Studies. *Evaluation Review*, *47*(3), 563–593. https://doi.org/10.1177/0193841X221116721

**Comment 11:** *(from COM 968-52, Statistics for Social Research III)*

**Quote/Paraphrase:** “In the past few decades there has been an explosion in the numbers of randomized controlled trials (RCTs) of development interventions, overall and in specific sectors like water, sanitation and hygiene, and governance. However, some types of relationship are not amenable to randomised assignment, for example, where program eligibility is universal or implementation has already begun, or where the primary measure of interest is an exposure, like use, rather than assignment to an intervention. In addition, some types of outcomes are measured with difficulty in prospective studies for ethical reasons. Theory is clear that under the right conditions—specifically that the selection process is completely known and has been perfectly measured—nonrandomized studies of intervention effects, also called quasi-experiments, can produce unbiased treatment effect estimates. It follows that if the selection process is reasonably well understood and measured, NRS should produce results that are reasonably close to those that would have been produced in a randomized experiment.” (pp. 564-565).

**Essential Element:** This comment is associated with the essential element, statistical procedures – sampling.

**Additive/Variant Analysis:** The information inserted in this comment is additive to me as it reinforces my understanding of randomized and non-randomized sampling. The authors describe a current context of an increase in the use of randomized control trials but goes further to note it limitations within that area of research (development interventions). The use of non-randomized selection is given credence, especially when the selection process is known and properly measured. This gives way to the quasi-experimental option, which can provides unbiased treatment effects, and therefore, still produce results comparable to the randomized option.

**Contextualization:** The target group scenarios described in the study may present as unique, however, in social science research, studies affecting and involving human subjects show similarities in limitations. Being able have quasi-experimental procedures as an option is a significant advantage. I will take lessons from this study as I continue with the developmental readings and formulate my own justifications for choice of experimental procedure for my research.

**Source** **Seven (Journal #5):** Agbangba, C. E., Sacla Aide, E., Honfo, H., & Glèlè Kakai, R. (2024). On the use of post-hoc tests in environmental and biological sciences: A critical review. *Heliyon*, *10*(3), e25131. https://doi.org/10.1016/j.heliyon.2024.e25131

**Comment 12:** *(from COM 968-52, Statistics for Social Research III)*

**Quote/Paraphrase:** “The analysis of experimental data often includes a comparison of trends in measurements across groups. If the number of groups to be compared is equal to two, a Student’s t-test is appropriate when the model residuals follow a normal distribution; otherwise, its non-parametric equivalent is used. However, when the number of groups to be compared is greater than two and the required conditions hold, an analysis of variance (ANOVA) is adopted. In the case of significant differences (null hypothesis rejected), further analysis (post-hoc test) is necessary to identify subgroups that are significantly different from each other. Post-hoc tests, or multiple mean comparison tests, are also used after several other statistical methods, such as the linear mixed effect model (LMEM), generalised linear model (GLM), and generalised least squares model (GLS)... The application of these tests requires compliance with certain conditions. For instance, the choice of a post-hoc test is conditioned on certain assumptions. Normality, equality of variance, parity in the number of groups compared, and whether observations are planned or unplanned from one group to another are common conditions. Similarly, there are special post-hoc tests for non-parametric methods” (pp. 1-2).

**Essential Element:** This comment is associated with the essential element, post-hoc procedures.

**Additive/Variant Analysis:** The information presented by Agbangba et al. (2024) is additive to my views as it reinforces my understanding of the use of post-hoc tests. The passage actually does well in providing a logical process of considerations for appropriateness of use of particular statistical procedures. I also value the listing of several post-hoc tests. This is important as I am still be introduced to post-hoc procedures. The listing is also complemented by certain assumptions for choosing a test: Normality, equality of variance, parity in the number of groups compared, and whether observations are planned or unplanned from one group to another are common conditions.

**Contextualization:** The authors state the foundational themes that “when the number of groups to be compared is greater than two and the required conditions hold, an analysis of variance (ANOVA) is adopted” and “In the case of significant differences (null hypothesis rejected), further analysis (post-hoc test) is necessary to identify subgroups that are significantly different from each other.” I have included this passage in my developmental readings because it demonstrates another set of authors reinforcing procedural statements that are salient to the understanding of statistical procedures, and more specifically, the post-hoc scenario.

**Works Cited**

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