Factor Dimensions of the Leadership Opinion Questionnaire for Nursing Students

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FACTOR DIMENSIONS OF THE LEADERSHIP OPINION QUESTIONNAIRE

FOR NURSING STUDENTS

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Abstract: The purpose of this study was to develop factor dimensions
and scale the Fleishman Leadership Opinion Questionnaire according
to responses of nursing students enrolled in Associate Degree Nursing
and Bachelor of Science Nursing Programs.   Validity of the Fleishman
scales, consideration and structure, for student nurses was tested
using factor analytic techniques.   Best results were based on clarity
of factor pattern loadings for 2 factor VARIMAX rotated solutions
from bounded raw data and covariance matrices.   Both methods showed
13 of 20 items recommended by Fleishman loaded as Fleishman structure
items and 12 of 20 loaded as Fleishman consideration items.   Kaiser's
measure of overall sampling adequacy for these nursing student data
varied between .72 and .97 at the item level.   Reliability analysis
produced satisfactory reliabilities for composite estimates based

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on non-Fleishman algorithms. Generalized results suggest that nursing

students exhibit specific patterns of leadership attributes somewhat

different from the attributes suggested by Fleishman's algorithms.

Further research is recommended.

Background for the Study

Reports on the use of the Leadership Opinion Questionnaire (LOQ) for

study of leadership styles of student nurses have been shown to be limited

(Walters, Wilmoth, Pitts, 1987). Nevertheless, there was an attempt to

use the LOQ in a previous study in an attempt to measure "structure" and

"consideration" dimensions of leadership style of student nurses in Bachelor

of Science in Nursing (BSN) and Associate Degree in Nursing (ADN) Programs.

That previous study was based on reports of successful use of the instrument

in a variety of different organizational contexts: business, industrial,

educational (leadership), hospital, nursing, research and developmental,

military, and governmental. Further, there were also reports of successful

use with female groups at the college level (Adams & Hicks, 1978; DeJulio,

Larson, Dever, & Paulman, 1984).

The literature left open the possibility that there were problems

with its application in some studies even though the LOQ had been applied

to a number of research situations. Researchers in some instances either

modified the items (Duxbury, Armstrong, Drew, & Henly, 1984) or used only

a sample of the items on the two scales (Tucker, 1983). Such adjustments

to the LOQ were undertaken without explanation. Other researchers (Baker,

1975; DeJulio, et al., 1984) did not report internal consistency

reliabilities for the LOQ determined for the samples, perhaps they assume

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that the Fleishman reliabilities generalized to the populations studied, or because the reliabilities determined for the focal groups were very different from those reported by Fleishman. On the other hand, many researchers reported assumed appropriateness of the LOQ because of its purported self-report format, its ability to discriminate between two leadership dimensions (consideration and structure), its acceptable Fleishman standardized reliabilities and validities, and its extensive application for the LOQ determined for their samples, perhaps because they assumed that the Fleishman reliabilities to normative data (Stun, Homer, & Boal, 1981). Analyses of student nurse data in the Walters, et al. (1987), study did not support application of the LOQ to their population of nursing students. Although Fleishman's algorithms for scaling and aggregating item data were followed precisely, singularity of the correlation matrix prevented meaningful validation of the LOQ for measuring leadership attitudes of nursing students. Reliability analyses produced negative values for every computed reliability suggesting the LOQ to be an unsuitable measure of opinions about leadership for the nursing student sample.

Some reports of previous research claimed the LOQ to have potential for broad application in assessment and description of college student leaders but failed to substantiate its application with reliability and validity analyses for the populations studied. Some reports demonstrated absence of sex bias with the LOQ; others demonstrated it to discriminate between leaders and non-leaders; and still others provided some evidence of its potential use in leader selection, and placement or training of students. Walters, et al. (1987), recommended that future investigations be continued with consideration for the need thoroughly to examine

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reliability and validity properties of the instrument for the groups measured. In the present study, the authors began at the beginning with a complete reevaluation of factor structure and scale properties of the LOQ for nursing students.

Many nursing programs, the greatest majority at the baccalaureate level, offer a management course during the last quarter prior to the preceptorship. The purpose of including principles of management in undergraduate nursing programs is two fold: (a) to foster the development of leadership styles, and (b) to develop perception of self as a leader. This rationale served as the basis for investigating leadership attributes of student nurses in this study. For defining leadership attributes in nursing students, the instrument of choice is the LOQ because of its variety of applications in the literature.

Purpose

The specific objectives for the study, formulated as research questions were:

1. Do nursing students in Associate Degree Nursing (ADN) and Bachelor of Science in Nursing (BSN) programs exhibit specific patterns of leadership attributes?

2. How does the factor structure of leadership attributes in nursing students differ from the population on which the factor structure was defined by Fleishman?

3. What are the reliabilities of the principal items forming the factor scales for nursing students?

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Method

Subjects

Students in two nursing programs in demographically similar (adjacent) communities volunteered as subjects. There were 40 university BSN students, 13 junior college ADN students, and 46 (1986) and 31 (1987) junior BSN students. All 130 questionnaires were usable. All students signed consent forms under policy established by the educational institutions involved. Anonymity was protected through use of a numbering scheme. Demographic characteristics of the sample included: (a) both male and female, (b) both married and single, (c) previously and not previously employed with job titles of nursing assistant and registered nurse, (d) age ranging between 21 and 31 years, and (e) grade point averages between 2.30 and 3.90. Only four students had a previous college course in either nursing management or leadership.

Instrument

The LOQ was utilized as a method for modeling leadership perceptions in nursing students. It is purported to be a valid measurement scale used for analyzing leadership style and dimensioned on structure and consideration (Fleishman and Harris, 1962, cited in Duxbury). Both dimensions are relevant to managerial effectiveness.

Consideration was defined as the ability to maintain mutual trust, respect, warmth, and introspect into the feelings of subordinates. An individual with a high score on the consideration scale was presumed able to establish communication and rapport with subordinates. On the other hand, a low score was believed to indicate an impersonal manager within group settings, Structure was defined by Fleishman (1969) as the extent

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by which individuals design and define their roles and the roles of those around them. The primary drive in the structure mode was proposed to be goal attainment for organizational purposes.

DeJulio, et al. (1984) suggested use of ". . . the LOQ . . . where feedback concerning personal attitudes toward leadership may be of particular benefit to persons entering into occupations requiring managerial and leadership role functions." The LOQ was claimed to measure general leadership capacity in contexts other than business and industry. Prospective nurses would seem to require managerial and leadership skills; therefore, it was natural to select the LOQ as an appropriate instrument for this situation. But, reliability dsta were not reported for use of the LOQ with the student groups.

In an earlier study (Walters, et al., 1987), student responses on selected items as recommended by Fleishman were recoded for scaling into the two Fleishman scales: structure and consideration. The validity of those scales for many of the same nursing students at that time was tested with factor analytic techniques. Inter-item consistency and split-half (odd-even) reliabilities were computed for all 40 items and for the consideration and structure subscales. Had the tests materialized as expected, additional descriptive data would have been calculated for characterizing leadership attributes of nursing students. However, measurement problems with the LOQ interfered with pursuing that goal.

The first problem at that time occurred in defining constructs to establish construct validity of the LOQ subscales for nursing students. Scaled according to Fleishman's algorithm, the 40 items generated an ill-conditioned matrix for factor extraction using the SPSSX Factor Analysis

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Sub-Program. To determine the source(s) of singularity in the correlation matrix, 40 Regression analyses (by LOQ items) were performed producing R^2's ranging between .66 and .98, with 17 higher than .90. The regressions involved, in turn, each LOQ item as a dependent variable regressed on the remaining 39 LOQ items.

Factor analysis was repeated deleting the variable with the largest R^2, and again produced an ill-conditioned matrix due to a determinant of zero. In a second factor analysis a second LOQ item (with the second largest R^2) was deleted with similar results. This process was continued until 12 LOQ items with the largest R^2's were deleted from the factor analytic models. Each of the 12 reduced matrices was ill-conditioned. It was obvious after 12 attempts (still with R^2's greater than .93) that the LOQ was not functioning as expected with that sample of nursing students and would not produce results comparable with other studies.

The inquiry shifted to an examination of reliabilities. **Fleishman's** LOQ, test-retest, and split-half (odd-even), reliability estimates for the standardizing sample of first line supervisors and Air Force NCO's ranged between .70 and .89 for the Consideration Scale and .67 and .88 for the Structure Scale (**Fleishman,** 1969). Every reliability coefficient, uncorrected for anchor points (Wirier, 1971, p. 289) or corrected for anchor points, was a negative coefficient--a condition indicating that noise in the nursing student's data exceeded information.

Even though the LOQ has been empirically validated with managerial and supervisory personnel in a variety of environments such as industrial, business, and hospital (**Fleishman,** 1973; Kerr, Schriesheim, Murphy, & **Stogdill,** 1974; Korman, 1966; Schriesheim & Kerr, 1974, Schriesheim & Kerr,

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1977), few published reports exist concerning its validation for student-leader populations. Nevertheless, Fleishman's LOQ manual presents college norms .

Two studies (Capelle, 1967; Florestano, 1970) cited in Duxbury, et al. were concerned with performance on the LOQ of student leaders and non-readers from "who's Who Among Students in American Colleges" and Omicron Delta Kappa (an honorary male leadership fraternity). Capelle (1967) found significant differences between male college leaders and non-leaders on both the consideration and structure scales. On the other hand, Florestano (1970) reported the structure scale differentiated former college leaders from non-leaders, but the consideration scale did not differentiate. Although both studies suggested that the LOQ showed promise for possible use with male college students, the LOQ in a prior application with nursing students (Walters, et al., 1987), by first reaction, was an unsuitable measure of their opinions about leadership. Measurement and statistical methodologies were adjusted for this report to clarify variations of responses of nursing students to the LOQ.

Measurement and Statistical Methodologies

Inherent properties of raw data have implications for methodological design, statistical analysis, and policy interpretations in any research study . In the present study it is assumed that all raw data reflect observed interval values or interval values resulting from coding: (a) dummy, (b) effect, or (c) criterion (scaling) coding. As such, inherent information contained as variability within the properties of the raw data distribution may be cataloged. Variables may vary among themselves in their units of measurement, central tendencies, frequencies of observed

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values, cumulative frequencies, symmetries, clusterings of observed values, and in their relative minima and maxima with respect to frequency versus values graphs. Furthermore each of the foregoing properties inherently IMY affect **covariances** and correlations that typically are fed to factor analytic algorithms in statistical packages. One should recall that whatever affects covariances will affect off-diagonal elements of a correlation matrix, and that in a true correlation matrix the principal diagonal elements will always equal 1.00.

All interested observers upon intuitive analysis of a **raw** data matrix will observe the variations described in the foregoing. The interested observer may not unite those variations with mathematical properties of their corresponding raw data distributions. Because mathematical properties are essential for unraveling potential problems in statistical analysis, they will be defined informally in the following list:

1. Mean: The typical or representative value around which deviations of all observed values sum to zero.

2. Range of observed values: upper and lower limits of variation.

3. Variance and standard deviation: values reflecting tendency to cluster around mean.

4. Skewness: value reflecting tendency to cluster at an extreme of the distribution.

5. **Kurtosis:** value reflecting too little or too much spiking with respect to the general frequency pattern along the range of the distribution.

Based on the foregoing fundamental properties of data, a set of specific objectives was developed to guide study of the problems related

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to measuring nursing students with the LOQ. Those specific objectives

may be stated as follows:

1.   To define relevant **artifactual** sources of variance in raw data

matrices.

2.   To describe transformations that selectively eliminate **artifactual**

sources of variance from further statistical analyses.

3.   To develop a general context for transforming raw data matrices

to reflect policy adjustments.

4.   To describe transformations that selectively adjust for specific

sources of variance to reflect policy adjustments prior to subsequent

statistical analyses.

5.   To discuss interpretational implications for health occupations

educators within the statistical context of factor analysis.

Antifactual Sources of Variance

As data are ordinarily available for statistical analyses by computer

programs, they are laid out in rows and columns of a raw data matrix.

When a computer program is opened the data are an abbreviation of the

schematic presented as Figure 1. That abbreviation may be represented

as the upper left rectangular portion continuing to the "nth" row and the

"nth" column. An early task in analysis is to produce data for the

additional rows and columns shown in the schematic. Every variation between

numbers in the schematic represents a source of interest to the

statistician. Some of the variation is a property of the unit and scale

of measurement used for each variable, some is a property of the statistical

manipulations applied to the data. All variation due to unit and scale

of measurement may be considered as **artifactual.** The question is, should

```
CASE │ V A R I A B L E          ROW          ROW
 ID  │  1  2  3  .  .  .  m   Sum  Mean    Variance
─────┼────────────────────────────────────────────────
  1  │  e
  2  │     l
  3  │        e
     │           m
  .  │              e
  .  │                 n
  .  │                    t
     │                       s
  n  │
─────┼──────────────────────┬───────┬──────┬──────────
COL  │                      │E│SUM   │v'│ROW
 Sum │                      │L│      │A │   MEANS
     │                      │E│      │R │
COL  │                      │M│MEAN  │1 │
 Mean│                      │E│      │A │
     │                      │N│      │N │COL
COL  │                      │T│VARIANCE│c│ MEANS
 Var │                      │s│      │E │
```

Figure 1. Schematic Context for Sources of Variance in Raw Data Matrices.

artifactual variation be removed prior to further statistical analysis?

Most professional educators have been taught routinely to remove by

standardizing the artifactual variation.   Perhaps some or all artifactual

variation should remain in the data, particularly if the raw data are based

on "meaningful units and scales" (Rummel, 1970, p. 289).

   When artifactual sources of variance are to be excised (removed or

adjusted out), a statistician may employ one or more of the methods

presented in Table 1.   (Each matrix element, for comparison, could be

weighted by the reciprocal of the number of cases.)   All methods in Table

1 were employed at some stage in analyses of LOQ data collected from the

130 student nurses in this study. Usually all vectors (variables) in a

raw data matrix are transformed using the same algorithm.   A vector has

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Table 1

Methods for Removing (Adjusting Out) Artifactual Sources of Variance From

Either Row or Column Vectors of Raw Data Matrices

Source with Result of Adjustment	Correcting Adjustment before Statistical Analysis
Unequal Vector Lengths Adjusted for Comparison with Length of an Arbitrary Vector.	Divide each element in the matrix by the length of arbitrary vector. Find inner products (moments). Divide each element in the matrix of inner products by the maximum inner product.
Unequal Vector Lengths Normalized to Length of 1.00	Divide each element in the matrix by its respective vector length. Find inner products (moments). Divide each element in the matrix of inner products by the maximum inner product.
Unequal Vector Means Adjusted to Mean of 0.00	Subtract from each element the mean of all its vector elements.
Unequal Vector Std Deviations Adjusted to Std Deviation of 1.00	Divide each element by the standard deviation of all its vector elements.
Unequal Vector Means and Unequal Std Deviations Standardized to Mean of 0.00 and Std Deviation of 1.00	From each element first subtract the mean, then divide by the standard deviation, of all its vector elements.

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both magnitude and direction. The magnitudes of vectors are known by
computing vector lengths. Ordinarily vector directions are determined
for vector pairs through computing cosines of angles between them (which,
for standardized vectors, are correlation coefficients).

   From the raw data matrix itself may be calculated (a) Moments about
(with respect to) their origin; that is, moments with respect to zero;
(b) Moments about their mean (covariances); (c) Moments about the mean
(of zero) of standardized data; that is, moments about zero having a
standard deviation of one (correlations). Moments computed with respect
to their origin make no adjustment to the data and should be used if the
computerized statistical program of choice does not require a range between
-1 and +1 such as in a correlation program. The theory of factor analysis
requires only a symmetric matrix. However, if there are computerized
statistical program requirements, they may be addressed through dividing
every value in the raw data matrix by the maximum value of the symmetric
matrix in a process known as bounding.

   An alternative is to adjust each symmetric matrix element with the
mean of all symmetric raw data matrix elements before proceeding with
bounding, that is, dividing by that mean. Other adjustments made to the
raw data matrix are designed to remove from the data, before factor analysis,
whatever source of artifactual variance would be considered as confounding
to the factor analytic results: if differences in length are considered
as a confounding source rather than a source that promotes understanding
of the factor analytic results, then those differences in vector length
should be excised.

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The same criterion should apply to each of the other adjustments:
(a) for differences in means, (b) for differences in standard deviations,
and (c) for differences in both means and standard deviations. Nothing
in the mathematics prevents coupling adjustments for combinations of
artifactual sources such as coupling adjustments for differences in unit
of measurement or of length with differences in means. Such adjustments
are also referred to under concepts in the literature presented as:

1. Scales of measurement considering distances between minima and
maxima, and actual values used with their between value properties (nominal,
ordinal, interval).

2. Scaling of variables (vectors) with a "scaling factor" to lengthen
or contract their corresponding vector lengths in the vector space of the
data matrix.

3. Precision of measurement dealing with arbitrariness of units of
measurement and meaningfulness of units of measurement chosen for a study.

4. Factor analysis of *covariance* or correlation matrices applying
the technique to one of two stages of adjustment correcting raw data
matrices (a) for differences among variable means, and (b) for differences
among both variable means and standard deviations.

It should be emphasized that direct factor analysis of unadjusted
raw data preserves both mathematical magnitudes and patterns of values
in the raw data distribution. Uncorrected variances and **covariances** are
based on unadjusted raw data, before removing influence of length, central
tendency, variability, symmetry, and peakedness. In short, uncorrected
variability and **covariability** are essentially raw data sums of squares
and cross products. But, raw data matrices may need resealing (for analysis

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by a statistical package) to a range of values bounded to simulate a

correlation matrix: -1 to +1; or to values within this range such as 0

to +1. Moreover, deficiencies in psychometric properties of an instrument

may require that adjustments be made to measurements generated by the

instrument.   If so, considerations in the foregoing may guide those

adjustments.   It was the intent of the authors for this study to define

objectively and precisely appropriate adjustments that could be made to

LOQ data matrices for nursing students such that research reports generated

in that segment of the health occupations professions may better be compared

with findings in other fields.

Eliminating Artifactual Sources of Variance

Background for the principle that a research should remain in full

charge of all data adjustments has been presented. It was noted throughout

the foregoing sub-sections under Methodology that a variety of artifactual

sources of variance can affect statistical procedures based on raw data

matrices.   What has not been presented is the notion that the researcher

should take care not to excise more information than is appropriate.   The

consequence of such carelessness may be matrices designated as "singular"

or "ill-conditioned. " This consequence may require a complete reorientation

to the data for analysis and to the data properties of the statistical

programs used for the analysis. When conditions are proper a researcher

may adjust raw data matrices at the level of single vectors or across all

vectors to achieve the following objectives: (a) a common unit of

measurement for all vectors (b) a common vector length, (c) a common mean,

 (d) a common standard deviation, and (e) a common distribution.

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For conceptual clarity the researcher should distinguish among **two transformations** for adjusting data: (a) <u>normalization</u> (to same length), versus (b) <u>normalization</u> (in direction of either columns or rows). These should be distinguished from <u>standardization</u> (to a [standard] mean and a standard deviation) versus <u>distributional</u> transformations to normal or standard normal distributions. Distributional transformations are based on areas under probability curves or are parametric based on means and standard deviations.

Each type of transformation may be <u>normative</u> or <u>ipsative.</u> For example: Vectors standardized along either rows or columns are said to be normative. But, when a data matrix has been iteratively standardized by both column and row vectors, every vector in both directions has a mean of zero and a standard deviation of 1. These doubly standardized vectors are said to be ipsative. However, the <u>lengths</u> of the doubly standardized vectors within either the column or row directions may not be constant.

In the present context it should be noted as a final principle that when column or row vectors are normalized to a length of 1, their orientations in vector space are such that their inner products are the same as the cosines between them. Normalization, however, does not equate means and standard deviations. When a data matrix (of column or row vectors) has been standardized, each vector has a mean of zero and a standard deviation of 1. However, the lengths of standardized vectors are not necessarily constant.

<u>Statistical Procedures</u>

In order to control the level of adjustment applied to the data for this project the PROC MATRIX in combination with the PROC FACTOR of SAS

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was used. Validation of the statements supplied to PROC MATRIX was accomplished by supplying to it the coding needed to produce comparable (known and controlled) results when feeding unadjusted raw data to PROC FACTOR. OUTPUT files produced by PROC MATRIX were passed to PROC FACTOR as either covariance or correlation matrices depending on the nature of the adjustments applied in PROC MATRIX. If adjustments did not produce 1's on the principal diagonal, the adjusted matrix was passed as covariance matrix; if the adjustments produced 1's and if all elements were cosines between vectors, the adjusted matrix was passed as a correlation matrix. PROC FACTOR in each case was invoked with an eigenvalue criterion equal to the mean eigenvalue for the matrix to be factored, and with the no intercept (NOINT) option active. Every matrix was rotated with both the VARIMAX (for orthogonal rotation) and the PROMAX (for relaxation of orthogonality) criteria.

Reliabilities of the factor scores were determined with SPSS[x]. Definition of the items loading on each factor score was contingent on access to results of PROC FACTOR in SAS. Item components of each factor score were weighted with the coefficient 1.0 to preserve comparability with Fleishman's reports for the norm-generating sample. Using a subset of LOQ items, each item weighted with the coefficient 1.0 is conformable to Rummel's description of producing composite estimates of factor scores.

Results and Discussion

In the interest of brevity not all factor analytic results are reported. An arbitrary decision was made to report only those results most related to other studies based on the LOQ. That decision was justified in every case by being in conformity with sound factor analytic criteria: either

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(a) retaining **only** factors having **eigenvalues** larger than the average for the methods used and data factored (the **eigenvalue** criterion), or (b) **applying** appropriate ·**professional** judgment in evaluating differences between eigenvalues of factors retained and factors eliminated from rotation (the scree criterion). When the **eigenvalue** criterion alone was applied, analyses of the more highly adjusted data tended to produce more factors, to a maximum of 7 for standardized data (correlation matrices). Upon addition of the scree criterion one could justify retaining at most 3 factors for further rotation. Therefore, Table 2 presents only results of 2 and 3 factor rotations.

   Out of those results it was determined that, on the basis of variance explained in the initial extraction, a number of adjustments provided essentially equivalent results. Comparison of the rotations also suggested no adjustment to be clearly superior. However, for comparison with earlier studies, two methods were of choice: the bounded, unadjusted raw scores at the top of Table 2 and the **covariance** adjustments near the bottom. Adjustments to correlation coefficients were rejected because **Fleishman's** reports did not suggest standardizing raw data before computing consideration or structure scores by linear combinations of values composing their respective scales; that is, before computing composite estimates. Since no method was clearly superior, it was thought best to proceed with the method that best fit current theory and practice for measuring leadership attributes of nursing students with the LOQ.

   After exploring the variance accounted for criterion, one should explore criteria of sampling adequacy, then of simple structure. Sampling adequacy indexes sufficiency of sample size for the factor analytic

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Table 2

Variance Explained (Rounded) with Principal Component Analyses of Raw LOQ Data Moments and Moments from Four Stages of Artifactual Adjustment under Initial Factor, Varimax Rotated, and Promax Rotated Methods (n ⁻130 Nursing Students)

Stage of Adjustment	VARIANCE EXPLAINED											
	Initial			Varimax			Promax with Factors Eliminated			Ignored		
	1	2	3	1	2	3	1	2	3	1	2	3
Unadjusted Raw Scores-- Bounded (Moments About Origin)	29	6		18	17		11	11		24	23	
Unadjusted Raw Scores-- Bounded (Moments About Mean)	20	3	1	16	3	2	10	3	2	19	12	2
	20	3		15	8		9	4		19	14	
Unadjusted Raw Scores-- Bounded (Absolute Moments About Mean)	20	2	2	16	6	3	10	3	2	20	11	2
	20	2		11	11		5	5		18	18	
Unit Lengths (Cosines Between Vectors)	34	1	1	16	12	9	5	3	2	30	27	20
	34	1		22	14		9	3		32	26	
Unit Lengths (Moments About Centered Data)	29	6		18	17		12	11		24	23	
Centered on Means-- Covariances (Moments About Means)	29	6		18	17		12	11		24	23	
Centered on Means and Homoskedastic--PPMCCs, Corrs (Standardized Data z Scores)	29	6		18	17		12	11		24	23	

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procedures used and varies between O and 1 with measures closer to 1 being the better measures. Simple structure refers to clarity of the rotation delineating which LOQ items clearly load on which rotated factors. There is no numeric criterion against which simple structure may be evaluated. Standard references (for example: Rummel, pps. 376-381), for factor analysis may be consulted to clarify the simple structure criterion.

Sampling Adequacies

Kaiser's measure of overall sampling adequacy (MSA) as calculated by SAS for these nursing student data varied between .72 and .97 with larger values being associated with TYPE=CORR matrices fed to SAS. The higher values may have resulted from the absence of number of cases criteria as parameters of the input TYPE=CORR data. The matrix of cosines between vectors of non-reflected item raw data produced the lowest overall MSA and had the smallest mean for item level sampling adequacies. The range of the latter varied between .51 and .92.

VARIMAX Rotated Factor Loadings

The reader should observe similarity in loading patterns and magnitudes for nursing students measured with the LQQ. Factor 1 by either analytic method agrees somewhat with Fleishman's composite estimate of structure with 13 of 20 items loading in accord with published scoring recommendations. Factor 2 by both methods is in best agreement with consideration with 12 of 20 items loading similarly with Fleishman. Exact loadings are presented in Table 3.

In an effort to find a function for the 15 LOQ items not represented in the 12 Item and 12 Item Fleishman related factors, the covariance matrix was refactored retaining 3 factors in VARIMAX rotation. The first two

Table 3

Factor Pattern Loadings for 2 Factor VARIMAX Rotated Solutions from Bounded

Raw Data and Covariances

	BOUNDED RAW DATA					COVARIANCES					
	FACTOR			FACTOR			FACTOR			FACTOR	
ITEM	1	2	ITEM	1	2	ITEM	1	2	ITEM	1	2
01s	50	72*	21s	91*	25	01s	50	25	21s	92*	24
02C	49	78*	22s	94*	20	02C	49	79*	22s	95*	20
03s	37	82*	23c	93*	18	03s	36	83*	23c	94*	18
04s	75*	50	24c	94*	19	04s	76*	50	24c	95*	18
05C	90*	33	25s	81*	45	05c	91*	32	25s	82*	45
06s	67*	59	26s	47	80*	06s	67*	60	26s	47	82*
07C	14	96*	27s	30	88*	07C	14	96*	27s"	30	89*
08c	32	87*	28c	21	93*	08c	31	89*	28c	21	94*
09s	75*	52	29c	9	98*	09s	75*	52	29c	9	97*
10c	72*	49	30s	73*	49	10c	72*	50	30s	74*	49
11c	37	86*	31s	95*	18	11c	36	87*	31s	96*	18
12c	73*	53	32c	90*	29	12c	73*	53	32c	91*	29
13c	36	87*	33C	90*	31	13c	35	88*	33C	91*	31
14s	89*	33	34C	9	98*	14s	90*	33	34C	9	97*
15c	60	67*	3.5s	49	76*	15c	60	68*	35s	49	77*
16s	50	77*	36c	25	88*	16s	50	78*	36c	25	89*
17c	87*	28	37s	35	87*	17c	88*	27	37s	35	88*
18s	76*	53	38c	21	93*	18s	77*	53	38c	20	95*
19c	57	69*	39s	70*	53	19c	57	69*	39s	71*	54
20s	94*	17	40s	95*	16	20s	95*	17	40s	96*	16

NOTES : VALUES ARE MULTIPLIED BY 100 AND ROUNDED TO THE NEAREST INTEGER.

Values greater than .65 are flagged with an "*".

Fleishman structure items are tagged s, and consideration items are tagged c.

Factor Dimensions of LOQ

factors loaded similarly to the 2 factor rotation, the third was a trivial

factor in not loading significantly on any item.

Scale Reliabilities

For additional understanding of the measurement properties of the

LOQ when applied to nursing students, it was determined to compute all

reliabilities relevant to the scales suggested by Fleishman's scoring

algorithms and to the scales uncovered through the factor analyses described

in the foregoing. Those reliabilities are presented in Table 4.

Also presented in Table 4 are Kolmogorov-Smirnov z scores for goodness

of fit of the respective composite estimates of all factor scores relevant

to Fleishman scaling and other possible scaling algorithms for LOQ data

from nursing students. The reader should note that scales derived from

factor analysis of the covariance matrix yield very acceptable reliabilities.

(No item score was reflected in those scaled scores as recommended by

Fleishman).

The smallest reliabilities (.23) are related to the vector of 20 item

composites recommended by Fleishman as consideration scores. The largest

reliabilities (.95) are related to the vector of 21 item composites

determined by SAS as FACTOR 1. Of items in Fleishman's algorithms,

structure items represent 13 of the 21 items of FACTOR 1. The point should

be emphasized that the lowest reliabilities of the 3 scaling algorithms

investigated were for the Fleishman algorithm. The best reliabilities

were for the 21 items of FACTOR 1 and the 19 items of FACTOR 2 arising

from factor analyzing the covariance matrix. However, if a researcher

chooses to measure leadership attributes of nursing students with the LOQ

because of its historical relationship to other studies, it would be best

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Table 4

Reliability and Goodness of Fit (to Normal) Data for Nursing Students on

the Leadership Opinion Questionnaire

Measures	Bet Peo MS	Within MS	Bet Meas MS	Resid MS	Reliability Uncorr	Corr	K-S z
40 Items Total	2.9493	1.6558	1.0869	1.6602	.4386	.4371	
13 Items Fl-Struct	10.0975	0.9084	0.3979	0.9123	.9100	.9096	1.832*
12 Items Fl-Consider	12.6294	0.9828	0.7357	0.9847	.9220	.9220	2.460*
20 Items Fl-Struct	4.2679	1.3695	0.8082	1.3738	.6791	.6781	0.710
20 Items Fl-Consider	2.3988	1.8340	1.2671	1.8384	.2354	.2336	0.592
21 Items Factor 1	17.4986	0.8676	0.4602	0.8707	.9504	.9502	2.038*
19 Items Factor 2	15.0443	.9858	1.0062	0.9856	.9345	.9345	2.038*

[1] Reliabilities are both uncorrected and corrected for anchor points.

Abbreviated scale names are expanded as follows: Struct--13 Items that
both load on Factor 1 and were claimed by Fleishman to be components of
the structure scale; Consider--12 Items that both Load on Factor 2 and
were claimed by Fleishman to be compoents of the consideration scale; FL-
struct--20 Items found by Fleishman to load on the structure scale; FL-
Consider--20 Items found by Fleishman to load on the consideration scale;
Factor 1--21 Items that loaded empirically from the nursing student sample
on the factor designated by SAS as "Factor 1"; Factor 2--19 Items that
loaded empirically from the nursing student sample on the factor designated
by SAS as "Factor 2."

K-S z scores were computed by SPSS[x] under the hypothesis that the population
distribution function is normal.

Factor Dimensions of LOQ

to scale using the 13 items of FACTOR 1 that load in Fleishman's Structure algorithm, and that the 12 items of FACTOR 2 that load in Fleishman's Consideration algorithm. Noting that the sum of 13 and 12 is 25, the reader understands that 15 of the original 40 items on the LOQ would not contribute to scaling under the recommendation of scaling for historical linkage of results.

Conclusions and Recommendations

Some nursing programs offer a course in management prior to preceptorship to foster leadership styles and to develop perception of self as a leader. Thu S , the rationale for selecting Fleishman's LOQ as the instrument of choice in this study to investigate: (a) whether nursing students exhibit specific patterns of leadership attributes, (b) whether the factor structure of leadership attributes in nursing students differ from the population on which the factor structure was defined by Fleishman, and (c) to determine the reliabilities of the principal items forming factor scales for nursing students.

The LOQ has been applied to a number of research situations, however, the literature leaves open the possibility that there were some problems with its application in some of those situations. In this study factor analytic techniques revealed the best results were based on clarity of factor pattern loadings for 2 factor VARIMAX rotated solutions from (a) bounded raw data and (b) covariances. Both of the foregoing methods supported scaling of 13 of 20 items loaded on structure and 12 of 20 items loaded on consideration. No scaling technique required reflecting of items as recommended in Fleishman's scaling algorithms.

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Thu S , the results revealed that nursing students exhibit specific patterns of leadership attributes different from the population on which Fleishman's scaling algorithms were normed. Results further revealed that the factor structure of the leadership scales used to measure leadership attributes of nursing students varies in number of items and in how the items subset themselves for computing LOQ composite estimates of factor scores. All of these differences are distinct with respect to recommendations available for scaling in the current literature of leadership.

It is recommended that research be continued on measurement properties of the LOQ applied to health occupations personnel and students. It is certainly recommended, if the LOQ is to be used for measuring nursing students, that options in selecting scaling algorithms be carefully considered. Otherwise such unfortunate outcomes as negative reliabilities could render the LOQ data to be highly questionable.

Because leadership is a dimension of personality that forms early in life it is recommended that the LOQ be further investigated with even younger students, perhaps at high school or junior high school ages. Perhaps opportunities may present themselves for such studies through pre-post experimental designs incorporated into leadership development workshops provided in curricula for health occupations programs.

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