Preparing Effective Demonstrations for the Classroom and Laboratory

When was the last time you delivered an effective demonstration to your students? What if you find you have difficulty presenting demonstrations that effectively communicate, or show the "how-to-do" to your students? Let's take a look at the components of effective demonstrations that can provide the results you are looking for.

State the Importance of the Skill

Your students need to know why this skill is important or useful to them. It may be for future employment, or for a job they can perform in their home. If you hear questions such as, "Why am I learning this? or "Where am I ever going to use this skill?", you need to ask yourself why are you teaching this skill. Be sure to let the students know as you prepare to begin your demonstration the importance of the skill.

Obtain Interest of Students

Show an example of what the students will be creating or completing. Provide them with a visual clue. You want to "hook the student". Ever watch a demonstration of a food item being prepared on a television news program? There usually is a finished product for the audience to see before the demonstration begins. Let students see what they are attempting to complete or attain when they complete the skill.

All Necessary Materials Ready

Be sure all of your tools and supplies are set up at your demonstration area. There is nothing as frustrating than having to interrupt a demonstration to locate a tool or piece of material that is not at your demonstration area. Make a list of everything you need for a complete demonstration. Check to make sure you have your items in place or in easy reach before you begin.

Use Questions to Draw Upon Informational Lesson

One method to determine if your students are ready or prepared for the demonstration is to ask questions as you begin, and during the steps of your demonstration. You are checking for understanding, and how this activity relates back to lessons you presented in the classroom. If your students are unsure as to why you are performing specific steps, you may need to pause, and take time to refresh the student's memory.

Knowledgeable of Subject

Providing your students with incorrect information can affect your credibility as an instructor. Be sure to do your homework before you begin your demonstration. If a student asks a question that you are uncertain of the answer, let them know that is a good question. Help them locate the answer after the demonstration.

Stress the Key Points

Be sure to include key points during your demonstration. Reinforce proper safety practices. Make sure students remember to disconnect power tools and machinery from electrical sources prior to making adjustments. If the demonstration requires students to handle cutting tools, be sure students have had adequate safety instruction prior to use. See safety below.

Performed Skillfully

Practice, practice, and practice. If you fail to perform the skill to the desired level or degree, how can you expect your students to perform the skill? Determine if the skill is appropriate for the experience-level of your students. Get assistance if you need help with perfecting your skill.

Setting/Location

Can all students watch you perform the task? Do you need to arrange stools around a table or bench for students to sit while a row of stands behind to view? Be sure to select the best setting. Make sure your voice can be heard. If you must compete with background noise and cannot move the class to another location, consider using a cordless microphone and portable speaker.

3-Step Demonstration Technique

This is the heart of effective demonstrations for student achievement of a task or skill.

(1) Instructor does and tells. The first step is the instructor performs the skill while verbalizing the steps and key points.

(2) Student does and tells/or Student does and Instructor tells/or Teacher does and student tells. During the second step, call a student volunteer forward to repeat the skill. Ask the student to verbalize the steps as he/she performs the skill. If the student is uncomfortable with talking, ask if they would prefer to have you talk while they perform the steps. If the student is uncomfortable with performing the task, ask them to repeat the steps while you perform the task.

(3) All students do (practice) under teacher supervision. During the third step, allow students to work on the task while you closely monitor their progress. This provides you with opportunity to see if students can replicate the process of performing the task.

Emphasize Safety

Always take into account personal safety. If the demonstration requires students to wear personal safety protection such as safety glasses, splash goggles, or lab coats, make sure you model it first. Never place you or your students in harm's way. Remind students about safety practices covered during lecture. If a student may come to harm from not following directions, make sure each student has had proper safety instruction, and that a signed and dated safety exam is kept on file before the student attempts the skill.

Time Required

The attention span of a high school student (and a college student) is limited. A rule of thumb for demonstrations is to keep it to less than 15 minutes in length. Any longer, and you may be interjecting too much informational material (best presented in lecture before the demonstration). Or cut back on the number of steps and prepare two separate demonstrations. If the skill is too complicated (too many steps to follow or remember) the student may become frustrated if they are not successful.

Job Operation Sheets (JOS)

Create an instruction sheet to serve as a reference for students to complete the skill. The JOS should include the objective, a list of tools and materials, steps to perform the task, key points (including safety), and illustrations or graphics. The JOS serves to refresh the student's memory and provides a step-by-step procedure to complete the task. Teachers should have a JOS at their side when performing the demonstration to serve as a reminder or reference. JOS should be distributed to students at the end of the demonstration as the class practices the task.

Assessment

Develop a scoring rubric to measure student achievement or mastery of the skill. The rubric should present a breakdown of the point value for the project or task. The student is able to see where the most value is assigned to the activity (i.e. appearance, within measurable tolerances, workmanship, use of time, etc.). A column on the scoring rubric should allow the student to assess their own ability and provide their own score of their skill. A column for the instructor will allow the student to see how he/she compares to their instructor.

Taking the time to properly prepare will help you achieve effective results.

Source: McCormick, Floyd (1994) *The Power of Positive Teaching*. Krieger Publishing Company

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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.

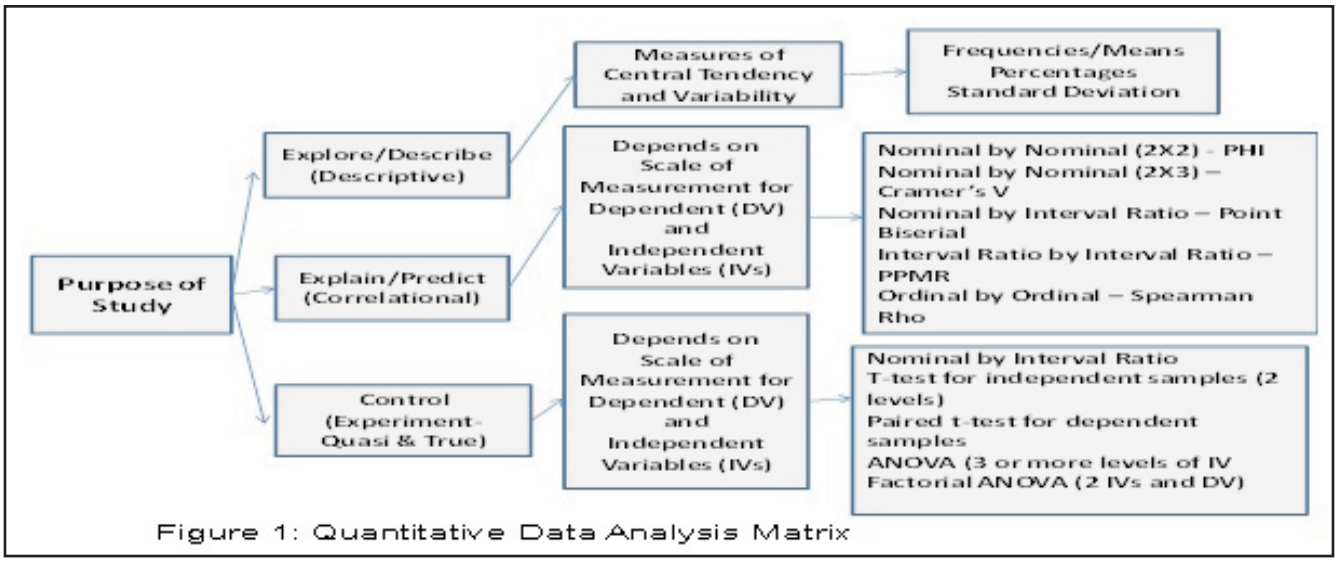

Figure 1: Quantitative Data Analysis Matrix

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 Information (Survey)	Scale of Measurement Ind. Variable and Levels	Scale of Measurement Dep. Variable and Levels	Statistical Analysis/ Tools
What are the demographic 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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