CHAPTER III

METHODOLOGY

The population identification process and the sampling method are discussed in this chapter. The data collection technique is identified, and the development of the data collecting instrument is outlined. An explanation of the content validity study of the instrument and the results are included along with the method used to test the reliability of the instrument. Procedures for the distribution and return of the instrument along with organization and analysis of the data conclude the chapter.

Population and Sample

This study was conducted using the planetarium directors operating public-school-owned planetaria across the United States. This was a nationwide study focusing on permanent planetarium facilities as opposed to portable planetaria. These planetarium facilities represent a range of sophistication. Some facilities are simple star projectors under small domes 10 to 24 feet in diameter, while other facilities are 30 to 65 foot domes using computer-controlled multimedia audiovisual technology. The population was the 464 directors listed in the Loch Ness Productions Planetarium Compendium (Petersen, 1998). A sample size of 210 was determined using Krejcie and Darlye’s (1970) “Table for Determining
Sample Size for a Given Population.” The sample of directors was drawn from the identified population using a random numbers table.

Data Collection

Data were collected using a questionnaire developed under the Total Design Method (TDM) described by Dillman (1978).

Analysis of Early Versus Late Returns

Because of the modest return (62%) on the survey, an analysis of early returns versus late returns was conducted. Lehman (1963) has shown that non-respondents on mail surveys tend to agree with the responses of late responders. A comparison of early versus late returns was conducted in order to make an assumption on how the non-respondents might have answered the survey. If there are no significant differences between the early and late respondents, it can be assumed that the results of the survey can be inferred to the entire survey sample. It can also be assumed that the results of the survey can be inferred to the targeted population.

Respondents were divided into two groups based on the return date posted on the surveys. The returned surveys were sorted in ascending order with the earliest returns listed first. The top 35% (N = 43) were group 1, and the bottom 35% (N = 43) were identified as group 2.
Data were analyzed using t-tests for variables which were continuous and chi-square for variables which were on categorical. On selected questions percentages were compared between the two groups. The results of the chi-square test, the t-tests, and the comparison of percentages are in appendix A.

The results of the early versus late analysis indicates there are some differences but they are not sufficient to indicate the early returns differed significantly from the late returns; therefore, I am fairly confident that the data collected in this survey can be generalized to the entire population of planetarium directors operating public-school-owned planetaria in the United States.

Development of the Questionnaire

Five domains were chosen for the questionnaire. These domains were based on past research on the topic of planetaria in education, a review of the literature on job analysis, and input from a panel of planetarium directors.

Brainstorming key words identified within the five domains resulted in 100 possible questions for the survey (see Appendix B). Two criteria were used to select the final questions for the questionnaire. First, the items were divided into five domains and reviewed by three planetarium educators not selected as participants in the study. Two of these planetarium directors operate public-school-owned planetarium facilities and one directs a university planetarium. The
university planetarium director was included based on his educational experience in working with public school systems. Items found to be redundant and superfluous were omitted and suggestions were made to rewrite or restructure some items.

Secondly, the items were subjected to a content validity study by fourteen professional education administrators who were enrolled in a Virginia Tech doctoral program. Items that were rated not clear or somewhat clear were either rewritten or omitted. The final questionnaire contained a total of 72 questions within the five domains (see Appendix C).

The five domains chosen for the questionnaire were:

(a) the job

(b) the curriculum

(c) the organization

(d) the facility

(e) the director

The domain of “job” was developed through a review of job analysis literature. The researcher, guided by a panel of planetarium educators, developed questions using terms commonly found in job analysis surveys. Questions covering job skills, duties, and responsibilities were included.
The domain of “curriculum” was based on planetarium education studies that raised questions as to which teaching methodology or strategy was most effective in the planetarium environment. Curriculum topic issues and curriculum implementation questions were developed using a panel of planetarium educators.

The domain of “organization” emerged as the researcher reviewed planetarium studies and discovered a lack of clarification on the administrative positions planetarium directors hold within the public school setting. A review of studies also revealed a need to clarify the placement of the planetarium facility within the educational and administrative setting.

The domain of “facility” emerged as a result of a state of confusion within the literature as to what type of planetarium facilities had been studied. In all studies reviewed no detailed descriptions were provided as to the style of planetarium facility or its degree of sophistication. Questions in this domain were developed based on this researcher’s 30 years of experience as a planetarium director.

The domain of “planetarium director” was developed to answer basic questions about the qualifications of planetarium directors operating public-school-owned planetaria across the nation. No studies on planetarium education
were found that included information on planetarium directors as to academic background, educational certification, skills, or special training.

**Content Validity of the Questionnaire**

A content validity study was conducted using a seminar of 14 professional educators enrolled in a doctoral program at Virginia Tech. Participants were asked to associate the questions with one of the five domains (1 = job; 2 = curriculum; 3 = organization; 4 = facility; 5 = director). The degree of association with each domain was measured using a four response scale (1 = very weak; 2 = somewhat weak; 3 = somewhat strong; 4 = very strong). Questions were rated on clarity using a three response scale (1 = not clear; 2 = somewhat clear; 3 = very clear), (See Appendix D for the content validity instrument.)

The content validity study resulted in acceptance of all but two of the original questions. A 60 percent or higher agreement with domain resulted in the placement of questions or statements within that domain. Several questions resulted in lower than expected percentages due to the placement of the questions on the content validity instrument, or the lack of additional information which was available to the survey respondents. These questions contained a list of task or job skills that were not printed on the content validity instrument. A review of the questions resulted in a majority of the questions being re-written or re-phrased from their original form.
Survey questions were reviewed by the committee chair and the researcher five times to make adjustments and revisions. The results of the content validity study are in Appendix E.

**Reliability of the Questionnaire**

A test-retest procedure was used to measure the reliability of the questionnaire. Ten planetarium directors not selected for the study were randomly selected and asked to participate. Each participant received a copy of the questionnaire and was asked to complete and return it. Approximately one week later a second copy was mailed to directors that returned the questionnaire. The degree to which the answers agree between the two questionnaires was used to compute the stability of the questionnaire over time. Item reliability was additionally pretested using a panel of educators in the field of planetarium education. Precautions were taken to ensure a representative sampling of appropriate content in the survey (Wood, 1961).

**Scoring of the Questionnaire**

The questionnaire was composed of four answer formats. Respondents were asked questions that require a response of “No” or “Yes,” a Likert scale rating, a choose-an-answer response, or a fill-in-the-blank response. The Likert-type items had four response categories: 1= strongly disagree, 2= disagree, 3= agree, 4=
strongly disagree. Questions evoking a “No” or “Yes” response were scored No = 1 and Yes = 2. Closed ended responses were given a series of choices, and fill-in-the-blank questions were grouped according to emerging themes. Means and percentages for each question in the five domains were computed.

**Distribution and Return of the Questionnaire**

Questionnaires were mailed to 210 randomly selected participants. Respondents were allowed one week to return the questionnaire before any follow-up procedures was used. After one week a postcard reminder was mailed to all participants. The postcards were custom printed with a photocopy of a space-art painting by this researcher. It was assumed the art work would form a link between the researcher and the survey respondents thus increasing the chances of having the surveys returned. The postcard served as both a “thank you” for those who had returned the questionnaire and a reminder for those who had not. At the end of the fourth week 74 (35%) of the surveys had been returned.

At the beginning of the fifth week, a second copy of the questionnaire was mailed to all non-respondents. In an effort to increase survey responses, the second copy of the survey included an offer for all respondents to win an original watercolor space-art painting. A photo-copy of the painting was included. A notice was attached stating all respondents had a one out of 210 chance to win the painting.
for returning the survey. The second survey copy also had a shorter cover letter re-emphasizing the importance of returning the questionnaire. At the end of the seventh week 112 (53.3%) of the surveys had been returned.

At the beginning of the eighth week, a third copy of the questionnaire was mailed to all non-respondents. Attached to each survey was a hand written note personally addressed with the first name of the respondent. The note re-emphasized the importance of their participation in this research project. A small address label note was used to attach the note directly to the survey. The survey also contained a “return due” date highlighted in fluorescent pink. At the end of the tenth week 131 (62%) of the surveys had been returned.

Data Organization and Analysis

Data were entered into the Statistical Program for the Social Sciences (SPSS) for analysis. Data were analyzed by research questions within each domain. For questions that require a “Yes” or “No” response, frequency counts and percentages were computed. For questions using a Likert scale, means, standard deviations, minimums, and maximums were computed. Close-ended and fill-in-the-blank questions were scored as frequency counts and percentages.