DOCUMENT RESUME

ED 382 675 TM 023 122

AUTHOR	Campbell, Todd C.
TITLE	Investigating Structures Underlying Relationships When Variables Are Not the Focus: Q-Technique and Other Techniques.
PUB DATE	22 Apr 95
NOTE	31p.; Paper presented at the Annual Meeting of the American Educational Research Association (San Francisco, CA, April 18-22, 1995).
PUB TYPE	Reports - Evaluative/Feasibility (142) -- Speeches/Conference Papers (150)
EDRS PRICE	MF01/PC02 Plus Postage.
DESCRIPTORS	*Counseling; *Factor Analysis; *Q Methodology; Research Methodology; *Responses; *Statistical Analysis; *Test Items
IDENTIFIERS	*R Technique Factor Analysis

ABSTRACT

This paper discusses alternatives to R-technique factor analysis that are applicable to counseling and psychotherapy. The traditional R-technique involves correlating columns of a data matrix. C, P, Q, S, and T techniques are discussed with particular emphasis on Q-technique. In Q-technique, people are factored across items or variables with the measure or measures being administered on one occasion. This technique clusters people based on similarities in their responses. Q-technique analysis can only be employed when the number of people being factored is small compared to the number of variables in the study. The applications and limitations of different types of Q sort methods are also presented. A case example of Q-technique factor analysis is included. Three tables present analysis results. (Contains 30 references.) (SLD)

Running Head: INVESTIGATING STRUCTURES UNDERLYING RELATIONSHIPS

Investigating Structures Underlying Relationships When Variables Are Not The Focus: Q-technique and Other Techniques

Todd C. Campbell

Texas A&M University 77843-4225

Paper presented at the annual meeting of the American Educational Research Association (session #54.21), San Francisco, April 22, 1995.

Abstract

This paper discusses alternatives to R-technique factor analysis that are applicable to counseling and psychotherapy. O, P, Q, S, and T techniques are discussed with particular emphasis on Q-technique. The application and limitations of different types of Q sort methods are also presented. A case example of Q technique factor analysis is included.

A primary task of clinicians during the course of counseling is to integrate tremendous amounts and varying types of data pertaining to clients. This integration helps the clinician to formulate a treatment plan focused on helping each client to resolve some problem (Tinsley, 1992). However, often this integration is based on "clinical intuition" which may or may not be on the mark and does not lend itself well to empirical investigation. Factor analytic techniques can be applied to the counseling situation to aid clinicians in diagnosis, the development of treatment plans, and in the evaluation of treatment effectiveness (Cattell & Birkett, 1980).

Factor analysis was first developed in the early part of the twentieth century by Spearman (1904), but remained inaccessible to many researchers until the advent of both the computer and user-friendly statistical software packages (Thompson & Dennings, 1993). Factor analysis embodies a variety of analytic techniques aimed at examining or summarizing interrelationships among variables (Carr, 1989; Gorsuch, 1983). As Kerlinger (1986) states,

> Factor analysis serves the cause of scientific parsimony. It reduces the multiplicity of tests and measures to greater simplicity. It tells us, in effect, what tests or measures

belong together. . . It thus reduces the number of variables with which the scientist must cope. (p. 569)

In the counseling arena, the scientist is the clinician and the goal of the science is to aid the client in reaching the goals of the treatment plan.

The most commonly used factor analytic technique is the R-technique (Cattell, 1952; Gorsuch, 1983; Nunnally, 1978; Tinsley, 1992). In R-technique, a matrix of associations (e.g., the correlation matrix) is computed from a two-dimensional data matrix where the rows represent scores of people and the columns represent the different variables being measured. Analyses based on raw data matrices where the rows delineate people and the columns delineate variables are termed two-mode factor analyses (Gorsuch, 1983; Thompson & Dennings, 1993). The factors analyzed in R-technique are clusters of the variables used in the study. The constructs representing these clusters are named and defined by the investigator (Kerlinger, 1986). Daniel (1990) states that, R-technique factor analysis ". . . may be used by the social scientist both in theory development and in the validation of measures of human behavior and abilities" (p. 1).

However, there are alternative two mode factor analytic techniques that are available to the researcher. Cattell (1966, 1978) presented the basic data relation matrix (BDRM) or "data box" which summarized a three dimensional model for measuring and describing the data in a study. The three dimensions (or modes) are subjects, variables, and times of measurement. Typically the factor analytic techniques are used to investigate only two modes and the third is held constant (Gorsuch, 1983). Table 1 presents the six techniques identified by Cattell (1966).

INSERT TABLE 1 ABOUT HERE.

R-technique is the most commonly used technique followed by Q-technique and then P-technique. It is possible to employ three mode analyses though it is very uncommon to do so (Thompson & Miller, 1978; Gorsuch, 1983). Gorsuch (1983) reports that multimode factor analysis procedures are insufficiently developed to be accessible to most researchers.

Q-Technique

The development of Q technique

In 1917 Sir Cyril Burt proposed factoring people over a series of tests, though at the time he did not label the technique "Q-technique" (Cattell, 1978). In 1935, the British factorist, Sir Godfrey Thomson published a paper outlining the possibilities of computing correlations between persons rather than tests. Thomson named this technique "Q" to distinguish the technique from the traditional R technique. However, for various reasons, Thomson was pessimistic about Q-technique and did not pursue it further (Brown, 1980). At virtually the same time (independent of Thomson) William Stephenson was writing about the possibilities of person correlations and intrapersonal relationships (Brown, 1980; Stephenson, 1935). Stephenson introduced Q-methodology as a means to investigate human subjectivity. Stephenson elaborated on the theory and techniques of Q-methodology in his classic text The study of behavior (Stephenson, 1953).

Stephenson deemed all experience to be behavior and therefore able to be investigated. In the same way that brain waves can not be observed without aid, but can be measured with an EEG, subjective experience can be operationalized and measured with Q-technique. As seen in Table 1, in Q-technique people are factored across items or variables with the measure(s) being administered on one occasion. This technique clusters people based on similarities in their responses. In contrast to R-technique, Q-technique analysis can only be employed when the number of people being factored is small compared to the number of variables in the study (McKeown & Thomas, 1988; Thompson & Miller, 1983). More specifically, the number of people in a Q-analysis should be at least one less than one-half of the number of items to be sorted (Thompson & Miller, 1983).

Q-methodology is particularly useful in theory development and investigating differences between persons (Daniel, 1993; Kerlinger, 1986). However, Q-technique can rarely be used for purposes of generalizing to populations. Kerlinger (1986) states,

> Indeed, one usually does not wish to do so. Rather, one tests theories on small sets of individuals carefully chosen for their "known" or presumed possession of some significant characteristics . . . Used thus, Q is an important and unique approach to the study of psychological, sociological, and educational phenomena. (p. 598)

Q-technique has been used in a variety of investigations including the study of artistic judgments (Stephenson, 1953), attitudes (Thompson & Miller, 1978), self concept (Meltzoff & Kornreich, 1970), counseling session semantic content (Levitov, 1981), and clustering of psychotherapists (Fiedler, 1950).

Q versus R technique

Various authors have referred to Q-technique as simply the application of R-technique factor analysis to a transposed data matrix (Cattell, 1978; McKeowen & Thomas, 1988). Cattell (1978) states, "As regards dimensions, Q technique tells us nothing we do not know from R technique, and vice versa" (p. 326).

In contrast to Cattell, Stephenson (1953) argued that Q-technique offers fundamentally different information than that obtained from R-technique. Q is not simply an inverted R matrix. Brown (1980) concurs with this viewpoint:

> . . . Q and R refer to broad methodological distinctions which cannot, except under the rare condition of equality of measuring unit, be reduced to mere differences in the correlations between rows or columns of the same matrix. In R, columns are single centered around the postulate of individual differences for objectively scorable traits; the elements of the sample (people) do not interact. In Q, rows are single centered around the assumption of intraindividual differences of significance; the elements of the sample (statements) interact in the course of Q sorting. In R, traits

> are variables; In Q, persons are variables. Owing primarily to the subjectivity involved in Q technique, the results from Q method cannot be reduced to those obtained in R, each being subsumed by a different data set. (p. 55)

Gorsuch (1983) states that Burt's conclusions that factors from an R analysis and factors from a Q analysis could be directly translated from one or the other have been generally upheld (cf. Gollob, 1968). However, Gorsuch expands on this statement pointing out another example of how R and Q techniques may yield different results:

> If the R technique is analyzed in the usual manner (i.e., by correlating columns of the data matrix) and the Q technique is performed in the usual manner (i.e., by correlating rows of a normalized data matrix) then the results will not be the same. **The R-technique analysis will include information on mean differences between individuals that is excluded from the Q-technique analysis.** Therefore the R-technique has the possibility of finding a general factor. (p. 317)

Nunnally (1978) argues that the most important difference between the R-technique and Q-technique is "the ease with which they can be fitted into psychological theories" (p. 429).

The analytic model must fit the theoretical model. If a researcher is interested in clusters of variables then R-technique should be applied. If the researcher is interested in clusters of people then Q-technique should be used. R and Q techniques both yield precise mathematical relations (Burt, 1941). However, rarely will this happen in actual practice. Nunnally (1978) states, "To think otherwise would be analogous to thinking that because the same machine could be used to measure heart rate and brain waves, it would make no difference which was measured" (p. 428).

Factor scores

The prime efficacy of Q-technique lies in its analytic possibilities (Kerlinger, 1986). In Q-technique the factor scores are used in the interpretation of the factors as opposed to the more common R-technique in which the factor pattern/structure coefficients are consulted for the interpretation of the factors (McKeowen & Thomas, 1988). In Q-technique analysis, there is one factor score calculated for each variable on each person factor. The factor scores provide information as to which items identify and differentiate the factor clusters of people.

A factor represents common covariation in perceptions held by those people who make up the factor. The Q sorts of those people associated with a particular factor are merged, using the factor scores, to form one model Q sort for that particular factor . This model Q sort or "factor array" represents the variance that is common to the people associated with the factor (Brown, 1980; Kerlinger, 1986). The factor scores can be transformed from Z scores back to the scale of the original Q sort (e.g. -5 to +5) to aid in interpretation. The factor scores can then be used to interpret the factors by identifying which variables are positively or negatively associated with the factor. Mckeowen and Thomas (1988) recommend

> [The] procedure for computing factor scores is to designate as defining variates only those Q-sorts that are solely and significantly loaded on a given factor and to merge them in computing an array for that type. As differences in the magnitude of significant loadings indicate, however, some Q-sorts are more closely associated with the viewpoint of a particular factor than are others. Accordingly, the mechanics of factor scoring call first for the calculation of factor weights whereby these magnitudes are taken into account. (p. 53)

Types of Q-sorts

There are two major types of Q-sorts that researchers can employ regarding variable selection (Kerlinger, 1986; Thompson & Dennings, 1993). One type is the unstructured Q-sort which is comprised of variables that are chosen without regard to the underlying structure. Items from various sources (or a single source) presumed to be representative of a single population of items or one domain can be used in the Q-sort. Kerlinger (1986) suggests that the item pool may come from measures such as personality or attitude scales.

The second type of Q-sort is a structured Q-sort. In a structured Q-sort the variables are also from one domain, but the variables are selected to be representative of some particular theory. The structure is defined by using a fixed number of sortable variables per structural dimension (e.g., 20 items measuring masculinity and 20 items measuring femininity). Thompson and Denning (1993) provide the example, ". . . if the subjects responded to the 42 items on the Love Attitudes Scale (Hendrick & Hendrick, 1990), the responses would be structured, because the scale includes seven items measuring each of the six types of love posited by Lee (1973)" (p. 7). The structure may be based on a priori theoretical assumptions (deductive) or patterns that emerge as the data are collected (inductive) (McKeowen & Thomas, 1988). Kerlinger (1986) states, "To structure a Q-sort is virtually to build a 'theory' into it" (p. 588).

Typically, in a Q-sort each subject is directed to sort a set of stimuli (e.g., cards) "from a specifiable universe of content" (Carr, 1989, p. 47). The stimuli can be of any type (e.g., cards with statements, photographs, shapes etc.); the list is limitless.

Subjects are to sort the cards (usually 60 to 100) into categories ranging between two extremes such as "most characteristic" to "least characteristic" or "strongly agree" to "strongly disagree". The number of stimuli to be placed in each category is predetermined and produces a symmetrical distribution. The typical number of categories in a Q-sort is seven or nine and subjects are required to place a predetermined number of cards in each category. Typically the Q-sort is set up to "force" the distribution to be normal or quasi-normal (Kerlinger, 1986). The *rhos* among the subjects are calculated and then factor analyzed. Thompson (1980) points out that the shape of the subjects' responses will be identical and so the *rhos* will not be attenuated by heteroscadastic distributions. T. : strategy for Q-sorts has been termed the "conventional-sorting method" (Thompson, 1980).

Thompson (1980) points out that the conventional-sorting method "throws away" information,

For example, if a subject sorts 10 cards into the "agree" category, all 10 cards receive the same score, even though the subject may not equally agree with all 10 statements. This procedure violates the logic of the method, which is best applied when most subjects will not feel exactly the same regarding the different objects being sorted. (p. 548)

In addition, the reliability of the scores increases as the number of data points collected is increased (Nunnally, 1978). In regard to this, Thompson (1980) proposes a "mediated-ranking" (p. 548) procedure for sorting items in a Q-sort. This procedure calls for the sorters to first separate the items into categories and then rank the each item within each category. This procedure offers a way for people to rank order many items without becoming cognitively overwhelmed with the task. The rank ordering of the cards would yield more reliable information (Nunnally, 1978). An alternative benefit from ranking items, as opposed to simply categorizing items, would be that the same amount of information could be obtained from less items (Thompson, 1980).

Thompson and Dennings (1993) propose yet another alternative for increasing the reliability of the scores from a Q-sort. They describe a mediated Q-sort that utilizes an "unnumbered graphic scale" (Thompson, 1981).

> Subjects are presented with a straight line drawn between two antonyms (e.g., "Disagree" and "Agree") and are asked to draw a mark through the line at the position that best indicates the extent of their agreement with a given statement. These marks are subsequently scored by the researcher using an equal-interval measurement scaled with a relatively large number of categories, e.g., 1-15. (Thompson & Dennings, 1993, p. 7)

The unnumbered graphic scale allows people to rate (as compared to rank) data. The rating of one item is not tied to the rating of any other item thus allowing for more variable scores. Because this procedure uses normative data the bivariate product moment correlations will be attenuated by heteroscadastic distributions. Though the unnumbered graphic scale may produce different shapes of distributions, this will not automatically devastate the factor analytic solution. If, in fact, the procedure allows for more accurate reflection of people's perceptions then tolerating some deviations in shape may be desirable (Thompson & Dennings, 1993). Attention must be paid to the skewness and kurtosis of distributions being analyzed, otherwise erroneous conclusions may be drawn (Campbell, 1994).

Though there appears to be two camps when it comes to Q-technique and R-technique, both can benefit from one another's methods and assumptions. Thompson and Dennings (1993) pointedly state

> It is ironic that we typically do not see much attention paid to distributional requirements that also apply in R-technique factor analyses, while we seem to have obsessive concerns regarding the same dynamics in Q-technique analyses that employ the same mathematics. (p. 8)

Case example

Twenty four applicants to a Ph.D. psychology program were invited to interview for acceptance into the program. Following the interviews the applicants were rated in regard to desirability for acceptance into the program. The applicants were rated by eight raters: 3 full professors, 3 associate professors, 1 assistant professor, and 1 "composite student" (currently enrolled students reached a consensus in their rankings and submitted a composite ranking of the applicants). This example is based on real data, but the interpretive information has been slightly altered here to protect anonymity.

The interviewers' rankings were factored analyzed and yielded 3 factors that accounted for 69.9% of the variability in the rankings. Table 2 shows the correlations of each rater with each rater/person factor or "factor loadings" of each rater with each factor.

INSERT TABLE 2 ABOUT HERE

The factor scores reported in Table 3 were analyzed to determine which applicants helped to define each of the factors. it should be noted that because lower rankings indicated a more favorable evaluation, negative factor scores indicate more favorable rankings and positive factor scores indicate less favorable rankings.

INSERT TABLE 3 ABOUT HERE

The applicants ranked most favorably (factor Z score of negative one or less) by those raters associated with Factor I (e.g., cases 1, 3, 15) were strong in research interest and research experience. The applicants ranked less favorably by those raters associated with Factor I did not have much experience in research or indicate much interest in research. This led to Factor I being defined as "researchers". This makes sense considering that the two full professors associated with Factor I were research methodologists and the students were in the midst of various projects and realize the role of research in a doctoral program. The clustering of the students with the full professors may indicate a tendency to "come full circle" in one's perceptions regarding what makes a successful Ph.D. student.

The applicants ranked most favorably (factor *Z* score of negative one or less) (e.g., cases 8,14, 20) by those raters associated with Factor II were strong in clinical experience and were greatly interested in focusing on developing their clinical skills. Applicants rated less strongly (e.g., cases 5, 6) were particularly weak in the clinical area. This led to Factor II being defined as "clinicians". Again, this was consistent because all of the professors associated solely with Factor II were primarily clinically oriented in their teaching and professional interests. Rater 7 was associated primarily with Factor II, but also with Factor I. This also makes sense considering that rater 7 has interests that are both clinically oriented and research oriented.

The applicants ranked most favorably (factor *Z* score of negative one or less) by those raters associated with Factor III (e.g., cases 8, 15, 23) tended to be extremely focused in their areas of interest, both clinically and in regard to research. Applicants rated low on this dimension (e.g., cases 7, 10) were particularly ambiguous in their focus as regards both clinical and research objectives. This led to Factor III being defined as "explicators". The student raters being associated with Factor III and Factor I, as reported in Table 2, indicated a tendency to favorably rank broad research interests, but also perceiving favorably those applicants with a well defined area of interest.

The factor scores shown in Table 3 indicate some consistency in the rankings of the applicants. Applicant number 8 was favorably ranked by all of the raters and was the first or second choice of all the raters. Factor scores with an absolute value of less than one (e.g., applicant 4 and 18 in Table 3) may indicate that the applicant was ranked in the middle by all of the raters, but it could also be that the raters associated with a factor varied greatly in their ranking of the applicant. Regardless of the reason, factor scores with an absolute value of less than one were not helpful in defining the factors.

Q technique offers researchers and clinicians additional tools to evaluate and increase the effectiveness of counseling. Attention must be paid to both the advantages and the limitations of Q technique.

P-Technique

Gorsuch (1983) deemed P-technique to be ". . .the forerunner of and multivariate approach to what is currently called <u>single-subject design</u> or

N of 1 analysis" (p. 312). P-technique is a method used to show changes in scores for the same person at different points in time (see Table 1) or for the average score of a group of people at different points in time (Gorsuch, 1983; Nunnally, 1978). The need for single-subject research designs in studying the efficacy of counseling and psychotherapy has been presented by many (Cattell, 1978, 1980; Kazdin & Tuma, 1982; Meltzoff & Kornreich, 1970), "but relatively few converts are evident" (Barton & Flocchini, 1985, p. 61). Cattell and Birkett (1980) cite three reasons for the lack of use of P-technique: "(1) The schism in psychological education between clinicians and psychometric statisticians, (2) The exorbitant time demand relative to the clinician's and the patient's available hours, (3) The lack of routine hook-ups between clinics and computers" (p. 2). The first two reasons presented by Cattell and Birkett (1980) are still valid, but with the proliferation of personal computers and statistical software packages, the third reason no longer holds true. The schism between clinicians and psychometric statisticians still needs to be addressed by educators. In regard to the exorbitant amount of time involved in P-technique, Cattell and Birkett (1980) offer several proposals to shorten the number of occasions needed for the analysis. Birkett and Cattell (1978) also provide a case example of a P-technique study involving an "episodic alcoholic" client.

O, S, and T-techniques

O-technique seeks to identify similarities in occasions for a particular individual (Gorsuch, 1983; Sells, 1963). One application of O-technique would be to identify high-risk relapse situations for those clients dealing with substance abuse. T-technique is a method of factoring occasions across individuals with the variable being held constant. S-technique factors individuals across occasions also with the variable being held constant. According to Gorsuch (1983),

> S and T techniques are virtually never used because the generalization would be limited to one variable. One suspects that the lack of S and T applications is a function of the fact that factor analysis comes, historically, from the individual difference approach to psychology and therefore experimentalists interested in only one characteristic have not been aware of its possibilities. (pp. 312-313)

Conclusion

R-technique factor analysis and the alternative factor analysis techniques, particularly Q and P are important tools in increasing the efficacy of counseling and psychotherapy. Factor analysis is available and accessible to clinicians, but continues to be greatly underutilized. It is incumbent upon clinicians to familiarize themselves with the nature and use of factor analysis in order to provide more effective services to clients.

References

Birkett, H. & Cattell, R. B. (1978). Diagnosis of the dynamic roots of a clinical symptom by P-technique: A case of episodic alcoholism. Multivariate Experimental Clinical Research, 2, 173-194.

Brown, S. R., (1980). Political subjectivity. New Haven: Yale University Press.

Campbell, T. C. (1994, April). Factors that do and do not affect r and its generalizations. Paper presented at the annual meeting of the American Educational Research Association, New Orleans. (ERIC Document Reproduction Services No. forthcoming)

Carr, S. C. (1992). A primer on the use of Q technique factor analysis. Measurement and Evaluation in Counseling and Development, 25, 133-138.

Carr, S. C. (1989, January). The use and interpretation of Q-technique factor analysis. Paper presented at the annual meeting of the Southwest Educational Research Association, Houston. (ERIC Document Reproduction Service No. ED 306 297)

Cattell, R. B. (1952). Factor analysis. New York: Harper & Brothers.

Cattell, R. B. (1966). The data box: Its ordering of total resources in terms of possible relational systems. In R. B. Cattell (ed.), Handbook of multivariate experimental psychology (pp. 67-128). Chicago: Rand McNally.

Cattell, R. B. (1978). The scientific use of factor analysis in behavioral and life sciences. New York: Plenum Press.

Cattell, R. B., & Birkett, H. (1980). Can P-technique diagnosis be practicably shortened? Multivariate Experimental Clinical Research, 5, 1-16.

Daniel, L. G. (1993, April). Q-methodology: An overview with comments relative to artistic and scientific elements of educational research. Paper presented at the annual meeting of the American Educational Research Association, Atlanta. (ERIC Document Reproduction Service No. ED 358 108)

Daniel, L. G. (1990, November). Common factor analysis or components analysis: An update on an old debate. Paper presented at the annual meeting of the Mid-South Educational Research Association, New Orleans. (ERIC Document Reproduction Service No. ED 325 531)

Fiedler, F. E. (1950). A comparison of the therapeutic relationships in psychoanalytic, non-directive, and Adlerian therapy. Journal of Consulting Psychology, 14, 179-188.

Gollog, H. F. (1968). Confounding of sources of variation in factor-analytic techniques. Psychological Bulletin, 70, 73-115.

Gorsuch, R. L. (1983). Factor analysis. Hillsdale, NJ: Lawrence Earlbaum Associates.

Kazdin, A. E., & A. H. Tuma (Eds.). (1982). Single-case research designs. San Francisco: Jossey-Bass.

Kerlinger, F. N. (1986). Foundations of behavioral research (3rd ed.). New York: Holt, Rhinehart and Winston.

Levitov, J. E. (1981). A computer-based semantic content analysis of exemplars of five counseling theories. Unpublished dissertation, University of New Orleans.

McKeowen, B., & Thomas, D. (1988). Q methodology. Newbury Park, CA: Sage Publications.

Meltzoff, J., & Kornreich, M. (1970). Research in psychotherapy. Chicago: Aldine Publishing.

Nunnally, J. (1978). Psychometric theory (2nd ed.). New York: McGraw-Hill.

Sells, S. B. (1963). Stimulus determinants of behavior. New York: Ronald Press.

Spearman, C. (1904). "General intelligence," objectively determined and measured. American Journal of Psychology, 15, 201-293.

Stephenson, W. (1935). Technique of factor analysis. Nature, 136, 297-310.

Stephenson, W. (1953). The study of behavior. Chicago: The University of Chicago Press.

Thompson, B. (1980). Comparison of two strategies for collecting Q-sort data. Psychological Reports, 47, 547-551.

Thompson, B. (1981, January). Factor stability as a function of item variance. Paper presented at the annual meeting of the Southwest Educational

Research Association, Dallas. (ERIC Document Reproduction Service No. ED 205 553)

Thompson, B., & Dennings, B. (1993, November). The unnumbered graphic scale As a data -collection method: An investigation comparing three measurement strategies in the context of Q-technique factor analysis. Paper presented at the annual meeting of the Mid-South Educational Research Association, New Orleans. (ERIC Document Reproduction Service No. ED 364 589)

Thompson, B., & Miller, A. H. (1978). Dissonance Theory and education students' attitudes toward teachers. Journal of Experimental Education, 47, 55-59.

Thompson, B., & Miller, L. A. (1983, April). Differences and similarities in administrators' and evaluators' perceptions of evaluation. Paper presented at the annual meeting of the American Educational Research Association, Montreal. (ERIC Document Reproduction Service No. ED 235 236)

Tinsley, H. E. (1992). Psychometric theory and counseling psychology research. In S. D. Brown & R. W. Lent (Eds.), Handbook of Counseling Psychology (2nd ed.) (pp.37-70). New York: John Wiley & Sons, Inc.

Table 1

Two-Mode Factor Analysis Techniques

Technique	Columns Defining Mode Being Factored	Rows Defining Indices of Association	Mode Held Constant
O	occasions	variables	individual
P	variables	occasions	individual
Q	individuals	variables	occasion
R	variables	individuals	occasion
S	individuals	occasions	variable
T	occasions	individuals	variable

Table 2

ROTATED FACTOR MATRIX			
Rater	FACTOR 1	FACTOR 2	FACTOR 3
1. Full Prof	.83121	-.01939	-.19422
2. Students	.75600	.09377	.44441
3. Full Prof	.67930	.29552	.31966
4. Full Prof	.05542	.83285	-.20431
5. Assoc Prof	-.39483	.73584	.20886
6. Assoc Prof	.28017	.64788	.07693
7. Assoc Prof	.43857	.61117	-.10196
8. Assist Prof	.07005	-.08240	.92966

Table 3

Applicants	FSCORE1	FSCORE2	FSCORE3
1	1.11114	-0.95324	1.42197
2	0.23662	-1.16562	-1.03390
3	1.23519	0.39236	-0.26219
4	-0.23803	-0.36333	-0.85981
5	-0.35986	1.43596	0.50985
6	-0.81097	1.52123	0.12805
7	0.20536	0.39875	2.03652
8	-1.28327	-1.39752	-1.47744
9	-0.75360	0.41634	-0.58937
10	-1.76346	-1.27124	1.50531
11	1.01464	-0.35945	0.22739
12	-0.05614	0.07248	-0.46246
13	-1.01826	0.19900	-0.61641
14	-0.84715	-1.32308	-0.11141
15	1.51502	0.00549	-1.35747
16	0.88398	1.77178	0.30102
17	1.09488	-0.11404	-1.16012
18	-0.65899	0.19688	0.62496
19	-1.24004	-0.24802	1.05219
20	1.29834	-1.87780	-0.14109
21	0.95914	0.12900	0.83400
22	0.27163	-0.08809	1.22346
23	-1.38354	1.35364	-1.45619
24	0.58737	1.26850	-0.33684