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Applying Knowledge of Quantitative Design and Analysis

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### Abstract

This study compared and contrasted two quantitative scholarly articles in relation to their research designs. Their designs were analyzed by the comparison of research references and research specific vocabulary to describe how various research methods were used. When researching and analyzing quantitative scholarly articles, it is imperative to understand how research designs can be the same, but their methods of analysis can differ depending on the study, and how vocabulary describes the research being conducted. The course instructor provided two quantitative articles which were analyzed by research references provided by the student. A literature review of the two articles and that of the research references were conducted to provide a more in-depth explanation of the research designs. Analysis revealed that even though both articles shared the same research design, various analytical techniques that are used can produce different perspectives of the results.

### Applying Knowledge of Quantitative Design and Analysis

When examining interrelationships among variables, where objective theories are tested, the most logical method to use would be a quantitative design. These variables can be measured, typically by using instruments of predetermined, closed-ended questions, so that numbered data can be analyzed using statistical procedures (Creswell, 2009; Trochim & Donnelly, 2008). According to Gall, Gall, and Borg (2003) (as cited by Wiersma & Jurs, 2009, p. 118), quantitative research has its roots in positivist philosophy, “the epistemological doctrine that physical and social reality is independent of those who observe it, and that observations of this reality, if unbiased, constitute scientific knowledge” (p. 632). Even though the research provided in quantitative articles may begin with the same design methods, various design characteristics and analytical techniques can provide for a diverse analysis.

### **Research Design and Rationale**

When deciding to use a quantitative research design, a rationale should follow to explain the purpose of the design. The research an author intends to conduct will often dictate the type of design method (quantitative, qualitative, or mixed methods) that will be used to produce results. Analysis of two articles, Anderson, Murray, and Olivarez (2002), and Backhaus and Liff (2007), revealed a lack of terminology that described their design method and a lack of an explanation of the study. The authors of both articles provided numerous research questions but no hypotheses which suggested an experimental design, “a hypothesis that is tested to establish a cause-and-effect relationship” (Lodico, Spaulding, & Voegtler, 2010, p. 12).

## Results

### Method of Data Collection

Researchers of both articles distributed surveys to collect data. Anderson, Murray, and Olivarez (2002) did not mention the respondents who completed their surveys. Backhaus and Liff (2007) allowed students plenty of time to complete their surveys during class time. Data of both articles were tallied and recorded into tables. Anderson, Murray, and Olivarez (2002) were quite detailed in their study as they used a number of tables to arrange and display the managerial roles and regions of span of control. Backhaus and Liff (2007) condensed their data into a few tables as they compared a number of cognitive styles with that of gender roles.

### Data Analysis

**Descriptive statistics.** Backhaus and Liff (2007) developed and analyzed ten hypotheses by comparing cognitive styles to student grade point averages (GPA), students' gender, means (arithmetic averages), and standard deviations. They displayed their findings in a few tables with both surveys and cognitive styles on the left and means, standard deviations, and relationships between cognitive styles listed at the top of table.

Anderson, Murray, and Olivarez (2002) analyzed their data by using numerous tables that included number of responses, means, and standard deviations. These tables listed different types of data to display relationships between (1) managerial roles and influencing variables, (2) how managers perform managerial roles in the United States, and (3) span of control by regions (North Central, Middle States, New England, Northwest, Southern, and Western) that contained percentages of gender, age, years of managerial experience, years at current institution, and years at their current position.

**Causal-comparative statistics.** Anderson, Murray, and Olivarez (2002) found significant relationships with their independent variables (environment, personal, and situational) and dependent variables (10 managerial roles). Multivariate analysis of variance (MANOVA) proved significant differences between the independent and dependent variables where univariate tests confirmed the findings. Analysis of variance (ANOVA) proved differences in roles that were related to gender.

Backhaus and Liff (2007) found CSI, RASI scales and other variables to be related. The internal reliability for CSI was acceptable with a Cronbach's alpha coefficient of .79. Internal reliability for RASI ranged from .83 (for the Strategic Approach Scale) to .64 (for the Metacognitive Scale). This study found significant relationships between (1) CSI and GPA, (2) gender and cognitive styles, (3) various approaches to studying, (4) GPA and approaches to studying, and (5) mean scores on CSI.

### **Initial Critique**

#### **Research Questions or Hypotheses**

Both articles lacked a hypothesis but listed a number of research questions that could be answered through the "systematic collection of data and clearly meet ethical guidelines" (Lodico, Spaulding, & Voegtle, 2010, p. 27) to guide their research. Anderson, Murray, and Olivarez (2002) (as cited by Anderson, Murray, & Olivarez, 2002, p. 4) listed their research questions (1) What managerial roles do community college Chief Academic Officers perform and which roles do they emphasize? (2) Are there differences in their roles due to environmental characteristics, personal characteristics, or situational characteristics? Backhaus and Liff (2007) listed their questions (1) How do students process information? (2) Can they grasp the big picture? (3) Are

they studying the appropriate materials in the right ways to be prepared as managers and leaders (pp. 445-446)?

### **Definitions**

Only a few definitions were used between both articles. According to Murray, Murray, and Summar (2000) (as cited by Anderson, Murray, & Olivarez, 2002, p. 1), a Chief Academic Officer (CAO) is an “administrative head of academic programs with responsibility for all academic affairs at the institution”. A manager is a “leader of a particular organizational unit” (Anderson, Murray, & Olivarez, 2002, p. 3). According to Messick (1984), and Riding and Rayner (1997) (as cited by Backhaus & Liff, 2007, p. 446), cognitive style is a “consistent preference for gathering and understanding information”.

### **Measurement and Instrumentation**

Both articles used a very minute measurement scale for their instrument. Anderson, Murray, and Olivarez (2002) utilized a four-part scale (3) *not used at all*, (6) *a little*, (9) *some*, and (12) *often*. Backhaus and Liff (2007) used a trichotomous scale (1) *true*, (2) *false*, and (3) *uncertain* for the CSI and a 5-point Likert-type scale for the RASI survey.

For their instrumentation, Anderson, Murray, and Olivarez (2002) used a managerial role survey (Mintzberg, 1973) which was designed by Judson (1981) (as cited by Anderson, Murray, & Olivarez, 2002). Backhaus and Liff (2007) used a questionnaire that was comprised of two parts (1) CSI (Allinson & Hayes, 1996) (as cited by Backhaus & Liff, 2007), composed of 38 items that measured cognitive styles; and (2) RASI (Entwisitle & Tait, 1994) (as cited by Backhaus & Liff, 2007), composed of 44 items.

### **Validity and Reliability Processes**

Changes were made for both instruments to redefine their purposes. The managerial role survey (Mintzberg, 1973) (as cited by Anderson, Murray, & Olivarez, 2002) that Anderson, Murray, & Olivarez (2002) used was redefined further by Mech (1997) (as cited by Anderson, Murray, & Olivarez, 2002) and later again by researchers for this study. Ten more questions were added due to latent factors having fewer than three indicator variables. The survey was further critiqued by ten high education managers for content validity of managerial roles (latent factors). These managers were asked to identify which combination of three questions corresponded to each of the ten managerial roles, but none of the educators agreed. Wording revisions were made for three questions. The survey was further analyzed for internal consistencies. Further validity included an exploratory factor analysis that all 30 questions loaded onto nine independent factors. The survey's reliability was not stated.

The CSI questionnaire (Backhaus & Liff, 2007) was initially validated by Allinson and Hayes (1996) (as cited by Backhaus & Liff, 2007) and later used in studies of management students and managers (e.g., Allinson, Armstrong, & Hayes, 2001; Sadler-Smith, 1999; Sadler-Smith, Allinson, & Hayes, 2000) (as cited by Backhaus & Liff, 2007). Duff (2000) (as cited by Anderson, Murray, & Olivarez, 2002) had five items, measuring collaborative approaches to studying, added to RASI. Duff (2000) (as cited by Anderson, Murray, & Olivarez, 2002) reported the reliability of previous RASI studies showing alpha coefficients in the .70+ range. The Collaborative Scale consisted of five items related to desire to work together with other students. Sadler-Smith (1999) (as cited by Anderson, Murray, & Olivarez, 2002) reported this scale yielded strong internal reliability of .84.

### **Sampling Procedures**

The process of choosing samples was different for both studies. Anderson, Murray, and Olivarez (2002) used a stratified random sample for their study by six national accrediting regions, then calculating percentages of community colleges in each region. An appropriate number of colleges from each accreditation region were randomly selected. For statistical analysis purposes, oversampling was necessary. Surveys with instructions and a self-addressed, stamped envelope were mailed to randomly selected CAOs. Two weeks later nonrespondents received a second mailing. The final population used was 180 respondents. The sample type used in Backhaus and Liff's study (2007) was not mentioned but included undergraduate business students (management, accounting, statistics, and marketing) who were attending a comprehensive college in the Northeast. The final population used was 222 respondents.

### **Ethical Considerations**

**Protection from harm.** It was evident that the authors showed respect for their participants as it was never mentioned. Backhaus and Liff (2007) administered their survey to students in class and allowed them to complete during class time. Anderson, Murray, and Olivarez (2002) mailed their surveys, with instructions and a self-addressed, stamped envelope, to randomly selected CAOs.

**Informed consent.** In their study (Backhaus & Liff, 2007) of how to improve students' learning, it would be obvious that their students would not need to be informed of the purpose of the study as this most likely would change their students' view of the study. Anderson, Murray, and Olivarez (2002) did not mention if their participants were contacted before their study began. It would seem that it would be more time consuming calling or contacting them by mail beforehand.



**Confidentiality.** The class instructor's name and behavior (Backhaus & Liff, 2007) were not mentioned so it can be assumed that permission was granted to allow these students to participate in the study. Participant names were also not used (Anderson, Murray, & Olivarez, 2002) as surveys were sent randomly in hopes to obtain as many responses as possible.

### **Conclusion**

Even though both articles began with a quantitative method, no two articles are the same as their research can proceed in different directions based on their study. Both articles shared the experimental design that lead to the development of a survey. An initial critique revealed that research questions were used in both articles, but no hypotheses. Definitions explained various terminologies. Prestablished surveys were considered and later modified to ensure their validity. Survey measurements consisted of three or four parts for the scale. Samples used were either stratified random or not mentioned. Both articles showed respect towards their participants. No harm was done as surveys were completed with ease. Students' behaviors were not influenced before the study was conducted as well as their names were not mentioned to protect their identities.

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