AN ABSTRACT OF THE THESIS OF

Ewa M. Starmach for the degree of Doctor of Philosophy in Education presented on April 15, 1988.

Title: A Task Analysis of the Statistically Related Computer Application Needs of Doctoral Level University Graduates with Majors in Education.

Abstract approved: Redacted for Privacy

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This research evaluated the statistically-related computer application tasks which were deemed to be important to the graduate curriculum of doctoral students who major in Education. Data were gathered from samples of foreign (N=22) and American (N=117) students who held degrees in Education from Oregon State University.

The sixteen (16) item instrument utilized a six-point Likert type scale for the data collection. The scale, which was validated by consensus using a DELPHI panel procedure, utilized the Hoyt-Stunkard method for assessing reliability. The computed reliability for the instrument was determined to be +0.90.

Analysis of variance tests were completed for each of the sixteen (16) tasks and for two additional demographic variables to ascertain differences between foreign and American samples. Hartley's test was used to affirm the homogeneity of variance assumption for the F-statistic.

Factor analysis, using the R-mode, provided for the clustering of tasks and constituted the major analysis procedure for the study. The major goal of the research was to substantiate the necessary core of tasks which met the needs of doctoral degree holders majoring in Education.

The results of the study indicated the presence of seven (7) clusters of content which were considered basic to curriculum inclusion in doctoral programs for majors in Education. The identified clusters included; I. Analyzing Statistical Data (4 tasks), II. Database and Word Processing for Publishing (3 tasks), III. Hardware Training (2 tasks), IV. DOS Usage for Creating and Accessing Data Files (2 tasks), V. Mainframe Usage and Electronic Mail (3 tasks), VI. Spreadsheet Software Usage (1 task), and, VII. Word Processing Software Usage (1 task).

Overall task means ranged from 3.007 to 5.043; significance tests showed only two (2) rejected hypotheses for the sixteen (16) primary tasks. Standard errors of the mean were found to be significantly lower for the American sample. One of the two demographic variables showed a significant difference, that being the one which assessed the importance of computers to the job. American graduates marked this variable significantly higher than did the foreign group.

The results of the study present a valid pattern for the development of objectives which should be included in the curriculum of doctoral programs for Education majors.

A TASK ANALYSIS OF THE STATISTICALLY RELATED COMPUTER APPLICATION NEEDS OF DOCTORAL LEVEL UNIVERSITY GRADUATES WITH MAJORS IN EDUCATION

BY

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This is probably the easiest, and at the same time, the most difficult part to write in my dissertation. There have been so many moments when I was not sure whether I had the fortitude and the energy, or for that matter, the brain-power to complete this piece of research. If it were not for the love, encouragement, and the technical expertise of my husband, who happens to also be my best friend, this degree would not have been completed in such a timely way, or perhaps ever. It is truly from the bottom of my heart and soul that I say, great things are not possible without those who love us, and without sharing them with those we love, the achievements would be hollow, without any brilliance of color. In that spirit, I want to say that my love and appreciation for the man my husband is, has grown ten-fold because of this experience. For that I shall be forever grateful, and feel even more proud for having achieved this professional rank. My husband, Bob, who is a proud and very intelligent human being, is also a very humble and generous person, with whom I feel very fortunate to have shared the last 16 years. Our mutual respect toward each others' abilities and strengths, and learning to get rid of the weaknesses, have opened up doors to opportunities which might have never presented themselves were it not for my pursuit of this degree. In light of that, I must express my gratitude for all the support and good will, and say: "It would not have been all

possible if I did not go through with it. I would have not made it without you, Bob."

Self-actualization is a process I have believed in very strongly for many years. Very few people are selfless enough to share themselves with others so that those others can achieve a higher level of understanding. An understanding not only of themselves, but also of the world around them, and how they can improve both. Such a person I have found to be embodied in my major professor, and a dear friend, Wayne Courtney, Ph.D.. His altruistic nature, generosity, and human devotion to the excellence in the educational process, have all impressed me and stimulated my intellectual curiosity beyond my own desires for achievement. His support and unfailing ability to grow my inner strength as an individual and an instructor have propelled me even further into wanting to do the same for others. I only hope that I will influence someone, in my career as an university professor, in the same positive and overwhelming manner. I thank Wayne for all those times when he told me I could do it, when I was ready to give up on trying harder. In the words of Henry (Brooks) Adams: " A teacher affects eternity; he can never tell where his influence stops." In this case, I want Wayne to know that his influence was, is, and will continue to be absolute and without limits, in my case.

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through her art, are alive in me today. I think that I understand her better today, than I ever did when she was alive. Daniela, for that is her name, is still alive in my heart and soul, and will be, forever.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

A TASK ANALYSIS OF THE STATISTICALLY RELATED COMPUTER APPLICATION NEEDS OF DOCTORAL LEVEL UNIVERSITY GRADUATES WITH MAJORS IN EDUCATION

CHAPTER I

BACKGROUND AND RELATED LITERATURE

Introduction to the Study

The methodology of task analysis has been in existence for several decades, with much research work focusing on the skills and competencies which are necessary to the worker in the field (McCormick, et al., 1954). The changing technologies within the society dictate that there be a constant updating of skills for the performance of the individual worker on the job. The matter of the worker assessing the needed skills for the occupation has been substantiated (Courtney, 1968) and is regarded as an essential concept in developing curricula. This focus is especially relevant to the worker who directly interfaces with the rapid changes which are prevalent within the world of work. The essence of the present study is integrated in the premise that the worker on the job is in the best position to judge which skills are needed at the training level. The complexity of the modern world requires that professionals utilize computers in the acquisition of knowledge and information as a part of their job roles. The rapidity with which information is disseminated within the society mandates that the professional educator be provided with preservice and in-service upgrading experiences in order to retain adequate job performance and credibility. Each of these concepts is applicable and necessary to the model and philosophy of the present study.

Several objectives have influenced the immediate format of this research effort, of which is the present examination of graduate curricula within the Schools of Education for the purposes of semester conversion. A second element is that there is no substantial body of research in this area of interest. Two research studies set the stage for the design of this research effort (Burton,1984 and Soukup,1984). The results of these companion studies dealt with curriculum content in research and statistical methods for workers in education: namely, for those representing the occupations of secondary school counselors, Oregon State Department of Education Professional personnel, and state college and university faculty, teachers, and administrators. However, the matter of computer applications as they are applied to the needs of the graduate at the Ph.D. level were not addressed in either of these reports. The recent influx of computer utilization in the society at all levels causes this issue to be of immediate and relevant concern to the graduate level curriculum planner. Thus, the matter of identifying and prioritizing essential statistical application elements (including DOS as well as menu-driven software) is a critical question. The focus of the present research is based upon this precise corollary.

Statement of Objectives

The central goal of this research study is to identify the core of statistically-related computer application tasks necessary to the functional roles of graduates of doctoral programs with majors in Education. The study's focus was upon the job needs which are essential for performing the work roles into which graduates are placed following the completion of their degrees. The specific questions which were addressed included the following:

1.) What are the needed (statistically-related) computer application tasks or competencies which are required of holders of doctoral degrees who matriculate with majors in Education?

2.) What clusters of such tasks or competencies are relevant to university curricula?

3.) What importance weights are placed upon these tasks by field workers?

Importance of the Study

The need for research studies in this area of interest has been suggested by investigators representing many fields of education (Larson and Valentine, 1975; Worthen, et al., 1971; Worthen, 1975). Each of these reports has emphasized the need for skills' development and professional improvement. The various Worthen papers concentrated on the need for research and evaluation skills among educators. More recent studies (Burton, 1984 and Soukup, 1984) have been involved with the identification of research and statistical competencies necessary to various levels of education personnel. The methodology which has been used for these studies established the model and a precedent for approaching the present challenge of identifying computer and statistical application tasks for graduates of doctoral programs in Education. Two (2) primary bodies of literature appear to be relevant and emerge from the existing knowledge base.

Identifying Educational Research Tasks

Since the implementation of the various Education Acts after 1963, there has been an increasing sensitivity to the incorporation of research skills into vocational-technical and other programs for educators. Courtney and Halfin (1969) were pioneers in identifying professional training needs and competency requirements for teachers involved in the area of industrial-technical instruction. Complementing and corresponding to these efforts was the work at Minnesota (Moss, 1966), where program curricula were established for educational researchers. In the same year, the American Educational Research Association (AERA) recognized the need for improving the techniques which were being used by practicing educational research workers, (AERA, 1966). Teams of workers (Worthen and Gagne, 1969; Glass and Worthen, 1970; and Anderson, et al., 1971) identified skills which were essential for educators. These teams were each involved in some way with the AERA Task Force effort.

Encouraged by the AERA concern for the improvement of research skills, a team of researchers at Florida State University, headed by Andreyka (1976), designed a project to assist in the development of a competency based approach to teacher education, to include research skills and evaluation competencies. Bargar, et al., (1970) designed a program at Ohio State University aimed at training in educational research. Later, Owenby and Thomas (1978) followed the lead of Courtney and Halfin (1969) and identified research and evaluation competency needs in vocational-technical education.

More recent and cogent to the present study are efforts to identify the extent of microcomputer use by university faculty and others, including administrators (Johnston, 1986; Brown, et al, 1986; Jalbert, 1986). These studies concentrated on the acceptability of computer use by university personnel in terms of adoption and workplace change. Other reports detail curricula for instructing faculty in higher education in the use of microcomputers for skill development and application (Schwartz, 1986; Van Dusseldorp, 1984). At the same time, there has been a major effort to assess the influence of the integration process for computers into existing education curricula. (Hadley and Farland, 1986). These, along with many computer literacy assessment activities (Cloutier, 1986; Anderson, 1986; Pourciau, 1985; Kull, et al, 1984) constitute some of the backdrop for consideration in the present research.

Research efforts within the School of Education at Oregon State University during the past two decades have produced several papers which have dealt with the process of competency identification for professional workers. Those which appear to be most closely related to the research at hand are by Lindahl (1971), Gunderson (1971), Miller (1971), Behroozian (1981), Hammer (1983), Burton (1984), Soukup (1984), and Samahito (1984). These studies set the stage for the methodological aspects which were employed in the design of the present study.

Utilizing Clustering Methods

The body of literature pertaining to techniques developed by McCormick and others at Purdue University to analyze the occupational requirements of industrial workers offers the model for the present study's methodology (McCormick et al., 1954; Chalupsky, 1954; Scheips, 1954; Finn, 1954; Gordon and McCormick, 1969). These studies utilized the analysis of job interrelationships, featuring the identification of job components, the factor analysis of the components, and the identification of clusters of jobs. Of particular importance to the present research is the collection of basic field data from established professional workers, who indicated competency needs for their jobs by checking appropriate task lists. The conceptual basis for the methods of data analysis to be used in the current research emerged from these studies of job interrelationships.

The model for the present investigation derives its foundation for curriculum planning from work conducted by Courtney and Coster (1963). Here, a common core of skills and experiences form the knowledge base for occupational entry. The "centripetal" approach suggested by these authors is centered on the identification of the elements of the common core. The elements are likely to resemble fragments of abilities and knowledge and are apt to be general rather than specialized, except as specialization relates to the entire occupation for which a person is being prepared. Where a person works is not so important as the nature of the work itself. According to this premise, an empirically-based method for determining curricula content can be derived. (Halfin and Courtney, 1971)

In the centripetal approach, there is a search for the least common denominator of the occupation of interest. This common core of knowledge and skills is described in accord with a moving inward process. Figure 1 depicts a number of overlapping circles which illustrate the centripetal method of content identification (Courtney and Coster, 1963). Curriculum planning is centered on identifying the elements of common overlaps and what the worker does is made the criterion for classification within the core. (Courtney, 1962)

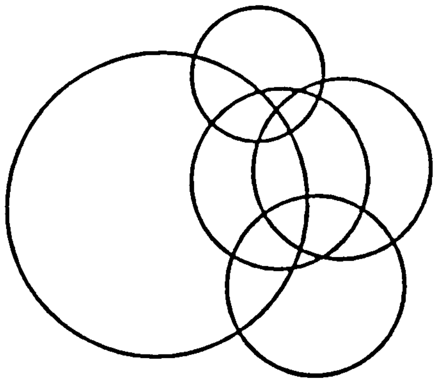

Figure 1. Schematic Illustration of the Centripetal Approach

The elements of the centripetal paradigm are likely to resemble those included in courses ordinarily offered in the natural, physical, and liberal arts sciences. Hence, the instruction is apt to be presented in a general format, rather than as a specialized curriculum. Thus, the centripetal approach may appeal to educators who see the necessity for general education which satisfies basic literacy requirements.

In retrospect, the present study resolves into a problem with curriculum ramifications for doctoral programs in education. The identification of the statistically-related computer application tasks required for doctoral university programs, along with a factor-based grouping of job activities, is important to designers of curricula at that level. The guiding principles of this focus may be stated as follows:

1.) Factor (cluster) identification may be completed using worker-assigned values for the purpose of verifying task statements.

2.) Subject matter content may be descriptively grouped for analysis purposes. From such groupings, patterns of academic preparation may be established for doctoral degree holders so that the basic common tasks and necessary common experiences can be identified.

3.) As content is determined, performance-based objectives for preparing doctoral degree candidates in Education can be specified.

4.) Using the sequence of performance-based objectives, instructional strategies may then be specified for doctoral level programs.

The basic thesis surrounding the use of this curriculum model is that a standard set of dimensions can be developed which provide guidance and content selection for statistically-related computer instruction. The present research brings this matter into quantitative focus.

It is advantageous to the educational community to utilize acquired skills which are relevant to the professional roles which professionals play in the society. Closely allied to the methods of analysis which are suggested for the present study are the procedures which were utilized by Stamps (1980), who developed a list of competencies in consumer education and personal finance, and Samahito (1984), who studied physical education competencies for the validation of graduate level curricula. Both of these studies, along with others (Behroozian, 1981; Burton, 1984; and Soukup, 1984) mailed survey instruments to professional workers in the field. University faculty were sampled in the research and completed the questionnaires judgmentally assigning values to competency lists. Data were analyzed using factor analytic methods which parallel those which have been used for the present research. In each instance, content validation was established using a DELPHI panel and reliability was ascertained through the analysis of variance method (Hoyt and Stunkard, 1952).

Definition of Terms

It seems prudent to define selected terms which have been used in the report. These are shown below; other terms or phrases are considered to be self-explanatory.

Cluster: a matrix of research tasks whose intercorrelations are high with factor loadings of + or - .50 or higher. A cluster is referred to as a factor. (Fruchter, 1954)

Common Factor: statistical representations of some task or trait which two (2) or more items in the questionnaire have in common (Cattell, 1952).

Common Variance: the sharing of variance by two (2) or more elements or tasks. In such a sharing, the elements are correlated and therefore, have some traits in common. (Fruchter, 1954)

DELPHI Technique: an expert opinion forecast method which interactively integrates the responses of surveyed experts. The method, ordinarily, utilizes three (3) or four (4) iterations with controlled feedback, using a questionnaire or a similar instrument to reach consensus. This method was developed by the Rand Corporation (Linstone and Turoff, 1975) to facilitate reaching agreement within large committees. (Sackman, 1974; Courtney, 1983) The DELPHI technique is based upon the premise that experts can make conjectures about the future, based upon rational judgment and shared information. It has been used successfully by industry and for the identification of goals for education.

Doctoral Degree Holders: graduates from Oregon State University in the past seven (7) years with a degree of Ph.D. in Education or Ed.D..

Factor Analysis: consists of a collection of procedures for analyzing the relations among a set of random variables observed, counted, or measured for each individual of a group. The purpose of factor analysis is to account for the intercorrelations among variables by postulating a set of common factors. It can be defined as a method for extracting common factor variances from sets of measures. (Fruchter, 1954)

Factor Loading: the correlation of any particular research task with the other research tasks being extracted in the same factor. Factor loadings may range from -1.00 to +1.00.

Factor Solution: refers to the number of factors the computer program was set to generate. The different factor solutions were studied in accordance to preset criteria in order to select the most appropriate number of factors for analysis.

Job: work that a person does and gets paid for. It is a production term. (Fryklund, from Allen, 1919)

R-Mode: is a factor analytic method which examines the relationship of every research task with every other research task and provides for a clustering of common tasks. In the R-mode, items are intercorrelated and factored according to respondents. (Harman, 1967)

Research Tasks: those elements of an individual's job which pertain to interpretation and application of research-oriented activities.

Spurious Tasks: a research task with a factor loading of less than + or - .50. It is tentatively identified as clustering with the factor in which its highest factor loading occurred, where its loading is less than + or - .50.

Task: complete task description includes three (3) types of information: 1.) all activities surrounding the operation (inputs, outputs, environment, and catalysts), 2.) everything the operator does on and for the operation, and 3.) enough detail to enable the operation to be performed again at a later time or another place as recorded. (Nadler, 1970)

Varimax Rotation: a technique which redefines the factors in order to make sharper distinctions in their meanings by pushing up high loadings on a factor and reducing small loadings to zero. Varimax rotation maximizes the variance of the loadings for each factor. (Kachigan, 1982)

Chapter II

METHODOLOGY

The Design of the Study

The design sets the stage for the analysis method in the research. It expresses the conditions under which observations are recorded and equates the dependent variable in terms of the objectives of the investigation. (Courtney, 1986) These conditions are described below and substantiate the study's direction for purposes of analysis.

The Dependent Variable

The dependent variable for the study was a scale value which was judgmentally assigned by each of the subjects who participated in the survey. The equal-appearing interval scale encompassed six (6) importance levels which reflected perceived tasks ncessary to the job and employment of the doctoral degree holder. The instrument itself was developed according to the DELPHI method of validation as described by Dalkey and Helmer (1963), Linstone and Turoff (1975), and Burton (1984). The scale (instrument) consisted of values which were based upon the following descriptors:

1 - extremely unimportant

2 - of little importance

3 - of some importance

4 - important

5 - very important

6 - extremely important

Preparation of the Instrument

The instrument which was utilized for this study contained a survey-type questionnaire designed for mailing and containing sixteen (16) response items. The six (6) point scaling allowed the respondent in the sample to judgmentally assign values which are considered necessary to the Ph.D. or Ed.D. recipient who has majored in Education, or in Health and Physical Education. The sample was drawn from the Oregon State University School of Education doctoral graduates beginning with the 1981 commencement until the present.

The method for establishing validity for this instrument was the application of the DELPHI procedure to an assemblage of potential tasks which were considered to be inherent to the discipline. The preliminary list of task statements was developed through an initial review of literature covering performance needs in this area, plus a review of curricula for the programs which were represented in the sample (See Appendix A). The actual validation involved the input of six (6) panel members who were chosen on the basis of the following criteria:

1.) Not less than three (3) years of current work experience, preferably in curriculum development for Education.
2.) Possess the Ph.D. or Ed.D. degree with a major in Education, or have specific expertise in computer applications.

The initial stage of the DELPHI process included a reaction from each member of the panel to suggest whether there was ambiguity or redundance within the listing of potential items for the instrument. The response categories for this phase asked each of the panel members to react to each item according to the following scale:

Retain _______

Reject _______

Retain with the following modification (s):________

____

The second and subsequent iterations with the panel utilized a 5-point scale to ascertain the importance level for each of the items which were retained or retained through modification in the initial phase (See Appendix A). Members of the DELPHI panel were encouraged to contribute new items for the questionnaire, if they felt there were gaps. The Likert-type scale carried the following categories:

Very Unimportant	Unimportant	Moderately Important	Important	Very Important
1	2	3	4	5

The liaison with the panel was continued until group consensus was met. Consensus was considered established when the responses of the panel members as a group were in agreement 80% of the time. Items were considered as being appropriate for inclusion in the instrument if the importance mean reached at or above the 3.5 level on the scale. The instrument was field tested on a small representative sample prior to its implementation for data collection in the study. An example of all iterations of the instrument formats are shown in Appendix A. Although the DELPHI method was originally intended as a forecasting tool, its more promising application in education appears to be in the following areas: 1) a method for studying the process of thinking about the future, 2) as a pedagogical tool which forces people to think about the future in a more complex manner than they ordinarily might, and 3) as a planning tool wich may aid in probing priorities held by members and constituencies of an organization (Weaver, 1971). The many advantages, including the simplicity and directness of the method, ease of administration, minimal application time requirements, and low cost, make this technique particularly well-suited to educational research.

Usually one or more of the following properties of the application leads to the need for employing DELPHI (Samahito, 1984);

1. The problem does not lend itself to precise analytical techniques but can benefit from subjective judgments on a collective basis.

2. The individuals needed to contribute to the examination of a broad or complex problem have no history of adequate communication and may represent diverse backgrounds with respect to experience or expertise.

3. More individuals are needed than can effectively interact in a face-to-face exchange.

4. Time costs make frequent group meetings unfeasible.

5. The efficiency of face-to-face meetings can be increased by a supplemental group communication process.

6. Disagreements among individuals are so severe or politically unpalatable that the communication process must be referred and/or anonymity assured.

7. The heterogeneity of the participants must be preserved to assure the validity of the results (e.g., avoidance of domination by quantity or by strength of personality).

Instrument Reliability

Reliability of the instrument was established using the procedure developed by Hoyt and Stunkard (1952) and practiced later in studies which are similar in design to the present research (Halfin and Courtney, 1971; Lindahl, 1971; Miller, 1971; Stamps, 1979; Behroozian, 1981; Samahito, 1984; and Andreyka et al., 1979).

An estimate of the internal consistency of the scores which were judgmentally assigned by the respondents in the sample utilized analysis of variance, providing for a rather straightforward solution to the problem of establishing the reliability coefficient for unrestricted scoring items. There is one matrix, with 139 subjects, 16 competencies, and one response per cell. Schematically, the matrix for the reliability calculation is represented as follows:

Competencies			Subjects			
1	1	2	3	J		139
2	Y11	Y12	Y13	Y1J	Y1	139
3	Y21	Y22	Y23	Y2J	Y2	139
.	.					.
.	.					.
.	.					.
I	YI1	Y12	Y13	YIJ	YI	139
.	.	.	.	.		.
.	.	.	.	.		.
K	Yk1	Yk2	Yk3	YkJ	Yk	139
Total	Y.1	Y.2	Y.3	Y.J	Y.	139

A two-way analysis of variance produces sums of square values for subjects and items; the residual sum of squares is obtained by subtraction. The estimate of reliability is obtained according to the following formula:

$$r = \frac{\text{Mean Square Subjects minus Mean Square Residual}}{\text{Mean Square Subjects}}$$

Past research studies which have utilized the equal appearing interval scale for data collection in task analyses have resulted in scale reliabilities exceeding +0.90 (see Behroozian, 1981; Samahito, 1984; Soukup, 1984; and Burton, 1984).

The Sample

The sample for this study consisted of a randomly selected group of professional workers who were holders of the Ph.D or Ed.d. degrees. They represented the population of graduates who have matriculated from the Oregon State University School of Education. The subjects were restricted to those individuals who have been granted the degree between 1981 and the present. The use of factor analysis to assure valid data interpretation requires approximately ten (10) respondents per instrument item (Courtney, 1983); however, Kerlinger (1986) states that this is only a rule-of-thumb suggestion. Where the sample is drawn from a homogeneous population or sub-population, fewer subjects may be adequate to reduce error variance which is associated with the factor analysis process (Courtney, 1988). The sample for this study was drawn from a homogeneous setting; and the 139 responses were considered adequate to meet the sample size criterion.

Collection of Data

Data were collected by mailing a questionnaire (coded for identification and follow-up), with a stamped, self-addressed envelope, and explanatory letter to each respondent (Appendix E). All data were collected within a period of six (6) weeks.

Different methods of follow-up were used. Respondents who failed to respond within a two week period after the first mailing were sent a second letter and questionnaire. Those whose address indicated a local phone number (within Oregon and California) were contacted by telephone, and if contact was made, a second questionnaire with an explanatory note was sent. The final step in the data collection sequence was to check and code each returned questionnaire before entering the data into the computer for statistical analysis.

The Statistical Design

As previously stated, the purpose and research intent of this study was to identify clusters of tasks and competencies which are relevant to the adequacy of the professional performance of Ph.D. and Ed.D. holders following the granting of their degrees. Important to the curriculum aspects of the study were the groupings and the levels of importance which are deemed essential to the job roles as judged by professional workers in the field. The major statistical method which was utilized for the analysis of data was factor analysis, where the R-mode with varimax rotation was used as the vehicle for proving clusters of tasks. Factor analysis utilizes the following mathematical model:

$$Vt = Vco + Vsp + Ve$$

Where: Vt is the total variance,

Vco is the variance that two or more measures share in common,

Vsp is the variance which is specific to an individual measure, and

Ve is the variance attributed to error.

The criterion factor loading weight for inclusion of an item or competency into a cluster was initially set at .50, with the option of lowering or raising the level for purposes of maximizing item identity with the parent clusters. Tasks were clustered in a manner that accounted for the largest percentage of common factor variance using the varimax rotation method of control.

A supplemental analysis supporting the study's design included one-way analysis of variance comparisons for American and foreign students. The model utilized for this procedure was:

$$Yij = U + Ti + Eij$$

where U is an unknown constant,

Ti represents the type of student effect, and

Eij is the residual (error) effect (Steel and Torrie,1980, p. 149).

This analysis tested the hypothesis of no difference between the means of the two (2) groups ($\mu^1 = \mu^2$) for each of eighteen (18) variables, including two (2) demographic data items. The instrument is shown in Appendix D. The basis for rejection was considered at alpha = .05, where in each instance df = 1, 139. The assumption associated with homogeneity of variance was tested using the Bartlett test (See Appendix B).

CHAPTER III

RESULTS AND DISCUSSION

The analyses for the study utilized factor analysis, analysis of variance, and the Hoyt-Stunkard method for establishing reliability. A Chi-square test was used to analyze independence for grand means of rejected tasks. The assumption for homogeneity of variance was verified using the Bartlett's test.

Reliability of the Instrument

The sixteen (16) item instrument was tested for reliability using the Hoyt-Stunkard method. This procedure utilized analysis of variance to establish internal consistency reliability for the six-point scale. This procedure utilizes between-respondent variance and error variance to compute the correlation coefficient for reliability. It provides a straight forward solution to the problem of estimating the reliability coefficient for unrestricted scoring items. The reliability for the instrument was determined to be +0.90 where a sample of 50 randomly selected respondents were used in the analysis. This result indicated consistency of response across the sixteen (16) major variables of interest included in the study. The two (2) usage demographic scaled items were not utilized in this analysis. (See Table I for the reliability coefficient for the instrument.)

TABLE I

The Reliability Coefficient For The Instrument

SOURCE OF VARIATION	df	MS	r
Respondents	39	15.440	+0.90
Residual	600	1.511	
Total	639		

$$r = \frac{\text{MS Respondents} - \text{MS Residual}}{\text{MS Respondents}}$$

therefore,

$$r = \frac{15.440 - 1.511}{15.440} = +0.90$$

Results of Homogeneity of Variance Testing

The Bartlett test was utilized in ascertaining the homogeneity of variance for hypothesis tests for differences between means for foreign and American students. The results of the Bartlett tests showed that the assumption of homogeneity of variance was met for each of the eighteen (18) variables included in the study. The assumption was tested at the .05 probability level with 1 degree of freedom being the criterion for the analysis. The critical Chi-square value was 3.84 . Calculated

Bartlett values ranged from 1.001 to 1.011 for the variables tested. (Calculated Bartlett test results are shown in Appendix B)

Results of Hypothesis Testing

The study involved the description of sixteen (16) tasks and two (2) usage demographic variables. Hence, a total of eighteen (18) separate hypotheses was included in this part of the data analysis. A total of one hundred and thirty nine (139) respondents participated in the study and reacted to the six-point scale of the data inventory. Two groups (foreign and American) were sampled.

The mean values for the respondents ranged from a high of 5.205 to a low of 2.974 for the American group, where N=117. The foreign respondents (with a sample of 22) showed means which ranged from a high of 4.682 to a low of 3.182. Means for both groups are reported in Table II.

TABLE II

Results of Analysis of Variance
Testing for Differences Between Group Means (American and Foreign)*
(N = 139)

Task Number	Task Description	$\overline{X}..$	$\overline{X}_1$	$\overline{X}_2$	$S_{\bar{x}_1}$	$S_{\bar{x}_2}$	Computed F-Ratio	H_0 Decision	Conclusions
1	Apply DOS for accessing computer software	4.007	4.051	3.773	0.132	0.303	0.709	Retain	$\mu^1 = \mu^2$
2	Analyze data using a mainframe computer	3.698	3.709	3.636	0.144	0.331	0.041	Retain	$\mu^1 = \mu^2$
3	Use the personal computer as a word processor	5.043	5.205	4.182	0.101	0.234	16.16	Reject	$\mu^1 > \mu^2$
4	Match data with appropriate statistical techniques	4.568	4.624	4.273	0.134	0.308	1.095	Retain	$\mu^1 = \mu^2$
5	Use spreadsheet products	4.173	4.299	3.500	0.120	0.277	6.983	Reject	$\mu^1 > \mu^2$
6	Set up computer hardware, including I/O devices	3.007	2.974	3.182	0.137	0.317	0.361	Retain	$\mu^1 = \mu^2$
7	Analyze data on a personal computer using a statistical pkg.	4.482	4.521	4.273	0.134	0.309	0.545	Retain	$\mu^1 = \mu^2$
8	Use the personal computer in an electronic mail network	3.567	3.615	3.318	0.148	0.342	0.636	Retain	$\mu^1 = \mu^2$
9	Interpret statistical analyses from computer output	4.748	4.761	4.682	0.128	0.295	0.060	Retain	$\mu^1 = \mu^2$
10	Evaluate computer hardware for its capacity to do graphics	3.137	3.094	3.364	0.136	0.313	0.625	Retain	$\mu^1 = \mu^2$

TABLE II (Continued)

Results of Analysis of Variance
Testing for Differences Between Group Means (American and Foreign)*
(N = 139)

Task Number	Task Description	$\bar{X}..$	$\bar{X}_1$	$\bar{X}_2$	$S_{\bar{x}_1}$	$S_{\bar{x}_2}$	Computed F-Ratio	H_0 Decision	Conclusions
11	Evaluate the PC for its capacity to do statistical analyses	3.662	3.641	3.773	0.137	0.316	0.146	Retain	$\mu^1 = \mu^2$
12	Use database management systems to organize and share/merge data files for future reference	4.158	4.137	4.273	0.135	0.311	0.161	Retain	$\mu^1 = \mu^2$
13	Use graphics software programs to illustrate data output	3.856	3.838	3.856	0.137	0.317	0.115	Retain	$\mu^1 = \mu^2$
14	Utilize the personal computer for desktop publishing	4.058	4.000	4.364	0.142	0.326	1.045	Retain	$\mu^1 = \mu^2$
15	Use database management systems and word processing programs to process data and produce text files	4.273	4.197	4.682	0.126	0.291	2.340	Retain	$\mu^1 = \mu^2$
16	Understand DOS files, hierarchical directories, and path commands	3.540	3.487	3.818	0.141	0.326	0.867	Retain	$\mu^1 = \mu^2$
17	How important is computer usage to your present job?	4.302	4.427	3.636	0.133	0.307	5.594	Reject	$\mu^1 > \mu^2$
18	How important is statistical analysis to your job?	3.619	3.564	3.909	0.136	0.314	1.018	Retain	$\mu^1 = \mu^2$

* Group 1 is the mean for the American sample and Group 2 is the mean for the foreign sample.

The range of the overall mean values extended from a high of 5.043 to a low of 3.137. The highest mean was task number 3 (Use the personal computer as a word processor), and the lowest was task number 10 (Evaluate computer hardware for its capacity to do graphics). The overall means for all respondents are shown in Table II.

The distribution of the means tallied as follows: ten (10) of the means ranged between 4.00 and 5.04 and eight (8) were in the range between 3.856 and 3.137. No tasks were judged at less than 3.00. Standard errors ranged from 0.101 (American respondents for task 3) to 0.342 (foreign respondents for task 8). The standard errors for American respondents ranged from a low 0.101 to a high of 0.148; foreign respondents standard errors ranged from 0.234 to 0.342 (see Table II). A t-test for American and foreign samples showed that a significant difference existed between standard errors for the two groups at the .001 levels. Americans had overall standard errors which were significantly lower than for those of their foreign counterparts. This result suggests that the sample means for American respondents were better estimates of population values than were those means for the foreign group.

The five highest means highlighted the areas of using the computer as a word processor; database management systems to produce text files, and analyzing data on the personal computer using statistical package. The lowest were concerned with DOS files, evaluating computer hardware for its capacity to do graphics, and setting up hardware. Means for all tasks are shown in Table II. The results of the analysis of variance testing for eighteen (18) variables revealed the presence of significant differences between mean scores for American and foreign graduates for only three (3) null hypotheses. There was a significant difference between the American and foreign respondents on the following task numbers: three (3) (Use the personal computer as a word processor); five (5) (use spreadsheet products); item seventeen (17) (how important is statistical analysis to your job?). The null hypotheses for these three items were rejected. The remainder of the null hypotheses were retained with the analysis of variance results indicating no significant differences in the mean responses between the two groups.

The grand mean score for all sixteen (16) tasks was 3.999. These means are reported in Appendix C. In general, task mean scores were not rejected by the F-test. It was decided to analyze the low mean scores (those falling below 4.000 contrasted to those falling above 4.000) using the Chi-square test in order to determine the independence of these tasks. The hypothesis tested was that the proportion of mean scores above 4.000 and below 4.000 was independent as to whether the tasks were common, or differentiated. The results of this test indicated that proportions were not independent. The observed frequencies and results of this analysis are shown in Table III. This finding indicates that the grand mean scores for the common tasks were no more likely than the grand mean scores of the differentiated tasks to be greater than 4.000.

TABLE III

Results of Chi-Square Test, Showing The Number of Task Mean Scores Not Significantly Different as Indicated by The F-Test For Levels Above 4.000 And Below 4.000.

	# OF $\bar{X}$'s NOT SIGNF. DIFFERENT	# of $\bar{X}$'s SIGNF. DIFFERENT	TOTAL
$\bar{X}$ >4.000	7	3	10
$\bar{X}$ <4.000	8	0	8
TOTAL	15	3	18

$$\chi^2 = 1.125$$

Yates' correction formula was used for the Chi-Square analysis with (R-1)(C-1) = 1 degree of freedom and alpha = 0.05.

The table value of Chi-Square = 3.841.

The hypothesis is <u>retained</u>.

Results of Factor Analysis

The use of factor analysis to establish clusters of statistically-related computer tasks constituted the major analysis vehicle for the study. The R-mode clustered tasks according to respondent ratings on a 6-point scale for each of the sixteen (16) variables in the study.

A total of seven (7) factors (clusters) were generated through the R-mode process where the minimum factor loading was set at .54 . Fruchter (1955) classifies factor loadings of greater than .50 as being highly significant. The results of the analysis for the present data verified that all sixteen (16) task statements met Fruchter's criterion. No spurious tasks were necessary to the results and there were no overlapping tasks generated by the analysis (See Table IV).

Cluster titles were assigned to each of the seven factors and are assumed to reflect the nature of the tasks within each cluster. The seven (7) clusters included the following:

Factor I - Analyzing Statistical Data

Factor II - Database and Word Processing for Publishing

Factor III - Hardware Training

Factor IV - DOS Usage

Factor V - Mainframe Usage and Electronic Mail

Factor VI - Spreadsheets

Factor VII - Word Processing Software

(Table IV shows the specific results of the factor analysis, including mean scores for each of the sixteen (16) tasks.)

Factor I. Analyzing Statistical Data.

The first factor accounted for four (4) tasks statements with factor loadings ranging from a low of 0.561 for Task 11 (Evaluate the PC for its capacity to do statistical analyses) to a high of 0.874 for Task 9 (Interpret statistical analyses from computer output). This loading was the highest for all tasks studied. This cluster accounted for 47.6% of the common factor variance. (See Appendix F)

The overall means for Factor I ranged from a high of 4.748 for Task 9 (Interpret statistical analyses from computer output) to a low of 3.662 for Task 11 (Evaluate the PC for its capacity to do statistical analysis).

Factor II. Database and Word Processing for Publishing.

The second factor included a total of three (3) tasks. Factor loadings ranged from 0.546 to 0.832. The cluster accounted for 9.2% of the common factor variance. The overall means for this cluster ranged from 3.856 for Task 13 (Use graphics software programs to illustrate data output) to 4.273 for Task 15 (Use database management systems and word processing programs to process data and produce text files). The third task, number 14 (Utilize the personal computer for desktop publishing) had a mean of 4.058.

Factor III. Hardware Training.

Two (2) tasks clustered into Factor III. Factor loadings for these tasks were 0.867 for Task 6 (Set up computer hardware, including I/O devices) and 0.589 for Task 10 (Evaluate computer hardware for its capacity to do graphics). Factor III accounted for 6.5% of the common factor variance. The means for this factor were the lowest of any of the seven clusters generated by the factor analysis. Task 6 had a mean score of 3.007 while Task 10 carried a mean of 3.137.

Factor IV. DOS Usage.

A total of two (2) tasks clustered under Factor IV. Task 1 (Apply DOS for accessing computer software) had a factor loading of 0.867 and a mean of 4.007. The second task, number 18 (Understand DOS files, hierarchical directories, and PATH commands) carried a loading of 0.581 with a mean of 3.540. This cluster accounted for 5.4% of the common factor variance.

Factor V. Mainframe Usage and Electronic Mail.

Three (3) tasks clustered under this factor. Factor loadings were all positive and included 0.788 for Task 2 (Analyze data using a mainframe computer), 0.600 for Task 8 (Use the personal computer in an electronic mail network), and 0.548 for Task 12 (Use database management systems to organize and share/merge data files for future reference). Only Task 12 carried a mean greater than 4.000. Factor V accounted for 4.9% of the variance in the analysis.

Factor VI. Spreadsheet Software Usage.

Only one (1) task clustered on Factor VI. Task 5 (Use spreadsheet products), with a mean of 4.173, had a factor loading of 0.836. This cluster accounted for 4.2% of the variance in the factoring.

Factor VII. Word Processing Software Usage.

The last cluster countained only one (1) task with a mean of 5.043. This was the highest mean of all of those included in the study. Task 3 (Use the personal computer as a word processor) accounted for 4.0% of the common factor variance and had a factor loading of 0.788.

TABLE IV
Results of Factor (Cluster) Analysis

Factor 1 - Analyzing Statistical Data

Task Number	Task Description	$\overline{X}$	V_{co}
4	Match data with appropriate statistical techniques	4.568	0.870
7	Analyze data on a personal computer using a statistical pkg.	4.482	0.809
9	Interpret statistical analyses from computer output	4.748	0.874
11	Evaluate the PC for its capacity to do statistical analyses	3.662	0.561

Factor 2 - Data Base and Word Processing for Publishing and to process data.

Task Number	Task Description	$\overline{X}$	V_{co}
13	Use graphics software programs to illustrate data output	3.856	0.546
14	Utilize the personal computer for desktop publishing	4.058	0.832
15	Use database management systems and word processing programs to process data and produce text files	4.273	0.690

TABLE IV (Continued)
Results of Factor (Cluster) Analysis

Factor 3 - Hardware Training

Task Number	Task Description	$\overline{X}$	V_{co}
6	Set up computer hardware, including I/O devices	3.007	0.867
10	Evaluate computer hardware for its capacity to do graphics	3.137	0.589

Factor 4 - DOS Usage for Creating and Accessing Data Files

Task Number	Task Description	$\overline{X}$	V_{co}
1	Apply DOS for accessing computer software	4.007	0.755
16	Understand DOS files, hierarchical directories, and path commands	3.540	0.681

Factor 5 - Mainframe Usage and Electronic Mail

Task Number	Task Description	$\overline{X}$	V_{co}
2	Analyze data using a mainframe computer	3.698	0.788
8	Use the personal computer in an electronic mail network	3.567	0.600
12	Use database management systems to organize and share/merge data files for future reference	4.158	0.548

TABLE IV (Continued)
Results of Factor (Cluster) Analysis

Factor 6 - Spreadsheet Software Usage

Task Number	Task Description	$\overline{X}$	V_{co}
5	Use spreadsheet products	4.173	0.835

Factor 7 - Word Processing Software Usage

Task Number	Task Description	$\overline{X}$	V_{co}
3	Use the personal computer as a word processor	5.043	0.788

Common Factor Variance

Common factor variance is the sharing of variance by two or more tasks. In this sharing, tasks are correlated. Hence, they have some traits in common with each other. In other words, all tasks which cluster within a factor share some trait in common.

The cumulative percent of the common variance accounted for in the analysis totaled 100% when sixteen (16) factors were generated. For the present study, seven (7) factors accounted for the following percent of variance in the factor analysis. Table V presents the percent of variance for this study.

Table V. Percentage of Common Variance for the R-mode

Factor	Percentage of Variance
1	47.6
2	9.2
3	6.5
4	5.4
5	5.0
6	4.2
7	4.0

The pattern of common variance accountability structures itself in accord with the factor analysis model, which supports the adherence that the first cluster should account for the largest percent of common variance. Subsequent clusters should account for lesser percentages of the common factor variance. The present analysis substantiates the model's assumption regarding common factor variance (SPSS, Inc., p. 657). The pattern of the seven-factor common variance is depicted in Table V (Also see Figure 2).

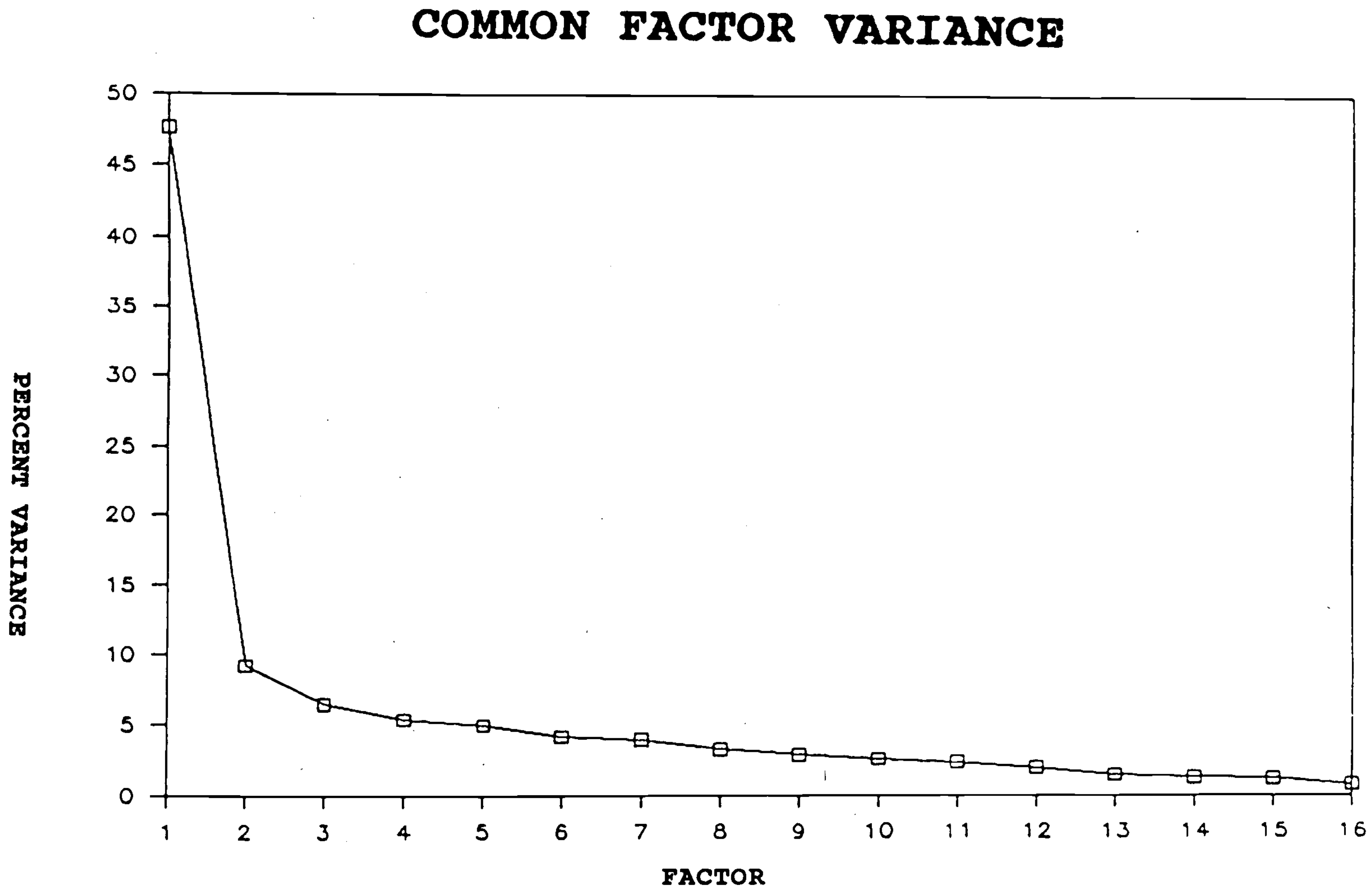

Figure 2 Common Factor Variance

CHAPTER IV

THE SUMMARY AND CONCLUSIONS

Restatement of the Problem

The main goal of this research study was to isolate a core of statistically-related computer application tasks necessary to the functional roles of graduates from doctoral programs with majors in Education. The study's focus was upon the job needs which are essential for performing the work roles into which Education graduates are placed after the completion of their degrees.

The Dependent Variable

The dependent variable in this research was a score which was judgmentally assigned by respondents in the sample to denote an assessment of the level of importance necessary to sixteen (16) statistically-related computer variables. Two (2) additional demographic usage variables were analyzed as supplementary items.

Reliability

The obtained Hoyt-Stunkard internal consistency reliability coefficient for respondents was determined to be +0.90 (See Table I). This result indicated that the ratio of error variance to total respondent variance was minimal. The qualitative reliability for the instrument was considered to be very high (Starmach and Courtney, 1986 p. 27).

Conclusions

The present research was designed to identify a core of statistically-related computer tasks necessary for doctoral students included in the population. Several procedures were utilized in ascertaining the program needs of this population.

The Hypothesis Testing

Analysis of variance was used to test for significance between American and foreign graduates. The results of this testing revealed a general pattern of similarity in task needs for the two groups (See Table II). The analysis rejected only two (2) of the sixteen primary tasks included in the survey. An additional demographic item relating to the importance of statistical analysis to the job was also rejected, with the American sample showing a higher mean score. At the same time, standard errors were significantly higher for the foreign group as evidenced by the t-test results. These differences may be speculated to have been different because of the size of the sample for the foreign group, which consisted of only twenty-two (22) respondents. These results do not suggest any significant differences between the way foreign and American students perceive their statistically-related computer needs. Therefore, it can be concluded that American and foreign students can be taught the same content, in common classrooms, with common computer hardware/ software, and in common laboratories.

Factor Analysis Conclusions

The use of factor analysis to establish clusters of statistically-related computer tasks constituted the major analysis vehicle for the study. The R-mode clustered tasks according to respondent ratings on a 6-point scale for each of the sixteen (16) variables in the study. A total of seven (7) factors (clusters) were generated through the R-mode process where the minimum factor loading was set at 0.54 (See Table IV). All of the loadings were positive, there were no spurious tasks, and all sixteen (16) tasks were accounted for through the analysis. Factor I contributed 47.6% of the common factor variance, other factors accounted for lesser accounts.

Implications

Implications consist of practical considerations which are forthcoming from both data analysis and literature review. In practice, the preparation of doctoral students has traditionally been one of providing a uniform training in educational experiences. To date, there has been no practical suggestions of differentiation in the educational process for foreign and American graduate students. This model provides a basis upon which the following implications can be drawn:

1. The data results show no significant difference in the way foreign and American doctoral graduates view their

computer needs, and therefore, both American and foreign students should be taught the same content, with the same emphasis, in the same classrooms and computer laboratories.

2. The resultant clusters can be organized into course content which are relevant to a doctoral level curriculum and, subsequently, to the professional needs of these students.

3. A common core of skills and experiences form the knowledge base for occupational entry (Centripetal model). Therefore, based on the data collected from this sample, a basis for curriculum planning may be derived for such a common core of skills and knowledge.

4. These results may serve as a source of formulating a sequence of performance-based objectives and instructional strategies for doctoral program instruction. (see Appendix G)

5. The procedural results of this study have verified the use of the curriculum model for purposes of content identification and instructional planning. It is recommended that the model which was utilized in the present research be applied to future curriculum development activities at the doctoral level. (see Appendix H)

Suggestions for Further Study

The following suggestions for expanding the research in this area are made on the basis of the findings and conclusions of this study:

1. The present research ought to be replicated with the inclusion of related populations, not just those majoring in Education.

2. The sample should be expanded to include respondents from other institutions which are located in other states.

3. The sample size needs to be increased to verify all of the statistical findings.

4. Other demographic data should be collected to determine if such characteristics as gender, age, and number of years in a profession influence these factors. A multiple regression analysis is recommended for such a study.

5. Cognitive levels of tasks assessed in this study should be identified for purposes of curriculum planning. In a future research effort, assessment of cognitive domain aspects is suggested.

6. In a future study, the repondents should be asked to rank or prioritize the various tasks in order of importance in their positions.

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APPENDICES

APPENDIX A

Letters to Delphi Panel with Each Iteration of Instrument

School of Education
OSU WOSC

A merged School serving Oregon State University and Western Oregon State College with graduate and undergraduate programs in Education.

October 22, 1987

TO: Charles Carpenter
Kenneth Ahrendt
Cynthia Yee
Lance Haddon
Wayne Courtney
Terry Wood

Redacted for Privacy

FROM: Ewa M. Starmach

Thank you for agreeing to serve as a DELPHI panelist for the study which we are conducting to identify competencies and tasks for statistically related computer application needs of doctoral level students. Your input will serve as a major contribution to the existing research information in this topic area. The major purpose of the DELPHI process is to determine the content and format for the collection of data from our graduates. The results will be critical to future curriculum as we revise courses and content for the planned conversion to a semester-based calendar at Oregon State University.

The DELPHI technique suggests that you react individually and independently from the other panelists. I will serve as the liaison for the work and will provide each of you with feedback along the way. It is anticipated that only two or three iterations will be required before consensus is gained for the job at hand. Consensus among the panel members will be considered complete when 80% of you agree on the content for the instrument.

The initial job for the panel members is to assess, evaluate, and, if necessary, to modify the attached list of tasks which are to be considered for inclusion in the instrument (questionnaire) to be mailed to samples of doctoral degree holders. Your instructions on this matter are to take each of the listed tasks and either RETAIN, REJECT, or MODIFY its content according to your judgement of acceptability. A second instrument (revised and based upon the first iteration) will be forwarded to you for review at a later date.

Thanks again for agreeing to work with me on this matter. I look forward to our mutual interactions.

Department of Foundations and Educational Specialties
OSU Campus: Education Hall, Room 423 · Corvallis, Oregon 97331 · (503) 754-3648

APPLIED COMPUTER NEEDS STUDY

DELPHI (ROUND ONE)

DIRECTIONS: THE MAJOR OBJECTIVE OF THE DELPHI PROCEDURE IS TO DETERMINE THE ITEMS (TASKS) WHICH ARE TO BE INCLUDED IN THE SURVEY QUESTIONNAIRE. IN ESSENCE, THE PANEL MEMBERS HAVE AS THEIR ROLE THE ESTABLISHMENT OF CONTENT VALIDITY FOR THE INSTRUMENT. THUS, FOR EACH OF THE TASKS, YOU ARE ASKED TO PLACE A CHECK-MARK BENEATH EACH STATEMENT TO INDICATE WHETHER YOU RETAIN OR REJECT THE ITEM AS A PART OF THE FINAL QUESTIONNAIRE. IF YOU WISH TO RETAIN THE ITEM ONLY AFTER IT IS MODIFIED, REWRITE THE TASK IN THE SPACE WHICH IS PROVIDED.

PLEASE ACCEPT MY SINCERE APPRECIATION FOR YOUR INPUT IN THIS MATTER. SHOULD YOU HAVE ANY QUESTIONS REGARDING THIS ASSIGNMENT, PLEASE CALL ME AT EXTENSION 3648 OR MY HOME NUMBER (745-5674).

ROUND ONE (DELPHI)

1.) USE AND MAINTAIN COMPUTER HARDWARE.

RETAIN ______ REJECT ______ REVISE AS FOLLOWS:

____

2.) APPLY DOS FOR ACCESSING STATISTICAL SOFTWARE.

RETAIN ______ REJECT ______ REVISE AS FOLLOWS:

____

3.) ANALYZE DATA USING A MAINFRAME COMPUTER.

RETAIN ______ REJECT ______ REVISE AS FOLLOWS:

____

4.) ANALYZE DATA USING A PERSONAL COMPUTER.

RETAIN ______ REJECT ______ REVISE AS FOLLOWS:

____

5.) UNDERSTAND PROGRAMMING IN SETTING UP THE COMPUTER FOR DATA ANALYSIS.

RETAIN ______ REJECT ______ REVISE AS FOLLOWS:

____

____

6.) INTERPRET COMPUTER OUTPUT IN STATISTICAL ANALYSIS.

RETAIN ______ REJECT ______ REVISE AS FOLLOWS:

____

7.) USE THE PERSONAL COMPUTER AS A WORD PROCESSOR.

RETAIN ______ REJECT ______ REVISE AS FOLLOWS:

____

8.) Utilize downloading in accessing software.

RETAIN ______ REJECT ______ REVISE as follows:

____

9.) Evaluate printers for capability to do graphics.

RETAIN ______ REJECT ______ REVISE as follows:

____

10.) Match data with appropriate statistical techniques.

RETAIN ______ REJECT ______ REVISE as follows:

____

11.) Select PC computer hardware.

RETAIN ______ REJECT ______ REVISE as follows:

____

12.) Use mainframe computers.

RETAIN ______ REJECT ______ REVISE as follows:

____

13.) Use spreadsheet products.

RETAIN ______ REJECT ______ REVISE as follows:

____

14.) Service and/or repair computer hardware.

RETAIN ______ REJECT ______ REVISE as follows:

____

15.) ORGANIZE AND STORE DATA FILES FOR FUTURE REFERENCE.

RETAIN ______ REJECT ______ REVISE AS FOLLOWS:

____

16.) USE GRAPHIC TECHNIQUES TO ILLUSTRATE DATA OUTPUT.

RETAIN ______ REJECT ______ REVISE AS FOLLOWS:

____

17.) EVALUATE THE ACCESSIBILITY AND SPEED LIMITATIONS FOR AVAILABLE HARDWARE.

RETAIN ______ REJECT ______ REVISE AS FOLLOWS:

____

____

18.) EVALUATE THE ACCESSIBILITY AND SPEED LIMITATIONS FOR AVAILABLE SOFTWARE.

RETAIN ______ REJECT ______ REVISE AS FOLLOWS:

____

____

19.) (SUGGESTED ADDITIONAL ITEM).______________________

____

____

20.) (SUGGESTED ADDITIONAL ITEM).______________________

____

____

School of Education
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NOVEMBER 6, 1987

TO: CHARLES CARPENTER
KENNETH AHRENDT
CYNTHIA YEE
LANCE HADDON
WAYNE COURTNEY
TERRY WOOD

Redacted for Privacy

FROM: EWA M. STARMACH

EACH OF YOU HAVE NOW REACTED TO THE FIRST ROUND OF THE DELPHI PROCEDURE IN IDENTIFYING STATISTICALLY RELATED COMPUTER APPLICATION TASKS AND COMPETENCIES OF DOCTORAL LEVEL STUDENTS. ATTACHED IS THE ROUND TWO LISTING, WHICH INCLUDES THOSE ITEMS WHICH HAVE BEEN REVISED BY PANEL MEMBERS DURING ROUND ONE.

FOR EACH OF THESE REVISED OR ADDED ITEMS, PLEASE EITHER REJECT, RETAIN, OR REVISE THEM AS YOU DID IN ROUND ONE.

IT IS ANTICIPATED THAT NOT MORE THAN THREE ROUNDS WILL BE REQUIRED FOR COMPLETION OF THE TASK AND COMPETENCY LISTING. PLEASE ACCEPT MY VERY SINCERE APPRECIATION FOR ASSISTING ME ON THIS PROJECT AS A DELPHI PANEL MEMBER. I MAY BE REACHED AT EXTENSION 3648 OR AT MY HOME PHONE (745-5674) IF YOU SHOULD NEED TO DO SO.

Department of Foundations and Educational Specialties
OSU Campus: Education Hall, Room 423 · Corvallis, Oregon 97331 · (503) 754-3648

APPLIED COMPUTER NEEDS STUDY

ROUND TWO (DELPHI)

DIRECTIONS: THE TASKS WHICH ARE INCLUDED BELOW REPRESENT STATEMENTS WHICH WERE EITHER REVISED OR SUBMITTED AS NEW ITEMS FROM THE FIRST DELPHI ROUND. AS YOU DID IN THE FIRST ROUND, PLEASE RETAIN, REJECT, OR MODIFY EACH OF THE STATEMENTS IN THE SPACE PROVIDED.

1.) USE AND SET UP COMPUTER HARDWARE, INCLUDING INPUT/OUTPUT DEVICES.

RETAIN ______ REJECT ______ REVISE AS FOLLOWS:

____

4.) ANALYZE DATA USING A STATISTICS PACKAGE ON A PERSONAL COMPUTER.

RETAIN ___✓___ REJECT ______ REVISE AS FOLLOWS:

____

5.) UNDERSTAND PROGRAMMING SUFFICIENTLY TO SET UP AND USE DATA ANALYSIS SOFTWARE.

RETAIN ___✓___ REJECT ______ REVISE AS FOLLOWS:

____

6.) INTERPRET STATISTICAL ANALYSES FROM COMPUTER OUTPUT.

RETAIN ___✓___ REJECT ______ REVISE AS FOLLOWS:

____

9.) EVALUATE COMPUTER HARDWARE FOR ITS CAPACITY TO DO GRAPHICS.

RETAIN ___✓___ REJECT ______ REVISE AS FOLLOWS:

____

11.) EVALUATE PC COMPUTER HARDWARE FOR ITS CAPACITY TO PERFORM STATISTICAL ANALYSIS.

RETAIN ✓ REJECT ______ REVISE AS FOLLOWS:

____

15.) USE DATA BASE MANAGEMENT SYSTEMS TO ORGANIZE AND SHARE DATA FILES FOR FUTURE REFERENCE.

REJECT ______ RETAIN ✓ REVISE AS FOLLOWS:

____

____

16.) USE GRAPHICS SOFTWARE PROGRAMS TO ILLUSTRATE DATA OUTPUT.

REJECT ______ RETAIN ✓ REVISE AS FOLLOWS:

____

17.) EVALUATE THE ACCESSIBILITY AND SPEED LIMITATIONS FOR AVAILABLE HARDWARE AND SOFTWARE TO PERFORM STATISTICAL ANALYSES.

REJECT ______ RETAIN ✓ REVISE AS FOLLOWS:

____

____

19.) USE DATA BASE MANAGEMENT SYSTEMS AND WORD PROCESSING PROGRAMS CONCURRENTLY TO PROCESS DATA AND TEXT FILES.

REJECT ______ RETAIN ✓ REVISE AS FOLLOWS:

____

____

20.) UNDERSTAND DOS FILES, HIERARCHIAL DIRECTORIES, BATCH FILES, AND PATH COMMANDS.

REJECT ______ RETAIN __✓__ REVISE AS FOLLOWS:

____

____

21.) SELECT APPROPRIATE SOFTWARE FOR THE PURPOSE OF STATISTICAL ANALYSIS.

REJECT ______ RETAIN __✓__ REVISE AS FOLLOWS:

____

____

School of Education

Oregon State University

Corvallis, Oregon 97331

NOVEMBER 16, 1987

TO: CHARLES CARPENTER
KENNETH AHRENDT
CYNTHIA YEE
LANCE HADDON
WAYNE COURTNEY
TERRY WOOD

FROM: EWA M. STARMACH

EACH OF YOU HAS NOW REACTED TO THE SECOND ROUND OF THE DELPHI PROCEDURE IN IDENTIFYING STATISTICALLY RELATED COMPUTER APPLICATION TASKS AND COMPETENCIES OF DOCTORAL LEVEL STUDENTS. ATTACHED IS THE ROUND THREE LISTING, WHICH INCLUDES THOSE ITEMS WHICH HAVE BEEN RETAINED BY PANEL MEMBERS DURING THE FIRST TWO ROUNDS.

PLEASE EVALUATE EACH OF THE ITEMS INCLUDED ON THE ATTACHED INSTRUMENT IN TERMS OF <u>IMPORTANCE</u>, AS YOU PERCEIVE IT, FOR INCLUSION INTO A DOCTORAL LEVEL PROGRAM OF WORK, BASED UPON ITS NEED IN THE FIELD.

THE NEEDS SCALE FOR YOUR RESPONSES IS AS FOLLOWS:

6 - CONSIDERED TO BE EXTREMELY IMPORTANT IN NEED
5 - CONSIDERED TO BE VERY IMPORTANT IN NEED
4 - CONSIDERED TO BE IMPORTANT IN NEED
3 - CONSIDERED TO BE OF SOME IMPORTANCE IN NEED
2 - CONSIDERED TO BE OF LITTLE IMPORTANCE IN NEED
1 - CONSIDERED TO BE UNIMPORTANT IN NEED

IT IS ANTICIPATED THAT THIS WILL BE THE LAST ROUND WHICH IS REQUIRED FOR COMPLETION OF THE TASK AND COMPETENCY LISTING. IF YOU SEE ANY PROBLEMS WITH THE INSTRUMENT IN TERMS OF ITS FORMAT OR STRUCTURE FOR USE IN THE FIELD, PLEASE MAKE IT KNOWN BY INSERTING CORRECTIONS ON THE PAGES THEMSELVES.

PLEASE ACCEPT MY VERY SINCERE APPRECIATION FOR ASSISTING ME ON THIS PROJECT AS A DELPHI PANEL MEMBER. I MAY BE REACHED AT EXTENSION 3648 OR AT MY HOME PHONE (745-5674) IF YOU SHOULD NEED TO DO SO.

APPLIED COMPUTER NEEDS STUDY

ROUND THREE (DELPHI)

DIRECTIONS: PLEASE EVALUATE EACH OF THE FOLLOWING TASKS IN ACCORDANCE WITH YOUR PERCEPTION OF ITS IMPORTANCE FOR INCLUSION INTO A DOCTORAL LEVEL GRADUATE CURRICULUM IN THE FIELD OF EDUCATION.

	VERY UNIMPORTANT					VERY IMPORTANT
1. APPLY DOS FOR ACCESSING COMPUTER SOFTWARE	1	2	3	4	5	6
2. ANALYZE DATA USING A MAINFRAME COMPUTER.	1	2	3	4	5	6
3. USE THE PERSONAL COMPUTER AS A WORD PROCESSOR	1	2	3	4	5	6
4. MATCH DATA WITH APPROPRIATE STATISTICAL TECHNIQUES.	1	2	3	4	5	6
5. USE SPREADSHEET PRODUCTS. . . .	1	2	3	4	5	6
6. USE AND SET UP COMPUTER HARDWARE, INCLUDING INPUT AND OUTPUT DEVICES.	1	2	3	4	5	6
7. ANALYZE DATA ON A PERSONAL COMPUTER USING A STATISTICAL PACKAGE	1	2	3	4	5	6
8. UNDERSTAND PROGRAMMING SUFFICIENTLY TO SET UP AND USE DATA ANALYSIS SOFTWARE. . .	1	2	3	4	5	6
9. INTERPRET STATISTICAL ANALYSES FROM COMPUTER OUTPUT	1	2	3	4	5	6

	VERY UNIMPORTANT					VERY IMPORTANT
10. EVALUATE COMPUTER HARDWARE FOR ITS CAPACITY TO DO GRAPHICS. . .	1	2	3	4	5	6
11. EVALUATE PC COMPUTER FOR ITS CAPACITY TO PERFORM STATISTICAL ANALYSES	1	2	3	4	5	6
12. USE DATABASE MANAGEMENT SYSTEMS TO ORGANIZE AND SHARE DATA FILES FOR FUTURE REFERENCE.	1	2	3	4	5	6
13. USE GRAPHICS SOFTWARE PROGRAMS TO ILLUSTRATE DATA OUTPUT.	1	2	3	4	5	6
14. EVALUATE THE ACCESSIBILITY AND SPEED LIMITATIONS FOR AVAILABLE HARDWARE AND SOFTWARE TO PERFORM STATISTICAL ANALYSES	1	2	3	4	5	6
15. USE DATABASE MANAGEMENT SYSTEMS AND WORD PROCESSING PROGRAMS TO PROCESS DATA AND PRODUCE TEXT FILES . . .	1	2	3	4	5	6
16. UNDERSTAND DOS FILES, HIERARCHICAL DIRECTORIES, BATCH FILES, AND PATH COMMANDS	1	2	3	4	5	6

ADDITIONAL INFORMATION WHICH YOU FEEL WOULD IMPROVE THE INSTRUMENT AS A DATA-GATHERING DEVICE.

____

____

____

____

APPENDIX B

Homogeneity of Variance Test Results

HOMOGENEITY OF VARIANCE TEST RESULTS

(BARTLETT'S TEST)

TASKS (Variables)	CALCULATED VALUES
1	1.007
2	1.011
3	1.008
4	1.000
5	1.001
6	1.009
7	1.001
8	1.011
9	1.001
10	1.000
11	1.005
12	1.007
13	1.006
14	1.020
15	1.003
16	1.007
17	1.003
18	1.003

Critical χ^2, where df=1, $\alpha = .05$, $\chi^2 = 3.84$

APPENDIX C

Overall Means by Variable

OVERALL MEANS BY VARIABLE

VARIABLE NUMBER	$\bar{X}_{..}$
1	4.007
2	3.698
3	5.043
4	4.568
5	4.173
6	3.007
7	4.482
8	3.568
9	4.748
10	3.137
11	3.662
12	4.158
13	3.856
14	4.058
15	4.273
16	3.540

GRAND MEAN = 3.999

APPENDIX D

Final Version of Instrument

SURVEY OF COMPUTER/STATISTICAL NEEDS

PLEASE PROVIDE US WITH THE FOLLOWING DEMOGRAPHICS:

YEAR THE DOCTORATE WAS AWARDED ____________

NUMBER OF YEARS IN YOUR PRESENT POSITION _____

MY PRESENT POSITION IS PREDOMINANTLY:

_______ ADMINISTRATIVE

_______ INSTRUCTIONAL

_______ RESEARCH

_______ CONSULTING

TITLE OF YOUR PRESENT POSITION:___________________________

____.

	VERY UNIMPORTANT					VERY IMPORTANT
HOW IMPORTANT IS COMPUTER USAGE TO YOUR PRESENT JOB	1	2	3	4	5	6
HOW IMPORTANT IS STATISTICAL ANALYSIS TO YOUR JOB	1	2	3	4	5	6

ID CODE______

SURVEY OF APPLIED COMPUTER/STATISTICAL NEEDS

DIRECTIONS: PLEASE EVALUATE EACH OF THE FOLLOWING TASKS IN ACCORDANCE WITH YOUR PERCEPTION OF ITS IMPORTANCE FOR INCLUSION IN A DOCTORAL PROGRAM IN THE FIELD OF EDUCATION.

	VERY UNIMPORTANT					VERY IMPORTANT
1. APPLY DOS FOR ACCESSING COMPUTER SOFTWARE	1	2	3	4	5	6
2. ANALYZE DATA USING A MAINFRAME COMPUTER.	1	2	3	4	5	6
3. USE THE PERSONAL COMPUTER AS A WORD PROCESSOR	1	2	3	4	5	6
4. MATCH DATA WITH APPROPRIATE STATISTICAL TECHNIQUES. . . .	1	2	3	4	5	6
5. USE SPREADSHEET PRODUCTS. . .	1	2	3	4	5	6
6. SET UP COMPUTER HARDWARE, INCLUDING INPUT AND OUTPUT DEVICES	1	2	3	4	5	6
7. ANALYZE DATA ON A PERSONAL COMPUTER USING A STATISTICAL PACKAGE	1	2	3	4	5	6
8. USE THE PERSONAL COMPUTER IN AN ELECTRONIC MAIL NETWORK	1	2	3	4	5	6
9. INTERPRET STATISTICAL ANALYSES FROM COMPUTER OUTPUT	1	2	3	4	5	6
10. EVALUATE COMPUTER HARDWARE FOR ITS CAPACITY TO DO GRAPHICS.	1	2	3	4	5	6
11. EVALUATE THE PC FOR ITS CAPACITY TO DO STATISTICAL ANALYSES.	1	2	3	4	5	6
12. USE DATABASE MANAGEMENT SYSTEMS TO ORGANIZE AND SHARE/MERGE DATA FILES FOR FUTURE REFERENCE.	1	2	3	4	5	6
13. USE GRAPHICS SOFTWARE PROGRAMS TO ILLUSTRATE DATA OUTPUT	1	2	3	4	5	6
14. UTILIZE THE PERSONAL COMPUTER FOR DESKTOP PUBLISHING.	1	2	3	4	5	6
15. USE DATABASE MANAGEMENT SYSTEMS AND WORD PROCESSING PROGRAMS TO PROCESS DATA AND PRODUCE TEXT FILES. . . .	1	2	3	4	5	6
16. UNDERSTAND DOS FILES, HIERARCHICAL DIRECTORIES, AND PATH COMMANDS	1	2	3	4	5	6

CODE #_____

APPENDIX E

Letter to Respondents

School of Education
OSU WOSC

A merged School serving Oregon State University and Western Oregon State College with graduate and undergraduate programs in Education.

DECEMBER 2, 1987

DR. ARNOLD ABRAMS
2100 VALLEYVIEW
ASHLAND, OREGON 97520

DEAR ARNIE:

GREETINGS FROM CORVALLIS! IT SEEMS LIKE A LONG TIME AGO WHEN YOU WERE HERE, BUT WE ARE SURE THAT YOU REMEMBER THE PLACE. IN ANY EVENT, WE ARE NOW SEEKING THE ASSISTANCE OF OUR GRADUATES AS THE UNIVERSITY MOVES TOWARD A CONVERSION OF OUR ACADEMIC CALENDAR FROM A QUARTER TO A SEMESTER SYSTEM. EACH OF THE DOCTORAL LEVEL COURSES WHICH IS BEING OFFERED WITHIN THE SCHOOL OF EDUCATION IS UNDERGOING SCRUTINY AND REASSESSMENT FOR PURPOSES OF DEFINING RELEVANCE OF CONTENT. THIS PROCESS NECESSITATES THAT WE ASK PROFESSIONALS IN THE FIELD TO HELP US IDENTIFY THE CURRICULUM NEEDS, BASED ON EXPERIENCES IN THE WORKPLACE. WE ARE MAKING EVERY EFFORT TO INCLUDE THOSE SKILLS AND PRACTICAL CONTENT WHICH ARE CONSIDERED AS BEING ESSENTIAL TO THE JOB FOR A PERSON HOLDING THE ADVANCED DEGREE IN EDUCATION.

ATTACHED IS A REACTION FORM WHICH WE FIND NECESSARY TO OUR ASSESSMENT OF THESE NEEDS. WE ARE LOOKING SPECIFICALLY AT THOSE COMPUTER AND STATISTICALLY-APPLIED SKILLS AND ABILITIES WHICH ARE NECESSARY TO THE DEGREE. THERE ARE A TOTAL OF SIXTEEN TASKS TO BE EVALUATED. THE SCALE IS A SIX POINT CONTINUOUS MEASURE OF EACH TASK WHICH ASSESSES THE IMPORTANCE LEVEL AS YOU PERCEIVE IT TO BE RELEVANT TO A DOCTORAL LEVEL PROGRAM IN EDUCATION.

A SELF-ADDRESSED STAMPED ENVELOPE IS ENCLOSED FOR YOUR CONVENIENCE IN RETURNING YOUR RESPONSE. COULD YOU GET THIS BACK TO US WITHIN A WEEK, NOT LATER THAN DECEMBER 14TH? BECAUSE YOU ARE A RANDOMLY SELECTED SAMPLE MEMBER, YOUR RESPONSE IS ESSENTIAL TO OUR CAUSE.

WITH SINCERE APPRECIATION,

E. W. COURTNEY	E. M. STARMACH
Redacted for Privacy	Redacted for Privacy
PROJECT ADVISER	PROJECT DIRECTOR

APPENDIX F

PRINCIPAL COMPONENTS ANALYSIS

PRINCIPAL COMPONENTS ANALYSIS

Component Number	Percent of Variance	Cumulative Percentage
1	47.64318	47.64318
2	9.18402	56.82720
3	6.52907	63.35627
4	5.44459	68.80085
5	4.95565	73.75650
6	4.24159	77.99810
7	4.02159	82.01969
8	3.27950	85.29919
9	2.87575	88.17494
10	2.64388	90.81882
11	2.35173	93.17056
12	1.98587	95.15642
13	1.48634	96.64276
14	1.31032	97.95309
15	1.23718	99.19027
16	0.80973	100.00000

When the cumulative percentage reaches 80%, the correct number of clusters has been established.

Appendix G

Means Ranked by Importance

Means Ranked By Importance

Rank	Task #	Description	Mean
1	3	PC Wordprocessing	5.043
2	9	Interpret Stat Analysis	4.748
3	4	Match Data/Stat Tech.	4.568
4	7	Analyze Data w/ Stat Pkg	4.482
5	15	Use DBMS & WP-Text Proc	4.273
6	5	Use Spreadsheets	4.173
7	12	Using Data Base Mgmt	4.158
8	14	Use PC for Desktop Publ.	4.058
9	1	Use DOS with Software	4.007
10	13	Using Graphics SW	3.856
11	2	Use Mainframe CPU	3.698
12	11	Hardware for Stat Anal.	3.662
13	8	PC w/Electr. Mail	3.567
14	16	Understand DOS Files	3.540
15	10	Hardware for Graphics	3.137
16	6	Set up PC Hardware	3.007

Appendix H

Model for Curricular Change

Model for Curricular Change