Analyzing Quantitative Data: Doing the Right Thing and Doing it Right

Analyzing quantitative data are both challenging and a time consuming effort. Problems associated with use of statistical tools to analyze quantitative data are well documented in literature and in critiques of articles, paper presentations, theses/dissertation defenses, etc (Yoder, 2008). A review of discussant comments in conference papers presented and a review of comments from manuscript reviewers revealed several concerns regarding the use of statistical tools (Radhakrishna, 2009). Examples of concerns include: 1) using inferential statistics such as t-tests, ANOVA when the sample reported is not random, 2) computing t-tests on single items to detect statistical significance, 3) not using the same subjects when using dependent t-tests or repeated measures, that is unequal "n" in each wave of data collection, 4) not dummy coding nominal scale variables when using regression, 5) using correlation to report differences, 6) using Chi-square for reporting differences as opposed to associations, and 7) reporting means when variables are nominal.

The focus of this article is to present a general quantitative data analysis matrix that help address concerns stated above. In addition, discuss specific data analysis matrices for types of research—descriptive, correlational and experimental. Appropriate use of statistical tools is critical to accomplishing the objectives of the study, testing the hypotheses or to predict outcomes of a research study. Appropriate analysis of data begins with the purpose—general description, determine relationships or predict variables, determine differences between groups or cause and effect. In addition, researchers should pay attention to data analysis when designing and constructing the questionnaire or instrument (Radhakrishna, 2007). The following key questions should be considered before selecting appropriate statistical tools to analyze data. 1) what is the end sought from the study—describe, explain-predict, control outcomes; 2) what is the scale of measurement—nominal, ordinal, interval/ratio-- for key variables examined in the study, 3) the number of levels of key independent and dependent variables, and how many independent or dependent variables are used in the analysis—univariate, bivariate, multivariate, 4) how were subjects selected, that is, probability (random sample) vs. non-probability (purposive sample) or the entire population (census), and 5) statistical assumptions to be met—parametric vs. nonparametric tests. Answers to these questions are not only important but are to be emphasized at the research proposal level and should be reported in chapter 3 of thesis/dissertation. Figure 1 summarizes key elements of appropriate statistical tools for data analysis.

Figure 1:

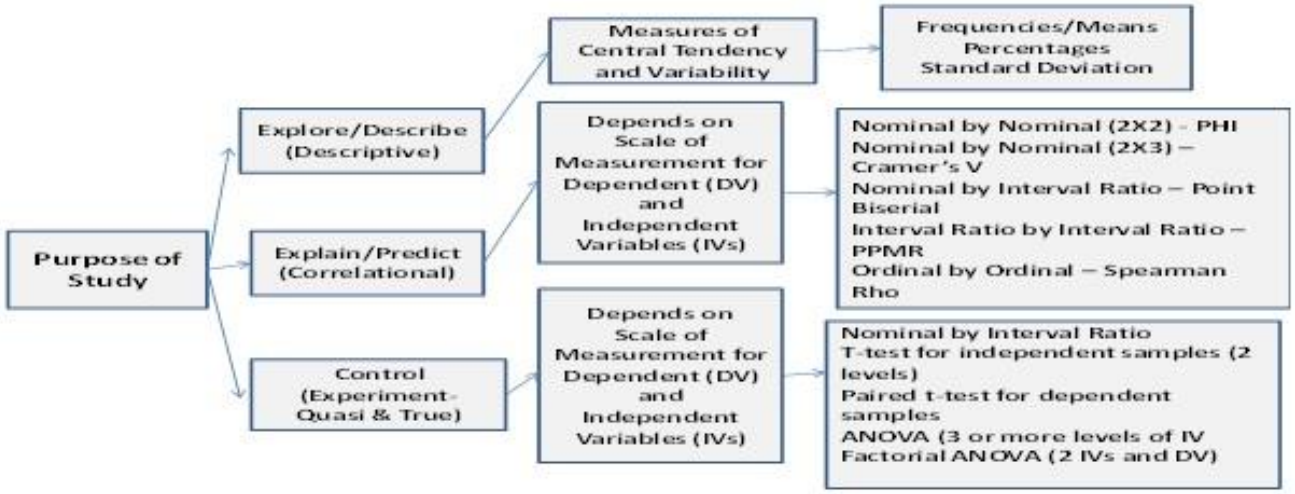

Figure 1: Quantitative Data Analysis Matrix

As shown in Figure 1, use of statistical tools to analyze data varies depending on the purpose of the study and type of data or scale of measurement. Faculty and graduate students can develop their own matrix for data analysis specific to their studies using the information in figure 1. Further, it is also useful to provide details of data analyses as depicted in Table 1. It is recommended that details of data analyses be reported in chapter three (methods and/or procedures) of a thesis or dissertation.

Table 1: Variables, Scales of Measurement, Data Sources, and Analysis by Research Questions

Research Questions/ Objectives/Hypothesis	**Source of In-formation (Survey)**	**Scale of Measurement Ind. Variable and Levels**	**Scale of Measurement Dep. Variable and Levels**	**Statistical Analysis/ Tools**
What are the demo-graphic characteristics of rice extension material users?	Section 6	Nominal Ordinal Interval/ratio	-	Descriptive Statistics, Measures of variability
What factors influence the usefulness of knowledge products as a mass media approach in disseminating rice information?	Sections 1, 2, and 5	Gratification and Non-gratification Variables (Nominal)	Usefulness of Knowledge Products (Interval/ratio)	PPMr, point bi-serial correlation, Mean, SD

Appropriate use of statistical tools to analyze quantitative data is critical to answering the purpose and methodological rigor questions. Graduate students, faculty teaching research methods and data analysis courses will find the information reported in this piece useful. In addition, appropriate use of statistical tools will not only help reduce errors but also help able to stand up to the critical review and scrutiny of reviewers, committee members, and faculty. Further, using appropriate statistical tools to answer research questions/hypotheses/objectives will provide a confident basis for action and withstand criticism aimed at discrediting results (Rossi, Lipsey & Freeman, 2004 and Braverman & Arnold, 2008). Here are key CHECK points for data analysis:

- Consider the purpose of the study. The purpose of the study drives the use of appropriate statistical tools to analyze data.
- Always keep in mind the purpose and data analysis as you start developing your instrument. This is very critical to not only using certain type of statistical tools, but also in asking the type of questions (scaled vs. open-ended questions).
- Consider early on developing a data analysis matrix or table to link the purpose of the study to research questions to identification of independent/dependent variables to scales of measurement to statistical tools.
- Report appropriate “test of significance” levels to determine if the results are due to chance.
- Use appropriate symbols to match and support use of specific statistical tools.
- Make sure that the statistical assumptions for using specific statistical tools have been met.
- When reporting mean differences, calculate and report effect sizes.
- When all said and done, make sure that you checked all the points so that your results will withstand the test of scrutiny.

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