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ABSTRACT

Five questionnaire forms containing 61 items specifying potential inservice topics for public school teachers were sent to a stratified random sample of Indiana public school administrators and curriculum supervisors. The five forms differed in that, for two forms, the items were ungrouped and appeared in different orders; and, for three forms, the items appeared in different orders and were presented within different labeled item groupings. A 68 percent return rate provided 1,468 useable questionnaires for the data analysis. An item-order effect was demonstrated by comparing Pearson product-moment correlations, covariance matrices, residuals resulting from a fixed factor structure, and factor loading patterns for the various questionnaire forms. The item-order effect appeared to be more pronounced for adjacent item pairs than for item pairs separated by one or two items. Only a marginal effect was demonstrated for item grouping with captions. It is probable that low-inference type items factor structures obtained from survey data are dependent upon item order, but only minimally affected by item grouping. (Author)

CAN QUESTIONNAIRE ITEM ORDERING AFFECT THE INTER-ITEM RELATIONSHIPS? AN EMPIRICAL EXAMPLE.

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ABSTRACT

Five questionnaire forms containing 61 items specifying potential inservice topics for public school teachers were sent to a stratified random sample of Indiana Public School administrators and curriculum supervisors. The five forms differed in that, for two forms, the items were ungrouped and appeared in different orders; and, for three forms, the items appeared in different orders and were presented within different labeled item groupings.

A 68 percent return rate provided 1,468 useable questionnaires for the data analysis. An item-order effect was demonstrated by comparing Pearson product-moment correlations, covariance matrices, residuals resulting from a fixed factor structure, and factor loading patterns for the various questionnaire forms. The item-order effect appeared to be more pronounced for adjacent item pairs than for item pairs separated by one or two items. Only a marginal effect was demonstrated for item grouping with captions.

It is probable that for low-inference type items factor structures obtained from survey data are to some extent dependent upon item order, but only minimally affected by item grouping.

Interest in the possible effects of item order (sequence) on the analyses of questionnaire data stemmed from an examination of the responses of a random sample of teachers to a 61 item instrument designed to assess teacher perception of inservice training needs (K. T. Schurr, F. Sciara, et. al, 1978). In attempting to interpret a factor analysis of these data, the question arose as to whether the obtained inter-item correlations, and subsequent factor analyses could be influenced by the sequencing and/or grouping of the items. Of particular interest was the possible influence of item sequence on correlations of adjacent pairs of items.

The particular results which piqued this question were (1) the residual correlations of adjacent item pairs, after the extraction of factors, were generally positive and larger than other residual correlations and (2) as might be suspected from this pattern, as the number of factors retained for rotation was increased, the rotated factors consisted mostly of sets of items which appeared in sequence on the questionnaire. This pattern was fairly consistent regardless of the number of factors extracted. That is, using an additional factor tended to split one sequence of items into two sequences of items.

Since an attempt had been made to provide some logical organization for the items, the factors with a relatively small number of items could be given a meaningful substantive interpretation. However, the dilemma was whether a solution consisting of factors with a small number of items had substantive meaning or whether these weaker factors were in fact an artifact of the manner in which the questionnaire was constructed.

A survey of the related literature indicated a concern for item sequence or order effects has been expressed by others (see Perrault, 1976), but relatively few studies have been conducted to assess the effects. Most of the expressed concern has been confined to the study of item order as related to items appearing early or toward the end of a questionnaire, where factors such as fatigue may become important, or the positioning of one item relative to another closely related item, biasing responses to the latter item.

Sudman and Bradburn (1974) concluded that no theory regarding position effects could be formulated without considerable additional research. Later, Bradburn and Sudman (1979) stated that item order was of minor importance in influencing responses obtained through the interview technique.

Most of the studies of item order effects have been concerned with either the comparison of mean item response and/or proportions of respondents "agreeing" with a statement. Examples of investigations for order effects using this type of analysis are provided by Krant, Wolfson, and Rothenberg (1975) and Clancy and Wachsler (1971). Krant et al. compared responses to 46 items placed near the beginning of the questionnaire with responses to these items when placed near the end of the questionnaire. They found that for items measuring attitudes toward pay, job security and advancement, respondents tended to choose extreme responses less frequently when an item appeared near the end of the questionnaire and saw this as an important consideration for researchers comparing information from one study to another. Clancy and Wachsler investigated item position by inserting six agree-disagree type items into two versions of a shared-cost questionnaire (items appeared near the beginning in one and near the end in the second version). They concluded the magnitude of the effect was so small as to be of no concern for that type of data.

Metzner and Mann (1953) considered the problem of observed correlations for items of a questionnaire being artificially inflated as a result of item grouping by using a sequenced (items grouped and captioned by subject) and nonsequenced (items interspersed with other subject areas) form of a questionnaire. They were unable to conclude that grouping with captions led to an intensification of a correlation between items. Kane (1971) studied adjective scale order in the use of a semantic differential. Using factor analytic techniques and a comparison of factor loading patterns he concluded there were no significant item order effects on the factor structure.

The present study differs from that of Kane since he used what Popham (1978, p. 196) terms high-inference items and the questionnaire employed in this study contained low-inference items. It differs from the Metzner and Mann study in that a larger number of items was used and five forms rather than two were administered. The use of five forms permitted better estimates of the relative effects of item grouping and sequencing, since these two effects were confounded in the correlations reported by Metzner and Mann.

Method

Sample and Instrumentation

Data for the investigation were obtained as part of an ongoing study in which responses to the same 61 items used in the study of teacher perceptions were obtained from a stratified random sample of Indiana Public School administrators, and curriculum supervisors. The purpose of this phase of the ongoing study was to compare teacher and administrator-supervisor perceptions of inservice needs. To investigate the item sequencing and/or grouping effect(s), five distinct forms were constructed. Each form reflected a different organization of the 61 items.

The 61 items consisted of brief descriptions of skills or activities that might serve as topics for inservice training. The respondent was requested to rate each item using the following scale: (1) among the least useful; (2) of little use; (3) of moderate use; (4) of use, but not one of the most useful; and (5) among the most useful. The items are shown in Table 10. The five forms of the questionnaire consisted of the items appearing in: (1) the same seven item groupings and in the same sequence that was used in the teacher study; (2) the same sequence that was used in the teacher study, but ungrouped; (3) a random sequence; (4) seven groupings representing a plausible seven factor structure determined from the analysis of the teacher data; and (5) nine of ten item groupings representing an alternative plausible factor structure determined from the analysis of the teacher data.

Five proportional random samples of respondents, stratified according to their administrative-supervisory position, were selected. Each sample responded to a different form of the questionnaire. Names of respondents were obtained from an Indiana Department of Indiana tape of all administrative and supervisory public school positions. The sample size for Form 1 was two times as large as for the other forms. This was done to assure that, in the event that the alternative forms affected administrator responses, a sufficient number of responses to Form 1 would be obtained for a comparison to the teacher data. A 68 percent return rate, including one follow-up, resulted in 1,618 responses, of which 1,468 were sufficiently complete to include in the data analyses. Numbers of usable questionnaires by form were: (1) 480, (2) 241, (3) 254, (4) 257, and (5) 236.

Statistical Procedures

Four types of procedures were used in analyzing the obtained data: comparing simple correlations, comparing covariance matrices, using confirmatory factor analysis procedures and using exploratory factor analysis procedures. The first procedure was to compute Pearson product-moment correlations for item pairs that appeared as adjacent items on one form of the questionnaire, but nonadjacent items on another form. In particular, correlations corresponding to pairs of items adjacent on Form 3 (random item sequence) but not on Form 2 were computed and compared using the procedure described in Glass and Stanley (1970, p. 321). Since all items appearing on Forms 2 and 3 were ungrouped, the direction of differences between the observed correlations and the tests of statistical significance for differences provided for an assessment of a sequence effect apart from an item grouping effect. Although possibly subject to a grouping effect, additional comparisons were made for adjacent vs. nonadjacent item pairs on the other forms.

The second procedure involved the use of COFAMM, a computer program for confirmatory and exploratory factor analysis (Sörbon and Jöreskog, 1976). It was used to test (1) the equivalence of the covariance matrices for particular pairs of questionnaire forms, (2) the models specified for the covariance matrices after appropriate equality constraints had been relaxed, and (3) the fit of a factor solution for Form 1 (the orginal questionnaire form) to comparable data obtained through other forms. Useful references on the use of this program are the COFAMM Users Guide, Jörskog (1971), Long (1976), and Sörbon (1974).

In general, the model tested by COFAMM, and its associated parameters are

$$\mathbf{x}_g = \gamma_g + \Lambda_g \mathbf{f}_g + \mathbf{z}_g \qquad (1)$$

where x_g is a p x 1 vector of observed values for group g = 1 or 2, γ_g is a p x 1 vector of location parameters, Λ_g is a p x k parameter matrix of factor loadings, f_g the k common factors, and z_g being the p unique factors or residuals. If it is assumed in the model that $E(z_g) = 0$, $E(f_g) = \theta_g$, and z_g and f_g to be uncorrelated, it follows that:

$$M_g = \gamma_g + \Lambda_g \theta_g \quad (2)$$

and that

$$\Sigma_g = \Lambda_g \Phi_g \Lambda'_g + \Psi_g \quad (3)$$

where Φ_g is the covariance matrix of f_g, Ψ_g the covariance matrix of z_g, and M_g is the mean vector of x_g.

In using COFAMM, one has three options in specifying characteristics of parameters in a hypothesized model: (1) fixing parameters to have assigned values, (2) constraining parameters which are unknown to be equal to one or more other parameters, and (3) freeing parameters which are unknown and not constrained to be equal to other parameters. If a hypothesized model does not provide an adequate fit to the data, as determined by the chi-square statistic, then some of the fixed and/or constrained parameters can be relaxed (freed) and a new chi-square statistic for the modified model is computed. In general there is interest in both the adequacy of fit for the newly specified model and the reduction in the original chi-square statistic brought about by relaxing the constraints on the parameters.

In testing the equivalence of pairs of covariance matrices, Λ_1 and Λ_2 were constrained to be equal p x p identity matrices, Φ_1 and Φ_2 were constrained to be equal p x p matrices, and Ψ_1 and Ψ_2 were fixed to be equal to a diagonal matrix, but containing zeros on the diagonal (0). When the chi-square statistic indicated a lack of fit, equality constraints placed on Φ_g were relaxed to test hypotheses about order and/or grouping effects. Parameter specifications for fitting the Form 1 factor solution to the correlation matrix of other groups were to fix Λ_g to equal Λ_1, free Φ and free a diagonal Ψ. This procedure is consistent with the ones illustrated by Sörbom and Jöreskog (1976) and Lawly and Maxwell (1971), but they simultaneously fit two groups with $\Lambda_1 = \Lambda_2$, $\Phi_1 \neq \Phi_2$, and Ψ_1 and Ψ_2 specified as free diagonal matrices. Selected differences between the observed and estimated matrices, the residuals, were inspected to determine if a pattern reflecting an item sequence effect could be identified.

Factor analysis procedures were also employed in an exploratory sense. A principal components analysis was conducted as a means for determining the number of factors needed to explain the variation in an item set for the Form 1 data. This analysis was conducted using the Statistical Package for the Social Sciences (SPSS) factor analysis routine. Information used in deciding on the number of factors was the determination of the number of eigenvalues greater than one, the relative values for all eigenvalues (Scree test) and the inspection of Varimax rotated solutions corresponding to iterated principal factor analyses based on a fewer number of factors.

Using the number of factors determined from the SPSS analysis, the computer program EFAP (Jöreskog and Sörbom, 1976) was used to generate the factor loading matrix used as input to COFAMM. A decision was made to produce the factor solution using the unweighted least squares (ULS) option for EFAP as this produces solutions equivalent to those obtained from the iterated principal factor method (see EFAP user's guide).

Since the typical researcher is concerned with results of factor analyses for exploratory and/or data reduction purposes, default options for the SPSS factor routine were used. The procedures for obtaining the factor solution for each of Forms 2, 3, 4 and 5 were consistent with that obtained for Form 1.

These five resultant sets of factor loadings were then inspected to ascertain whether differences in the construction of the questionnaire affected the results and, consequently, affect how one might proceed in reducing data by summing the associated items for the identified factors.

A limitation to the study was that the real core requirement needed to process analyses involving all 61 items exceeded what was available on the local computer configuration. Consequently, the analyses were performed with four subsets of items rather than with the entire set. Differences in the item organization of Forms 1 and 4 was used as the basis for determining the subsets. The subgrouping of items are identified in Table 1.

Insert Table 1 about here

Item Subsets 1 and 2, each containing 17 items, were of most interest since the primary differences between Forms 1 and 4 were the result of reordering and regrouping these items. Subset 1 contains two sets of items, 10-13 and 40-43, which appeared as separate groupings on Form 1, but on Form 4 each set was combined with other items. Items 10-13 were combined with items 14, 16-19, and 24, and items 40-43 were combined with 19, 22, 23, and 25. Subset 2 appeared as a single group of items on Form 1, but was split into two item groups on Form 4: Items 32-39 and 27-31. An additional modification for this subset was to group items 4, 20, 21, and 26 with items 27-31.

Item Subsets 3 and 4 appeared identically sequenced on Forms 1 and 4. Consequently, tests of the equivalency of the Form 1 and Form 4 covariance matrices were expected to display an adequate fit for Subsets 3 and 4. If item grouping or sequencing effects were operating, differences between Forms 1 and 4 should be expected for Item Subsets 1 and 2.

Results indicative of the sequencing and grouping effects follow. Equivalence of Forms 1 and 2, Forms 1 and 3, Forms 2 and 3, and Forms 1 and 4 would indicate neither item sequencing nor item grouping had an effect. Differences for all four of the comparisons would indicate both item sequencing and item grouping had an effect. Since items on Form 2 appeared in the same order as on Form 1, but were ungrouped, a result finding the equivalency of Forms 1 and 2, and differences between Forms 1 and 3 (the random sequence form), Forms 2 and 3, and Forms 1 and 4 (for items reordered on Form 4) would indicate only a sequence effect. Differences between Forms 1 and 2 and Forms 1 and 4, (for items reclassified on Form 4, but not reordered) would indicate a grouping effect.

Results

Correlations

The Pearson Product Moment Correlations for adjacent item pairs on questionnaire Form 3 are provided in Table 2.

Insert Table 2 about here

Since Form 3 represents the random form and the intent was to seek confirmation that items appearing as adjacent items would correlate to a higher degree with one another than if the items were separated, comparisons were made between those item pairs appearing as adjacent on Form 3 but not on Form 1. The differences between correlations were then tested for statistical significance. A two-tailed test with an alpha level of .01 was used as a partial control for the large number of tests made. Of the 61 item-pair correlations reported, 21 were statistically different with the higher correlation always favoring the adjacent items. Of the remaining 39 item pairs 34 observed differences in correlations were in the anticipated direction while only 5 were in the opposite direction. It should be noted that although there were 5 item pairs for which the observed nonadjacent appearing items correlated more highly, the difference with the largest magnitude was only -.062. Also, it is interesting to note that for 4 of the 5 pairs where nonadjacent items had the larger observed correlation, the nonadjacent items appeared within the same identified group of items.

Support for the above findings is contained in the information associated with the item pairs as determined from Form 2 shown in Table 2. The items on this form are in the same sequence as for Form 1 but do not appear in identified groups. In comparing the Form 2 and Form 3 correlations it is seen that 34 out of 60 differences were statistically greater than zero with 58 observed differences greater and only 2 observed differences less than zero. It is significant that the larger of these negative differences is, in an absolute sense, only .096.

Variance - Covariance Equivalence

A summary of information obtained from the comparisons of the covariance matrices is provided in Table 3.

Insert Table 3 about here

Using an alpha level of .01, it can be seen that for Item Subset 1 (items 10-14, 16-19, 22-25, and 40-43) the results marginally supported a model assuming equivalent covariance matrices for Forms 1 and 2. (χ^2 = 201.18, df = 153, and p < .0060). This would indicate that grouping items for the respondents may not necessarily influence the covariances of items appearing on a questionnaire.

For the same set of items a comparison of Form 1 responses with Form 3 (random) responses indicated a definite lack of fit to the hypothesized model of equivalence (χ^2 = 393.00, df = 153, p < .0001). Thus, some evidence for the suspected item sequence effect was apparent. Support for this finding was found when the equivalence of Form 2 and Form 3 matrices was tested and the result was again evidence of a lack of fit (χ^2 = 395.09, df = 153, p<.0001).

The comparison of Forms 1 and 4 for Item Subset 1 was of special interest. The regrouping of these on Form 4 resulted in a different item sequence than on Form 1 for some item pairs but not others. Based on the results reported earlier for comparisons of correlations of items adjacent on one form but nonadjacent on a second, it was expected that a difference between the two covariance matrices could be partially explained by differences between covariances for item pairs sequenced differently on the two forms. The two matrices, shown as correlation matrices, appear in Table 4. Those pairs of items whose covariances were expected to be influenced by a sequence effect are indicated by numbers used as superscripts. It should be noted that all differences between these pairs of items were in the anticipated direction.

Insert Table 4 about here

Correlations for additional adjacent item pairs are presented in Table 5.

Insert Table 5 about here

These pairs are composed of one item from the subset and an adjacent item which was not considered to be part of the subset. The item pairs presented are limited to those that appear as adjacent items on only one of Forms 1 and 4. For Item Subset 1, all eight of the Form 1 adjacent item pairs had higher correlations than for Form 4. However, only one of the three adjacent item pairs for Form 4 had larger correlations than found for Form 1.

Results shown in Table 3 indicate the equivalence model for Item Subset 1 did not fit the comparison of Forms 1 and 4 ($\chi^2 = 280.18$, df = 153, $p < .0001$). A second model in which the equality constraints were relaxed for parameters associated with adjacent item covariances also provided an inadequate fit to the data ($\chi^2 = 199.68$, df = 145, $p < .0020$). Thus, it appeared additional differences existed between the two covariance matrices not taken into account by the newly specified model. However, the relaxation of the equality constraints for these covariance parameters did provide for a significant improvement in the fit as demonstrated by the significant reduction of the chi-square value ($\chi^2 = 80.50$, df = 8, $p < .0001$). This result provided additional support for an effect of item sequence on the covariances corresponding to adjacent items.

Since the effects of item grouping and sequence could be confounded for additional comparisons of items grouped differently on Form 4 and Form 1 (items 14, 16-19, 22-25), additional models reflecting a distinct grouping or sequence effect were not tested. Instead, a model was specified which retained the equality constraints for only items appearing in the same groups and in the same sequence on both forms (items 10-13 and 40-43). This model provided for a significant reduction in the chi-square value

(χ^2 = 170.27, df = 109, p < .0010) and an adequate fit for the data (χ^2 = 29.40, df = 36, p < .7739). Thus, the reorganization of the questionnaire affected only those items which appeared in different sequences on the two forms.

Although a model was not specified to test for a second order lag effect, (i.e., one item separating an item pair) an inspection of the Form 1 and Form 4 correlation matrices revealed that all of the nine possible comparisons of second order lag correlations favored the form on which the item pair appeared with only one item separating the pair. These nine correlations are indicated in Table 4 by alphabetic superscripts.

Forms 2 and 3 were used in analyses for testing possible second (one item separation) and third (two item separation) order lag effects in addition to testing a first order effect. These forms were used for the analyses because the items appeared in a different sequence on the two forms and item groupings were not employed for either form. Consequently, item grouping and sequencing were not confounded.

As shown in Table 3, a model for which the first order equality constraints were relaxed in the Form 2 and Form 3 comparison provided for a significant reduction in the chi-square value (χ^2 = 105.13, df = 13, p<.0001). Although the chi-square value was also significantly reduced for models relaxing the second order equality constraints (χ^2 = 21.64, df = 9, p<.0110) and the third order constraints (χ^2 = 44.42, df = 8, p < .0001), the relaxation of first, second, and third order constraints did not provide an adequate fit for the data (χ^2 = 223.90, df = 123, p<.0001). This suggests that other, unexplored differences existed between the two data sets. An inspection of the correlations for Form 2 and Form 3 revealed that the most consistent influence of item sequencing was its inflationary effect on correlations between adjacent items. If an item sequencing effect was operating on second and third order correlations, it did not appear to be as systematic as for adjacent pairs.

The same procedures were used in the analysis of Item Subset 2, Items 4, 20, 21, and 26-39. The distributions of Subset 1 and 2 items were similar in that Subset 2 items also appeared as two separate item groupings on Form 4 and one or more of these items appeared within one of three item groupings on Form 1. Items 27-39 appeared in the same sequence on both forms, but items 32-39 were placed in a second grouping on Form 4.

Results for the overall comparisons for Subset 2 (displayed in Part B of Table 3) were similar to those found for Subset 1. Models for which equality constraints were placed on all parameters of the covariance matrices yielded significant chi-square values for comparisons of Form 1 with Form 2 ($\chi^2 = 214.27$, df = 153, $p < .0008$), Form 1 with Form 3 ($\chi^2 = 358.72$, df = 153, $p < .0001$), Form 1 with Form 4 ($\chi^2 = 237.85$, df = 153, $p < .0001$), and Form 2 with Form 3 ($\chi^2 = 337.30$, df = 153, $p < .0001$). As with the analysis of the Subset 1 items, the smallest chi-square value was obtained from the comparison of Form 1 to Form 2 and the largest chi-square values resulted from the comparisons of Form 3 with Form 1 and Form 2.

Results for Item Subset 2 analyses based on modified models, wherein equality constraints were relaxed, were also similar to those found for Subset 1. Relaxation of the first order lag constraints for the Form 1 with Form 4 comparison resulted in a significant reduction in the chi-square value ($\chi^2 = 9.80$, df = 3, $p < .0249$). The correlation matrices for both forms are provided in Table 6. All three of the differences between the adjacent item pair correlations were in the anticipated direction. These correlations are indicated in the table by numerical superscripts. Also, four of the five differences for item pairs with one item appearing between them were in the anticipated direction. These are indicated by alphabetic superscripts.

Insert Table 6 about here

Additional adjacent item pair correlations (one item of the pair not a part of the set) were also computed for Subset 2. Three of the four item pairs identified in Table 5 had larger observed correlations for the adjacent item pair.

The model in which equality constraints for parameters associated with items not contained in the same item groups in both forms (items 4, 20, 21, 26) were relaxed, yielded a significant reduction in the chi-square value (χ^2 = 116.20, df = 59, p < .0001) and provided for a reasonable good fit (χ^2 = 111.85 df = 91, p < .0681). A hypothesis of equality of the Form 1 and Form 4 covariance matrices for items 27-39 could not, therefore, be rejected even though 27-31 and 32-39 appeared in different groupings on Form 4. Thus, as found for Item Subset 1, the major effect of reorganizing the questionnaire appeared to be reflected in the covariances involving those items that appeared in a different sequence.

Subset 2 chi-square values were significant in the Form 2 and Form 3 comparison for first order (χ^2 = 248.57, df = 139, p < .0001), second order (χ^2 = 240.77, df = 127, p < .0001), and third order (χ^2 = 230.67, df = 116, p < .0001) lag effects. The model relaxing the equality constraints on first order lag pairs did provide for a significant reduction in the chi-square value (χ^2 = 88.73, df = 14, p < .0001), but models relaxing constraints for second order (χ^2 = 7.80, df = 12, p < .8000) and third order (χ^2 = 10.10, df = 11, p < .5200) lag effects did not result in a significant reduction. This finding, the relative magnitude of the reported chi-square values, and an inspection of the two correlation matrices indicate a pattern similar to the one described for Subset 1 items. That is, an inflationary effect of item sequencing was operating and it was most systematic for first order lag correlations.

Results for Item Subsets 3 and 4 were, as anticipated, quite similar. The item organization for these two subsets differed from that for Subsets 1 and 2 in that items in Subsets 3 and 4 appeared on Form 4 in the same sequence and groupings as on Form 1. Assuming the data to be consistent, the results for Subsets 1 and 2 suggest one would expect differences to be found between Forms 1 and 2, Forms 1 and 3, and Forms 2 and 3. Because no differences between Forms 1 and 4 were found in the previous analysis involving items 10-13 and 40-43 in Subset 1 and items 27-39 in Subset 2 (those items appearing in the same sequence for both forms), no differences were expected between Forms 1 and 4 for Subsets 3 and 4.

The chi-square values (see Table 3, Parts C and D) resulting from the comparisons of Forms 1 and 2 with Form 3 were significant for both Subset 3 ($\chi^2 = 501.79$, df = 171, $p < .0001$ and $\chi^2 = 471.36$, df = 171, $p < .0001$, respectively) and Subset 4 ($\chi^2 = 74.81$, df = 36, $p < .0002$ and $\chi^2 = 82.10$, df = 36, $p < .0001$, respectively). As was anticipated, the chi-square values resulting from the comparisons of Form 1 with Form 4 for Subset 3 ($\chi^2 = 201.96$, df = 171, $p < .0528$) and for Subset 4 ($\chi^2 = 39.43$, df = 36, $p < .3913$) were not significant. The only deviation of the findings for these two subsets from results reported for the other item subsets was that the comparison of Form 1 with Form 2 was significant for Subset 3 ($\chi^2 = 231.87$, df = 171, $p < .0013$) but not significant for Subset 4 ($\chi^2 = 42.48$, df = 36, $p < .2119$).

Results involving the possible item sequence effect on the first, second, and third order lag covariances indicated the same pattern as was found for Subsets 1 and 2. The largest reductions in the chi-square values for

Item Subsets 3 and 4 were those involving the first order lag effect (χ^2 = 176.58, df = 17, p < .0001 and χ^2 = 26.47, df = 6, p < .0050). A third order lag model did not fit the data for either Item Subset 3 or Subset 4. The reported tendency for first order lag correlations to be most affected by sequencing was also observed in the Form 2 and 3 correlation matrices for both Subsets 3 and 4.

Factor Analysis

Prior to fitting the Form 1 factor matrix to Forms 3 and 4, it was first used in an analysis of data collected previously for a sample of teachers. Since the teacher data were collected on a form identical to Form 1, the analysis provided some evidence of the stability of the factor matrix. For purposes of this analysis, a sample size of 257 was declared in order to obtain a chi-square comparable to that for Form 4. The analysis resulted in a nonsignificant chi-square (χ^2 = 560.32, df = 540, p < .2640) indicating the factor structure was reasonably consistent for an independent replication. It is of interest to note the obtained chi-square value approximated that obtained for Form 1 (χ^2 = 529.03).

The chi-square values obtained in fitting the Form 1 factor matrix to Form 3 (χ^2 = 1235.70, df = 540, p < .0001) and Form 4 (χ^2 = 1255.30, df = 540, p < .0001) were both significant. Residuals resulting from these two analyses, the teacher data analysis, and the Form 1 data analysis are shown in Table 7. Because residuals produced by COFAMM are calculated by subtracting elements of the sample matrix from elements of the matrix estimated from the model, negative residuals indicate underestimates.

Insert Table 7 about here

If item sequencing can affect results of factor analyses, the residuals recorded in Part A of Table 7 should be more positive--indicative of overestimates--for Form 3 than for the teacher data, Form 1, or Form 4. That is, the items listed in Part A were in the same sequence on all forms except Form 3, thus analyses using the factor matrix obtained from Form 1 should provide similar residuals for the teacher, Form 1, and Form 4 data, but overestimates for Form 3. Of the 23 item pairs identified in Part A of Table 7, 17 of the Form 3 residuals, indicated with plus signs, were more positive than the residuals for the teacher, Form 1, and Form 4 data. Of the remaining six pairs, four of the Form 3 residuals were more positive than two of the other three groups.

Residuals shown in Part B of Table 7 are for item pairs which appeared adjacent on Form 4, but nonadjacent on the Teacher form, Form 1 and Form 3. Consequently, the residuals would be expected to be more negative--indicative of underestimates--for Form 4 since the factor matrix obtained from Form 1 data would not be influenced by the proximity of the adjacent item pairs. Eight of nine residuals for Form 4 were more negative than those of the teacher, Form 1, and Form 3 data. For the one item deviating from the pattern, the Form 4 residual was more negative than it was for one of the other three groups and differed from a second by only .009.

Item pairs shown in Part C of Table 7 are those for which the residuals should be more positive--indicative of overestimates--for both Forms 3 and 4 since these pairs of items, excepting items 31 and 32, were adjacent on the teacher data and Form 1, but not on Forms 3 and 4. Items 31 and 32 were also adjacent on Form 3. As shown in Table 7, the residuals were more positive for both Forms 3 and 4 for six of the seven pairs which was consistent with expectations. Additionally, the residual of Form 4 was more positive than the residuals of teacher data and Form 1 for item pair 18 and 19. The Form 4 residual was also more positive for item pair 31 and 32 than those for the other three forms.

Item pairs shown in Part D of Table 7 are those for which the residuals should be more negative--indicative of underestimates--for Form 3 since these item pairs were adjacent on Form 3, but nonadjacent on the three other forms. Fourteen of the seventeen residuals were more negative for Form 3 than for the other three forms.

Overall, simultaneously considering the expected relationship among all four forms for each set of item pair residuals, 46 of the 57 were in the expected direction if a sequencing effect was operating. Considering pairwise differences, 151 of 178 were in the anticipated direction.

Exploratory Analyses

Results from the Varimax rotation of a six-factor solution for each of the four forms are shown in Table 8.

Insert Table 8 about here

The items are shown as they were grouped and in the sequence they appeared on Forms 1 and 4. The four columns under Form 4 indicate the four item groupings on Form 4. The sets of rows at the left of the table indicate the item groupings on Form 1. When possible, the most similar factors were assigned the same factor numbers. Only the largest factor loading for each item is shown.

The findings from the comparisons of the covariance matrices for the four forms suggested that (1) the factor matrix for Form 3 would deviate most from the factor matrices of the other three groups since the largest chi-square values were obtained in comparing Form 3 to Forms 1 and 2, (2) the factor matrices of Form 1 and Form 2 would be most similar since the smallest chi-square values were found in comparing the Form 1 and 2 matrices, and (3) the factor matrices of Forms 1 and 4 would deviate most for items 4, 14, and 16-26 since analyses with a modified model indicated that the difference between the two forms resided with these particular items.

As shown in the table, the factor matrix of Form 3 did deviate most from the factor matrices obtained for the other three forms. Also, the factor matrices of Forms 1 and 2 seemed most similar, with the major differences being (1) a shift of the adjacent item pair of 16 and 17 from factor II on Form 1 to the sequence of items 18 to 21, factor III, on Form 2 and (2) a shift of the adjacent item pair of 27 and 28 on factor II of Form 2 to the sequence of items 29-31, factor III, on Form 1. While, overall, the difference between Forms 1 and 4 does not appear to be much greater than between Forms 1 and 2, it is significant that most deviations of the Form 4 factor matrix from the Form 1 factor matrix reside with items 4, 14, and 16-26. Additionally, these deviations correspond to the grouping and sequencing used on Form 4: Factor I of Form 4 corresponds to the Form 4 item grouping 1, Factors II and VI correspond to item grouping 2, Factors III and IV correspond to item grouping 3, and Factor V corresponds to item grouping 4.

While Form 5 had not been included in any of the previous analyses--primarily, since nine item groupings were used on the form it added to the complexity of the study--it was decided that results of a factor analysis of Form 5 might provide confirmation for the results of the factor analysis, particularly those for Form 4. Since Form 5 represented yet a fifth way in which the items were organized, if questionnaire organization influences the inter-item correlations and subsequent factor analyses, results from the factor analysis would be expected to reflect the organization of the items on Form 5.

The item sequence and grouping and the results of the factor analysis of Form 5 are shown in Table 9. Some liberty has been taken by showing two loadings for items 11, 14 and 26; however, the addition of these second highest loadings could not be resisted in light of the very close correspondence of the first four factors and the item groupings.

Insert Table 9 about here

While it could be argued that only four factors are present, the sixth eigenvalue for Form 5 was 1.08 and the relative magnitudes of the values might justify six factors. Regardless, the analysis does provide additional evidence of the influence of questionnaire organization on a resultant factor matrix for these items.

Summary and Discussion

The results of the comparisons of Pearson product-moment correlations provide substantial evidence in support of adjacent item pairs having inflated correlations relative to what one would anticipate if the items had not appeared concurrently on the questionnaire. In general, the covariance matrices corresponding to particular sets of items for two questionnaire forms composed of grouped items were found to differ if item pairs were in a different sequence, and not to differ if the items appeared in the same sequence. Improvements in fitting data with a model assuming equivalent covariance matrices were generally found by specifying a model allowing covariances for item pairs adjacent on one form but nonadjacent on the second form to differ, but requiring items appearing in the same sequence on both forms to have equal covariances. Comparisons of two other questionnaire forms on which items appeared in different sequences and ungrouped indicated that although sequencing had some effect on second and third order lag covariances, these effects were less systematic than the effect of sequencing on first order lag covariances (adjacent item pairs).

An examination of the residuals obtained in fitting Forms 1, 3, and 4 and the teacher data using a six factor solution obtained for Form 1 data provided evidence that item organization could affect the factor structure. Differences observed among the factor structures of five different item organizations resulting from the use of rather conventional factor analysis procedures reflected these different item organizations. The differences among the factor structures could be attributed to the items which appeared in different sequences on the forms.

Although some evidence was found to suggest item grouping with an associated group descriptive caption had some effect on the covariances, it was difficult to draw firm conclusions about the strength of such an effect. Comparisons involving items that appeared in the same sequence, but were grouped on one form and ungrouped on another resulted in the smallest differences of all the comparisons made in the study. The results from exploratory factor analysis procedures indicated the grouping effect was quite small, if even present, at least in comparison to the sequencing effect.

The most striking result of the various analyses was the consistency of findings. The effects of item sequence were generally present when anticipated and absent when unanticipated.

The findings reported here are of course restricted to data of the type described. However, this type of data is representative of a vast array of data used by researchers. Researchers working with this type of data who include factor structure related procedures as part of their analyses might consider a possible item sequence effect in interpreting their results and in constructing their questionnaires.

The question of the presence of an item sequence effect in the analyses of questionnaires containing high-inference type items is raised by the results found in this study. Such measures are generally derived and/or confirmed with factor analysis procedures. Some consideration should be given to asking if the same factor composition would have resulted had the items been presented in some other sequence. Attention should also be given to factor solutions of only a few items. It is possible such factors are only reflecting inflated relationships resulting from items of close proximity.

Finally, one might hypothesize that a sequencing effect would be less influential on analyses involving fewer numbers of factors. This is currently being investigated using the data obtained for this study.

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TABLE 1

ITEM SUBGROUP COMPOSITION FOR THE 61 ITEMS APPEARING ON THE IN-SERVICE EDUCATION SURVEY QUESTIONNAIRE

Subset	Item number	Form 1 Group 1	Form 1 Group 2	Form 1 Group 3	Form 4 Group 1	Form 4 Group 2
	10	x			x	
	11	x			x	
	12	x			x	
	13	x			x	
	14		x		x	
	16		x		x	
	17		x		x	
	18		x		x	
	19		x			x
	22		x			x
	23		x			x
	24		x		x	
	25		x			x
	40			x		x
	41			x		x
	42			x		x
	43			x		x
2	4	x			x	
	20		x		x	
	21		x		x	
	26		x		x	
	27			x	x	
	28			x	x	
	29			x	x	
	30			x	x	
	31			x	x	
	32			x		x
	33			x		x
	34			x		x
	35			x		x
	36			x		x
	37			x		x
	38			x		x
	39			x		x

TABLE 1--Continued

Subset	Item number	Form 1			Form 4	
		Group			Group	
		1	2	3	1	2
3	44	x			x	
	45	x			x	
	46	x			x	
	47	x			x	
	48	x			x	
	49	x			x	
	50	x			x	
	51	x			x	
	52	x			x	
	53	x			x	
	54	x			x	
	55	x			x	
	56		x			x
	57		x			x
	58		x			x
	59		x			x
	50		x			x
	61		x			x
4	1	x			x	
	2	x			x	
	3	x			x	
	5	x			x	
	6	x			x	
	7	x			x	
	8	x			x	
	9	x			x	

Note.--Although identified as item groups 1, 2, or 3, each subset consists of distinct groupings, i.e., items in group 2 for item subset 2 are not necessarily in group 2 for item subset 1.

TABLE 2

PEARSON PRODUCT MOMENT CORRELATIONS FOR ITEM PAIRS
APPEARING AS ADJACENT ITEMS ON QUESTIONNAIRE
FORMS TWO AND THREE

Form 3 pairs	Form 1 N=480	Form 3 N=254	3-1	Form 2 pairs	Form 2 N = 241	Form 3	2-3
7,44	075	179	104	1, 2	176	254	-078
44,49	259	213	-046	2, 3	345	325	020
49,18	208	225	017	3, 4	331	232	099
18,21	429	537	108	4, 5	512	417	095
21,11	344	366	022	5, 6	466	456	010
11,42	176	219	043	6, 7	277	186	091
42,40	396	334	-062	7, 8	444	222	222*
40,13	225	286	061	8, 9	658	461	197*
13,15	315	443	128	9,10	225	321	-096
15,48	329	342	013	10,11	646	463	183*
48,33	277	351	073	11,12	660	456	204*
33,55	315	380	065	12,13	634	235	399*
55,24	318	293	-025	13,14	440	323	117
24, 9	340	370	030	14,15	450	207	243*
9, 4	240	361	121	15,16	396	202	194
4,61	216	448	232*	16,17	575	356	219*
61,20	218	262	044	17,18	565	414	151
20,32	263	394	131	18,19	535	432	103
32,31	408	486	078	19,20	557	400	157
31,27	507	633	126	20,21	611	536	075
27,38	331	330	-001	21,22	570	333	237
38, 1	124	307	183	22,23	416	316	100
1,28	183	436	253*	23,24	550	208	342*
28,51	389	555	166*	24,25	472	181	291*
51,39	310	296	-014	25,26	481	272	209*
39, 8	222	464	242*	26,27	490	405	085
8,25	189	260	071	27,28	677	549	128
25,14	209	353	144	28,29	546	342	204*
14,16	331	361	030	29,30	597	428	169
16,54	387	635	248*	30,31	493	459	065
54,19	257	273	016	31,32	598	481	112
19,30	404	512	108	32,33	505	249	256*
30,17	281	550	269*	33,34	639	320	319*
17,50	316	584	268*	34,35	462	377	085
50,57	395	519	124	35,36	416	337	079
57,36	286	409	123	36,37	494	237	257*
36,12	148	384	236*	37,38	548	319	229
12, 2	180	397	217*	38,39	654	102	252*
2,23	128	375	247*	39,40	430	223	207*
23,46	165	412	246*	40,41	580	319	261*
46,59	249	405	156	41,42	581	306	275*
59,37	313	546	233*	42,43	512	127	385*
37,26	271	374	103	43,44	516	213	303*
26,10	243	577	334*	44,45	499	121	378*

TABLE 2--Continued

Form 3 pairs	Form 1 N=480	Form 3 N=254	3-1	Form 2 pairs	Form 2	Form 3	2-3
10, 3	221	527	351*	45,46	724	412	312
3,47	244	312	068	46,47	445	302	143
47,58	250	448	198*	47,48	643	484	159*
58,41	363	461	098	48,49	612	260	352*
41,53	309	474	165	49,50	589	179	410*
53,56	327	568	341*	50,51	516	383	133
56,52	320	413	093	51,52	404	225	179
52,22	249	473	224*	52,53	507	434	073
22, 6	180	405	225*	53,54	506	214	292*
6, 5	322	456	134	54,55	473	190	283*
5,43	249	406	157	55,56	440	217	223*
43,35	323	438	115	56,57	693	527	166*
35,29	376	447	071	57,58	568	395	173*
29,60	266	443	177*	58,59	532	320	212*
60,34	431	589	158*	59,60	542	451	091
34,45	243	437	194*	60,61	517	254	263*

Note.--Values appearing in the table are correlations multiplied by 1000.
* p < .01 for two-tailed test.

TABLE 3

SUMMARY STATISTICS FOR TESTING EQUIVALENCE OF VARIANCE-COVARIANCE MATRICIES BETWEEN PAIRS OF ITEM FORMS FOR VARIOUS SETS OF ITEMS

Form comparison	Items fixed	Model df.	Model χ^2	Model p <	Reduction df	Reduction χ^2	Reduction p <
A. Item Subset 1: 10-14, 16-19, 22-25, 40-43							
1 vs 2	All	153	201.18	.0060			
1 vs 3	All	153	393.00	.0001			
1 vs 4	All	153	280.18	.0001			
	Adj. prs. free[1]	145	199.68	.0020	8	80.50	.0001
	10-14, 40-43[2,3]	36	29.40+	.7739	109	170.27	.0010
2 vs 3	All	153	395.09	.0001			
	First Order	140	289.96	.0001	13	105.13	.0001
	Second Order	131	268.32	.0001	9	21.64	.0110
	Third Order	123	223.90	.0001	8	44.42	.0001
B. Item Subset 2: 4, 20, 21, 26-39							
1 vs 2	All	153	214.27	.0008			
	20, 21, 26-39	136	195.05	.0007	17	19.22	.3160
	27-39	91	151.47	.0001	45	43.58	.5400
	32-39	36	57.41+	.0131	55	94.06	.0010
1 vs 3	All	153	358.72	.0001			
1 vs 4	All	153	237.85	.0001			
	Adj. prs. free[1]	150	228.05	.0001	3	9.80	.0249
	20, 21, 26-39	136	184.61	.0035	17	53.24	.0001
	27-39[2,3]	91	111.85+	.0681	59	116.20	.0001
	32-39	36	48.27+	.0831	55	63.58	.2000
2 vs 3	All	153	337.30	.0001			
	First order free	139	248.57	.0001	14	88.73	.0001
	Second order free	127	240.77	.0001	12	7.80	.8000
	Third order free	116	230.67	.0001	11	10.10	.5210

TABLE 3--Continued

Form comparison	Items fixed	Model			Reduction		
		df	χ^2	p <	df	χ^2	p <
C. Item Subset 3: 44-61							
1 vs 2	All	171	231.87	.0013			
1 vs 3	All	171	501.79	.0001			
1 vs 4	All[2]	171	201.96[+]	.0528			
2 vs 3	All	171	471.36	.0001			
	First order free	154	294.79	.0001	17	176.58	.0001
	Second order free	138	239.56	.0001	16	55.32	.0001
	Third order free	123	207.50	.0001	15	32.00	.0070
D. Item Subset 4: 1-3, 5-9							
1 vs 2	All	36	42.48[+]	.2119			
1 vs 3	All	36	74.81	.0002			
1 vs 4	All[2]	36	39.43[+]	.3193			
2 vs 3	All	36	82.10	.0001			
	First order free	30	55.63	.0030	6	26.47	.0001
	Second order free	25	44.84	.0087	5	10.79	.0560
	Third order free	20	33.10[+]	.0329	5	11.73	.0410

Note.--The superscripts denote the following: (1) items have been resequenced for one of the two forms, (2) items remain grouped identically and in the same sequence for the two forms, (3) items have been resequenced for the two forms, and (+) model provides for a sufficient fit of the data.

TABLE 4

ITEM SET ONE INTERCORRELATIONS[a] FOR FORM ONE AND FOUR

Form 1 Items \ Form 4 Items	10	11	12	13	14	16	17	18	19	22	23	24	25	40	41	42	43
10		56	53	42	17	28	39	37	34	24	10	39	20	26	22	21	27
11	59		59	46	25	36	38	38	36	29	25	35	32	18	19	31	24
12	50	63		52	17	38	34	29	23	22	17	40	28	17	18	22	21
13	36	45	53		32	45[A]	38	40	29	19	20	48	26	20	17	28	24
14	26	33	34	41		43[1]	33[B]	31	28	28	23	41	18	25	26	27	26
16	33	36	38	42[A]	33[1]		57	47	17	23	20	45	27	35	31	35	24
17	37	34	39	34	32[B]	64		56	12[C]	17	19	45[D]	22	24	20	25	31
18	27	33	36	35	32	40	38		33[2]	18	18	54[3]	28	20	24	22	33
19	29	20	23	35	25	21	28[C]	50[2]		41[4]	25[E]	27	34	31	20	22	30
22	19	21	17	26	31	34	31	28	25[4]		44	20[F]	51[G]	27	40	19	24
23	11	18	14	19	20	26	16	15	13[E]	36		13[5]	64[6]	27[H]	25	20	32
24	28	28	32	26	40	42	37[D]	38[3]	37	40[F]	34[5]		23[7]	26	29	30	36
25	23	22	19	23	21	30	23	27	33	48[G]	39[6]	44[7]		39[8]	37[I]	22	33
40	23	21	18	22	26	27	24	23	33	29	26[H]	31	32[8]		53	47	37
41	22	13	16	20	23	20	19	17	30	31	19	36	27[I]	50		49	35
42	16	18	15	20	20	28	22	24	27	28	25	31	31	40	45		44
43	18	13	20	22	25	31	29	27	32	35	37	45	35	47	38	42	

Note.--The numerical superscripts indicate the corresponding intercorrelations for items that were adjacent in only one of the two forms. Form 1 pairs are (18,19), (23,24), and (24,25). Form 4 pairs are (14,16), (18,24), (19,22), (23,25), and (25,40). The alphabetic superscripts denote those item pairs that appear as second order item pairs (separated by one other item) in only one of the two forms. Form 1 second order item pairs are (17,19) and (22,24). Form 4 second order item pairs are (13,16), (14,17), (17,24), (19,23), (22,25), (23,40), and (25,41).

[a]Tabled values are intercorrelations multiplied by 100.

TABLE 5

FORM ONE AND FORM FOUR INTER-ITEM CORRELATIONS FOR ADJACENT ITEM PAIRS WHERE ONE ITEM DOES NOT BELONG TO THE ITEM SUBSET

Form 1 pairs	Correlation		Form 4 pairs	Correlation	
	Form 1	Form 4		Form 1	Form 4
Item Subset 1: 10-14, 16-19, 22-25, 40-43					
9,10	21	16	3,10	22	36
14,15	35	26	19,31	43	35
15,16	51	27	43,32	38	29
19,20	45	38			
21,22	43	37			
25,26	43	25			
39,40	27	21			
43,44	39	36			
Item Subset 2: 4, 20, 21, 26-39					
3, 4	32	28	4,24	30	33
4, 5	45	40	39,44	27	26

Note.--Values appearing in the table are correlations multiplied by 100.

TABLE 6

ITEM SET TWO INTERCORRELATIONS[a] FOR FORMS ONE AND FOUR

Form 1 Items \ Form 4 Items	4	20	21	26	27	28	29	30	31	32	33	34	35	36	37	38	39
4		56[1]	40[A]	33	49	47	20	19	30	24	37	27	14	28	21	11	11
20	34[1]		54	31[B]	43	38	27	25	28	33	38	30	23	39	37	28	19
21	34[A]	61		44[2]	53[C]	49	38	48	51	31	33	39	36	37	56	43	41
26	27	33[B]	38[2]		46	37	24	30	32	18	15	18	22	24	25	22	14
27	31	45	49[C]	44		71	41	45	46	21	27	33	27	31	37	28	30
28	28	39	47	34	69		47	45	46	30	29	32	34	37	35	30	36
29	25	38	48	35	51	50		53	51	28	27	30	34	28	37	35	39
30	29	42	45	32	42	45	60		61	27[D]	23	27	31	23	43	42	37
31	26	45	52	34	51	52	63	63		31[3]	33[E]	37	33	34	48	38	34
32	29	26	34	23	33	32	40	38[D]	41[3]		51	54	36	42	39	32	34
33	24	34	34	27	36	38	37	37	44[E]	58		61	36	32	36	33	37
34	27	28	36	25	41	44	37	31	39	54	65		56	38	49	37	44
35	16	27	32	29	32	37	38	33	30	36	42	50		42	47	40	33
36	33	27	30	32	34	34	25	25	27	29	34	40	35		50	33	24
37	26	34	39	27	35	35	41	41	43	34	42	44	42	37		53	43
38	24	25	34	22	33	34	34	30	31	38	40	37	31	33	52		49
39	20	27	32	23	39	39	40	34	38	37	38	51	41	26	49	49	

Note.--The numerical superscripts indicate the corresponding intercorrelations for items that were adjacent in only one of two forms. Form 4 pairs are (4,20) and (21,26). The only adjacent pair for Form 1 is (31,32). The alphabetic superscripts denote those item pairs that appear as second order item pairs (separated by one other item) in only one of the two forms. Form 4 second order item pairs are (4,21), (20,26) and (21,27). Form 1 second order item pairs are (30,32) and (31,33).

[a]Tabled values are correlations multiplied by 100.

TABLE 7

RESIDUALS DERIVED IN FITTING SIX FACTOR MODEL BASED ON FORM 1 DATA FOR THIRTY-FOUR ITEM SET

Item pair	Residual[a]				
	Teacher	Administrator			
		Form 1	Form 4	Form 3	
A.	Item pairs for teachers form, Form 1 and Form 4				
10,11	-046	-033	-018	-026	-
11,12	-007	014	-006	-014	-
12,13	-069	057	052	143	+
13,14	-095	-127	-026	-050	-
16,17	-006	-058	-081	128	+
17,18	-177	011	-183	-013	-
20,21	-109	-125	-118	-106	+
22,23	-166	-199	-212	-121	+
26,27	-043	-013	-032	-043	-
27,28	-003	-011	-029	015	+
28,29	-028	003	014	120	+
29,30	-049	-045	-062	004	+
30,31	-084	001	-095	006	+
32,33	113	031	073	205	+
33,34	024	044	-030	114	+
34,35	-095	-058	-150	-047	+
35,36	-201	-031	-142	-088	-
36,37	-129	-059	-214	048	+
37,38	-186	-201	-208	-022	+
38,39	-208	-184	-191	-131	+
40,41	-154	-117	-175	-037	+
41,42	-215	-104	-170	-050	+
42,43	-133	-061	-102	148	+

TABLE 7--Continued

Item pair	Residual					
	Teacher	Administrator				
		Form 1	Form 4		Form 3	
B. Item pairs for Form 4, but not for form 1 or Teacher form						
4,20	013	-030	-289	+	097	
14,16[b]	010	-024	-124	+	-046	
18,24	041	022	-158	+	126	
24, 4	029	022	-014	+	071	
21,26	-001	017	-077	+	076	
31,19	-040	000	-010	-	-019	
19,22	-030	-008	-173	+	-055	
23,25	-208	-132	-384	+	-200	
25,40	024	035	-039	+	-012	
C. Item pairs for Teacher form and Form 1, but not Form 4						
18,19	-127	-182	-047	+	-153	-
19,20	-276	-141	-100	+	-127	+
21,22	-121	-064	-025	+	008	+
23,24	-092	-063	146	+	047	+
24,25	067	-060	129	+	156	+
25,26	-106	-085	086	+	-003	+
31,32[b]	079	106	150	+	-052	
39,40	-081	-061	-023	+	-035	+

TABLE 7--Continued

Item pair	Residual				
	Teacher	Administrator			
		Form 1	Form 4	Form 3	
D. Item pairs for Form 3, but not Form 1, Form 4, or Teacher form[b]					
10,26	-062	-013	041	-282	+
11,21	031	009	034	053	-
11,42	004	013	-082	046	-
12,36	-085	-014	011	-119	+
13,40	027	025	067	003	+
14,25	-006	-024	001	-154	+
14,16	-010	-024	-027	-046	+
17,30	-036	021	-062	-166	+
18,21	028	-002	008	-100	+
19,30	019	-012	074	-218	+
20,32	057	051	-011	-035	+
26,37	027	-041	-052	-131	+
27,31	038	022	062	-132	+
27,38	001	-013	-004	002	-
29,35	-038	-096	-062	-161	+
35,43	-046	-050	-147	-206	+
40,42	-026	-016	-007	-039	+

Note.--The values appearing in the table are 1000 times as large as the actual residuals. The (+) and (-) symbols are used to denote agreement and disagreement with anticipated patterns assuming item sequence inflates the covariances for adjacent items.

[a]COFAMM computes the residual as $\Sigma - S$ where Σ is the estimated covariance matrix and S the sample covariance matrix. Thus, in part A, Form 3 residuals should be less negative than residuals for Forms 1 and 4 and for the teacher form if sequence affects the covariances as anticipated. Form 4 residuals should, in the presence of the anticipated effect, be more negative for the residuals reported in part B. In part C, residuals for Forms 3 and 4 were expected to be less negative than the other residuals.

[b]These items appeared as adjacent items on Form 3.

TABLE 8

FOUR FORM MAJOR FACTOR LOADINGS FOR SIX FACTOR SOLUTION

Item grouping: Form 1	Form 4 Item Groups: 1	2	3	4	Factor loadings: Form 1 Factors: I	II	III	IV	V	VI	Form 4 Factors: I	II	III	IV	V	VI	Form 2 Factors: I	II	III	IV	V	VI	Form 3 Factors: I	II	III	IV	V	VI
1			4			31							68					33									51	
2	10				57						59						63						53					
	11				75						67						74						64					
	12				76						69						70						55					
	13				58						65						64									39		
3	14				36						a				29						37			48				
	16					43					49								55					43				
	17					50					50								53						42			
	18						51				44								61						57			
		19					53					34							51						50			
			20				49						57						66							43		
			21				44						43						64							43		
		22						51				55								55				55				
		23						51				68								42				56				
	24							38			49									45						55		
		25						61				76								75				45			64	
			26			39							46							52								
4			27				43						61					64							49			
			28				43						54					64							40			
			29				58							50					51				31					
			30				62							69					56						48			
			31				68							60					54							52		
				32					53						61						36					57		
				33					66						59						46					32		
				34					71						77						63					48		
				35					51						56						49			54				
				36		52									46						53						50	
				37					54						51						55			52				
				38					52						40						63			38				
				39					59						48						55			40				
5		40								60						59						67						59
		41								62						67						72		44				
		42								53						55						64						48
		43								46				33		b						51					42	

Note.--Actual loadings have been multiplied by 100.
[a]Loading is 26.
[b]Loading is [illegible].

TABLE 9

FORM FIVE MAJOR
FACTOR LOADINGS

Item Grouping						Factors					
Form 1	Form 5										
	1	2	3	4	5	I	II	III	IV	V	VI
1	4									36	
		10				57					
2		11				52				58	
		12				54					
		13				48					
		14				41					.50
		16				57					
		17				61					
		18				66					
		19				38					
3		20				59					
		21				63					
			22			40	40				
			23				50				
		24				53					
			25				69				
				26			36	23			
				27				40			
				28				55			
				39				59			
				30				60			
				31				65			
4					32				58		
					33				69		
					34				69		
					35				51		
					36				56		
					37				47		
					38				49		
					39				53		
			40				60				
5			41				55				
			42				54				
			43				58				

TABLE 10

QUESTIONNAIRE ITEM DESCRIPTION

Number	Item description
1.	Behaving in a manner which is consistent with the legal rights and responsibilities of teachers.
2.	Organizing the classroom environment to emphasize rewards rather than punishments.
3.	Coordinating individual and group instruction and supplementary activities within the confines of scheduling constraints.
4.	Maintaining classroom records to facilitate classroom management.
5.	Establishing procedures to maintain an orderly class.
6.	Implementing strategies to encourage positive student attitudes toward learning.
7.	Determining when and how to apply group methods of discipline.
8.	Analyzing the problem behaviors of students.
9.	Implementing procedures to resolve individual behavior problems.
10.	Selecting instructional objectives which are relevant to long-range goals.
11.	Stating instructional objectives in terms of observable student behaviors.
12.	Establishing expected student performance levels for instructional objectives.
13.	Using cognitive (e.g., ability and achievement) and non-cognitive (e.g., attitudinal, value, and sociological) information about students to establish priorities for goals and objectives.
14.	Identifying individual and group reinforcers which can be used to motivate students.
15.	Recognizing students with special cognitive (e.g., learning disabilities) or affective (e.g., emotional) problems who need the attention of school and community specialists.
16.	Determining whether the learning task identified in an objective requires primarily memorization, formation of a new concept, problem solving, synthesis, etc.
17.	Identifying the prerequisite skill and knowledge necessary for a student to achieve an objective.
18.	Breaking down a learning task into components in order to accommodate students with different skills and abilities.
19.	Designing instructional programs to meet the individual needs of students.
20.	Arranging instruction so that students can move in an orderly manner toward the achievement of an objective.
21.	Applying learning principles when planning and guiding learning activities.
22.	Incorporating recent subject matter developments into the instructional process.
23.	Experimenting with different methods of teaching.
24	Applying knowledge of child and adolescent development when planning and guiding learning activities.
25.	Using newly developed curriculum procedures and materials.
26.	Evaluating the appropriateness of instructional materials (e.g., textbooks).
27.	Collecting information on a regular basis concerning student progress toward the achievement of instructional objectives.
28.	Providing feedback to students on a regular basis concerning their progress toward achieving instructional objectives.
29.	Using performance information to pinpoint the nature of learning difficulties.
30.	Restructuring instruction when reteaching is necessary.
31.	Using information about student performance to assign subsequent learning activities (e.g., remedial and sequential).
32.	Interacting with students from a different social and ethnic background than theirs.
33.	Employing group activities to promote widespread student participation.
34.	Interacting with students in ways to promote mutual understanding and trust.
35.	Using techniques of questioning to encourage higher levels of student thinking (e.g., analysis, synthesis, and evaluative thinking).
36.	Presenting clear and logical verbal instruction (e.g., lectures).
37.	Employing procedures to encourage self-directed student behaviors.
38.	Incorporating value clarification activities into the instructional process.
39.	Using techniques to encourage positive student self-concepts and feelings of worth.
40.	Using learning centers, audio-visual aids, television, games, and other multimedia methods to promote student learning.
41.	Incorporating community facilities and resource people into the instructional process.
42.	Using para-professionals, tutors, and other instructional personnel in conducting classroom related activities.
43.	Devising instructional materials and activities, including remedial.
44.	Selecting tests which match stated objectives.
45.	Constructing objective cognitive test items (e.g., multiple-choice and matching).
46.	Constructing non-objective cognitive evaluation procedures (e.g., essay items, performance assessments, and product evaluation).
47.	Interpreting commercial achievement test scores.
48.	Calculating normative scores such as means, medians, percentiles, stanines, etc.
49.	Constructing non-cognitive assessment devices (e.g., attitudes and values).
50.	Improving present assessment devices and procedures.
51.	Interpreting the results of testing and evaluation to students, their parents and to other professionals in terms each can understand.
52.	Using student feedback (e.g., opinions) to evaluate and revise instruction.
53.	Using student achievement data collected throughout the instructional process to evaluate and revise instructional materials and procedures.
54.	Determining whether objectives have been obtained for which performance standards cannot be set (e.g., non-cognitive objectives).
55.	Devising accurate, objective methods for periodically summarizing and reporting student achievement (e.g., grades).
56.	Implementing procedures to enlist parental support of your instructional program.
57.	Exchanging information about students with parents on a regular basis (e.g., progress difficulties, special problems).
58.	Interacting with parents from a different social and ethnic background than theirs.
59.	Discussing their instructional successes, needs and problems with school administrators in a non-threatening environment.
60.	Communicating their goals and objectives to the public.
61.	Receiving pertinent information about the activities of government, school administration, community, and professional organization (s)