The Magic of Pretest/Posttest & Longitudinal Data Analysis 6 Week Webinar Class

CLASS 6:

WRITE-UP & REPORT

Presented by

William M. Bannon, PhD

StatsWhisperer, Inc.

www.statswhisperer.com

Welcome to **Week 6 Write-up & Report** of our 6-week webinar class *The Magic of Pretest/Posttest & Longitudinal Data Analysis*. Recall, *The 7 Steps of Data Analysis* listed below. Notice our focus will be on Steps 7.

The 7 Steps of Data Analysis:

1 Study Map

2 Data Entry

3 Check Data Integrity

4 Univariate Analysis

5 Bivariate Analysis

6 Multivariate Analysis

7 Write-up and Report **(FOCUS)**

Introduction

The subject of this week is **Step 7: Write Up & Report**. The write-up and report is a process that might seem as enigmatic as the process of data analysis. There are many sources to refer to professional style (APA, AMA, MLA) to which an article must conform. However, there do not seem to be many sources that inform the aspiring author of what topic to discuss first in an article, to discuss second, and so on. Therefore, while I will not present a full lecture, I would like to share a few techniques I came up with for publishing research reports, particularly peer-reviewed articles. Please keep in mind that I have a rather minimalistic data analytic perspective (as opposed to heavy theory), where I aim to effectively present study constructs, what past research suggests regarding those constructs, and the potential contribution represented by the original study presented in the paper.

Body of the Paper

You will see below, we have drafted a light paper outline following the APA style guidelines of writing. Please note that the instructions are rather short to facilitate an easier application. We will conceive of the manuscript as the following seven parts:

1. Title
2. Abstract
3. Introduction
4. Literature Review
5. Methods
6. Results
7. Discussion/Conclusion

Title

The title of a pretest/posttest and longitudinal study should reflect the analytic technique used, perhaps using the term a *Pretest to Posttest* or *Longitudinal Analysis Examining...* For example, the title of our pretest posttest project might be: *A Pretest Posttest Examination of the Efficacy of an Intervention Designed to Increase Happiness*.

Abstract

The abstract should be between 150-250 words. Here we will present a concise summary of the key points of your research. Specifically, although there is not a need to make definitive statements ("The research question is…"), we would at least refer to the research topic, research questions, participants, methods, study design, results, data analysis, and conclusions, as well as possible implications for future research. The focus of and the information mentioned will vary by the specific study (e.g., some studies do not have a research question to mention). You may also want to specify *Keywords:* at the bottom.

Abstract: Sample Study

Objective: The objective of this study is to examine the effectiveness of an intervention designed to increase levels of happiness.

Methods: This study employs a pretest/posttest design involving an experimental and control group.

Results: A repeated measures GLM indicated study participants in the experimental group evidenced significantly higher pretest to posttest changes in happiness scores relative to those in the control group.

Or is using MLR for final analysis:

A multiple linear regression model indicated study participants in the experimental group evidenced significantly higher pretest to posttest changes in happiness scores relative to those in the control group.

Discussion/Conclusion: Findings suggest that elements of this particular intervention, such as the esteem enhancement dynamic, may be a particularly effective method to increase levels of happiness with this specific population.

Introduction

The introduction should present a brief but compelling statement regarding the study topic and a clear rationale for why the issue needs to be researched. A strong introduction may describe the prior theoretical and empirical research, as well as the current knowledge regarding the study topic with clear citations. For example, the **Introduction** for our **Sample Study** might be:

Research links several benefits with increased levels of happiness, including low blood pressure (citation), decreased stress (citation), & other health outcomes (citation).

However, there is a dearth of research that identifies effective interventions designed to increase levels of happiness. *Therefore*, the current study employs a pretest/posttest design toward examining the effectiveness of an intervention designed to increase levels of happiness.

Literature Review

The literature review needs to be focused and finite. Many study topics have an extensive literature, so if you are not focused there are many directions that could be taken. Therefore, the literature review must be approached with a clear agenda that protects from veering in too many directions. In our sample paper, we will consider the following simple four point formula for writing a literature review that is a bit of an over simplification that won't meet the needs of every study, but it is a decent place to start:

1st Discuss Dependent Variable (Link CVs)

2nd Discuss Independent Variable

3rd Discuss DV & IV Link

4th In the Last Paragraph Enter Study Map Information

1st Discuss Dependent Variable (Link Covariate Variables)

The section describes that the first step is to discuss the dependent variable. For example, we describe several general and specific characteristics and measurement of the dependent variable *Happiness* with clear citations, e.g., *Happiness has been defined as the level of positive emotion…* (*citation*).

Next, you might discuss outcomes related to the dependent variable to illustrate the importance of the subject, e.g., *Happiness has been linked to several positive outcomes, such as higher quality of life (citation),….*

Next, discuss predictors linked to the dependent variable, but do not mention the independent variable(s) yet, but do include study covariate variables e.g., *One of the most consistent predictors of happiness is higher levels of annual income (citation), education (citation)…*

2nd Discuss Independent Variable(s)

If the independent variable is a construct that may change or be manipulated, such as level of annual income, the second section should discuss the independent variable in terms of definitions, measurement, and outcomes linked to the variable. Within our pretest posttest intervention study the independent variable is *study group*, which might not require that level of discussion.

3rd Discuss the Dependent Variable & Independent Variable Link

Next, we have a paragraph that discusses the relationship between the independent and dependent variables. Here we would discuss the intervention research to date that is designed to increase levels of happiness. It is essential to also describe the research that has not been conducted examining these two variables, which might be the focus of your study.

4th In the Last Paragraph Enter Study Map Information

The final paragraph before the Methods section has a precise function. Specifically, in this paragraph we will enter the information from our study map. Recall, the study map lists the research question and hypothesis, as well as the covariate, independent, and dependent variables. You will state the independent and dependent variable relationship, e.g., *The objective of this study is to examine the effectiveness of an intervention designed to increase levels of happiness ….*

Next, describe the covariate variable and dependent variable relationships under study, e.g., *several other variables that have been shown to impact changes in level of happiness over time, such as...*Include a statement regarding the significance of the study, e.g., *this analysis is the first study to examine changes in the level of happiness in the context of...*

Methods

Ideally, the Methods section would be written with a level of clarity that would allow another researcher to duplicate the study. This information is essential as it is the basis for the reader to observe how the study sample might reflect the target population to judge the degree to which study results may be generalizable. Specifically, the Methods section should present the *following items:*

Recruitment of Study Participants

The Methods should describe where the study participants came from. Also, any attrition (i.e., study participants who exit the study prior to completion) of study participants should be reported. Below, we describe that the sample study drew the sample from a single community residence complex.

Informed Consent and IRB Approval

The Methods should describe how the process of informed consent was implemented, as well as how IRB approval was secured.

Data Collection

The precise manner in which data were collected should also be described.

Noting whether conditions were manipulated or naturalistic

The individuals in our sample study are drawn from a group of community residents in a naturalistic setting. However, any type of manipulated conditions (e.g., an intervention that uses random assignment of cases to each study condition) should be described.

A description of the sample (e.g., demographic characteristics)

The sample description presents important characteristics of the study participants, such as demographic characteristics (i.e., race, gender, age, education).

Group assignment

In our sample study, we did not assign study participants to groups, as might be done in a randomized control trial per se. However, any group assignment, including a description of a random or non-random design, should be mentioned and described.

Measurement instruments

The description of measurement instruments should include references, as well as available reports of the reliability and validity evidenced by the measurement tool in prior research (if available).

If describing a continuous scale measurement, similar to the variable *Class Enjoyment* in our study, we would need to report the number of items on the scale (for *Class Enjoyment* it is one item), how each item is scored (e.g., 1-5), the method used to compute the scale (e.g., taking the Mean score of several items), the potential range of scores (e.g., the MIN/MAX scores), as well as what higher scores indicate. Lastly, consider if any psychometrics need to be conducted. For example, if there are multiple items that are combined to create an overall score, values need to be computed such as the internal consistency value for the Cronbach's Alpha.

For example, for the quantitative measurement instruments for our sample study we might list:

Ed0ucation Level: Respondents reported their highest level of education in the categories high school/GED, College (4 year), and Graduate School.

Income Level: Respondents reported their level of annual household income.

Study Group: Respondents are classified as being in the experimental of control group.

Happiness: The construct happiness is measured using a 5-item scale created for the current study. Items are measured along a Likert-type scale using a continuum of 1 (Strongly Disagree) to 5 (Strongly Agree). The scale is computed through taking the mean score of valid responses, resulting in a potential range of scores of 1-5, with higher scores indicating a greater degree of happiness. A reliability analysis indicated the level of scale internal consistency was acceptable for the current sample at pretest (Cronbach's alpha=.89) and posttest (Cronbach's alpha=.91).

Research design

The pretest/posttest or longitudinal research design used in the study should always be described.

Data Analysis Plan

The **Data Analysis Plan** will help follow the analysis and interpret results in a systematic fashion. Specifically, data analysis is a process and the data analysis plan describes how the process is approached in each data analysis study. For example, in the sample manuscript included at the end of this section we describe that in the current data analysis plan, analysis will be conducted in three phases, which are **Univariate (Descriptive) Analysis**, **Bivariate Analysis**, and **Multivariate Analysis**. Furthermore, in the section we should describe the process and results of **Checks of Data Integrity**. Specifically, the data analysis plan may read:

Data analysis will be conducted in three phases. First, all data will be analyzed descriptively. Second, the relationship between the DV changes in happiness from pretest to posttest and predictor variables (IV/CV) will be examined using bivariate analysis. Third, predictor variables associated with the DV at a statistically significant level (p<.05) will be entered into a multiple regression (or Repeated Measures GLM) model for multivariate analysis.

Prior to quantitative analysis checks of test assumptions indicated all assumptions associated with parametric testing were met, including linearity, homoscedasticity, normality, and multicollinearity. A power analysis indicated 85 participants would produce sufficient power to detect a medium size effect in a multiple linear regression model using four predictors. Of the 100 study participants there were no missing data points.

Results

Results are presented in text and tables. The text describes the tables and findings. For example:

Univariate Analysis

Table 1 presents a descriptive analysis of the categorical variables in the current study. Data indicated that half the sample (*n*=50; 50.0%) comprised the experimental group and control group (*n*=50; 50.0%). Regarding highest level of education, most study participants were at the level of college (*n*=38; 38.0%) and graduate school (*n*=38; 38.0%).

Table 1

Descriptive Analysis: Categorical Study Variables (*n*=100)

Variable	*n*	*Percent*
Study Group		
Experimental	50	50.0
Control	50	50.0
Education		
High School	24	24.0
College	38	38.0
Graduate School	38	38.0

Table 2 presents a descriptive analysis of the continuous variables in the current study. Data indicated the average study participant had an annual income of the mean level of $39, 680 (SD=13,525; MIN/MAX=21,000-75,000). Data also indicated that pretest and posttest mean scores tended to be toward the center of the scale range (2.54, SD=.65 vs. 2.72, SD=.62, respectively) with the mean pretest to posttest change reflecting *happiness* of .18 (SD=.25; MIN/MAX=-.20-.80).

Table 3

Descriptive Analysis: Continuous Study Variables (*n*=100)

Variable	Mean (SD)	MIN/MAX	Potential Range
Income Level	$39, 680 (13,525)	21,000-75,000	NA
Happiness	2.54 *(SD*=.65)	1.00-3.50	1.00-5.00
Happiness	2.72 *(SD*=.62)	1.50-3.90	1.00-5.00
Happiness	0.18 *(SD*=.25)	-.20-.80	-4.00-4.00

Bivariate Analysis

Table 3 presents an independent samples t-test indicating the experimental group (*M*=.36, *SD*=.22) evidenced higher levels of pretest to posttest changes in *Happiness* scores relative to the control group (*M*=.00, *SD*=.09), $t(98)=10.49$, $p<.001$. Analysis also indicated pretest to posttest changes in happiness was significantly associated with education level, $F(2, 97)= 10.83$, $p<.001$. Bonferroni Post Hoc Analysis indicated the mean level of the HS/GED group was significantly lower than the college and graduate school group.

Table 3.

Bivariate Analysis Change Scores & Categorical Variables

Variable	n	Mean (SD)	*t/F* (*df*)	*P*
Study Group				
Experimental	50	0.36 (.22)	10.89 (99)	.001
Control	50	0.00 (.09)		
Highest Level of Education*				
High School	24	0.01 (.16)	10.83 (2, 97)	.001
College	38	0.18 (.22)		
Graduate School	38	0.28 (.26)		

*Bonferroni Post Hoc Analysis indicated the mean level of the HS/GED group was significantly lower than the college and graduate school group.

Table 4 presents a bivariate analysis of happiness change scores and income level. Pearson's r correlation analysis revealed a significant positive correlation between pretest to posttest happiness change scores and income level, $r(98)=.56$, $p<.01$.

Table 4

Bivariate Analysis: Change Scores & Continuous Variables

Variables	1	2
1. Income Level	-	.56**
2. Pretest to Posttest Happiness Change Score		-

**$p<.01$

Multivariate Analysis

Table 5 presents a multiple linear regression analysis examining pretest to posttest change scores reflecting levels of happiness. Data indicated that the overall model was statistically significant, $F(4, 95)=113.66$, $p<.001$. Furthermore, the model explained over 80% ($R^2=.83$, Adjusted $R^2=.82$) of the variance in pretest to posttest changes in *Happiness* scores. In terms of individual predictors…study participants in the experimental group evidenced significantly higher pretest to posttest *Happiness* change scores relative the control group, B=.35, SE=.02, β=.71, $p<.001$. Data also indicated that higher levels of income and education were associated with greater changes in happiness scores from pretest to posttest.

.

Table 5

Multiple Linear Regression Examining Pre/Post Happiness Change Scores

Variable	B (*SE*)	β	Sig.
Education			
High School (Reference Group)			
College	.07 (.03)	.15	.014
Graduate School	.10 (.04)	.20	.005
Income Level	.01 (.00)	.44	.000
Study group	.35 (.02)	.71	.000

Model = R^2 = .83, Adj. R^2 =.82, $F(4, 95) = 113.66$, $p<.001$

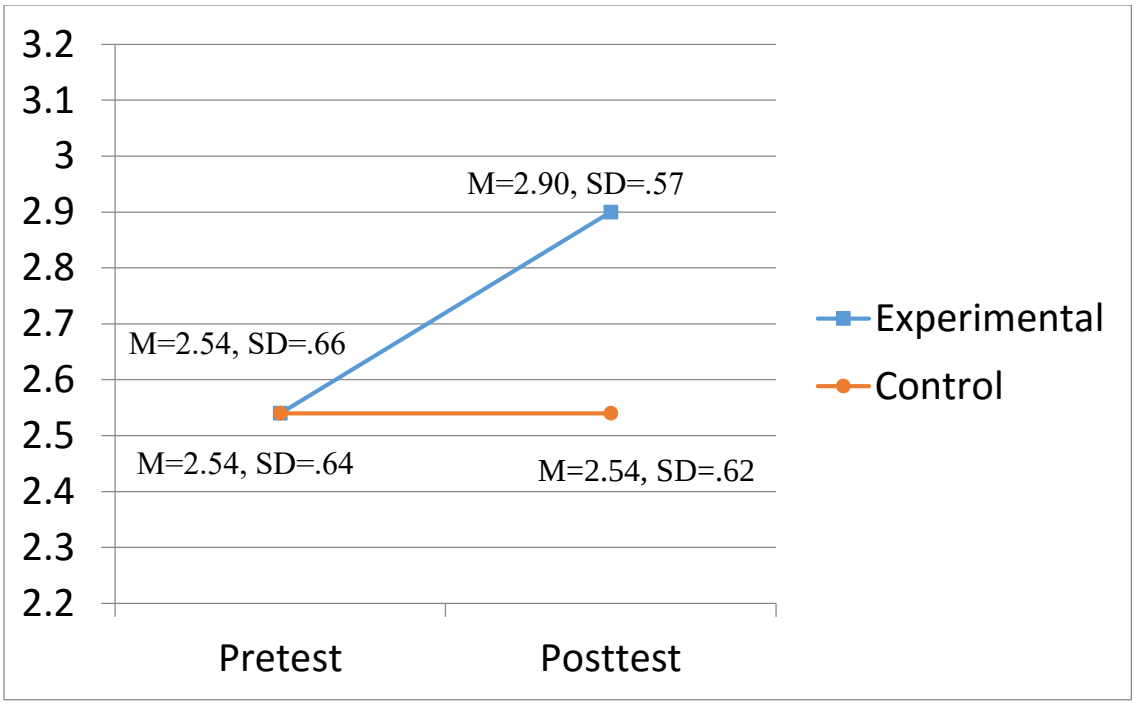
Or if using repeated measures GLM for multivariate analysis:

Table 5 present a Repeated Measures GLM analysis examining scores reflecting happiness. Data indicated in the context of the full model the experimental group evidenced a sig. higher pre/post change score relative to the control group, Wilks Lanbda=.26, F(1,96)=75.54, $p<.001$. Figure 1 presents a graph that clearly presents the relationship of these findings. The flat slope clearly indicated no change in scores for the control group from pretest to posttest (M=2.54, SD=.64 vs. M=2.54, SD=.62, respectively), while the experimental group evidenced a significant increase in happiness scores (M=2.54, SD=.66 vs. M=2.90, SD=.57, respectively).

Table 5

Variable	**Wilks Lambda**	**F (df)**	**p**
Pre Post Change	.67	46.79 (1,96)	.001
Pre Post Change*Education	.93	7.57 (1,96)	.007
Pre Post Change*Income Level	.60	63.92 (1,96)	.000
Pre Post Change*Study group	.26	275.54 (1.96)	.000

Figure 1. Pretest to Posttest Changes in Happiness Scores by Study Group



Discussion

In the Discussion section, the author should evaluate and interpret the findings of the study. The Discussion sections should begin with a statement of support or nonsupport for the study hypothesis (if applicable) relative to the study findings, as we did in our sample manuscript.

Typically, if a hypothesis is not supported, an author will describe possible explanations of the findings. Explanations often consider that a non-supported hypothesis might be a true finding, as well as the possibility that the result was a product of some weakness in the study design (e.g., imprecision of measures, small study sample size), or an alternate hypothesis. This section also incorporates a limitations section where shortcomings in the study design or some other feature of the study might be discussed.

For example, regarding our sample study we might state:

The study findings supported the study hypotheses that postulated the study participants in the intervention group would evidence sig. greater pre/post changes in happiness scores relative to the control…

In terms of limitations we might point out:

This current study also incorporates several limitations. For example, the design did not examine if happiness was impacted by any recent negative life events …

Conclusion

The conclusion should be a reasonable and accurate statement based upon implications of the findings. It should be a statement of what the findings infer, but should be careful not to go beyond those boundaries. For example, the conclusion within our sample manuscript would not recommend that class instructor should be the focus of every program simply based upon the findings of this study. Instead we might state:

The finding that this particular intervention seemed to effectively increase levels of *Happiness* suggests that future research should examine aspects of this program further. Specifically, future research might benefit from testing the esteem enhancing portion of this program in several new settings…

Important Point

One of the Best Ways to Develop Skills in **Step 7: Write-Up & Report** is to read published articles. Via this method, you can observe how other authors report findings and write the discussion and conclusion sections. There is no need to reinvent the wheel. Listening to the voice of others, can help you find your own writing style.

.