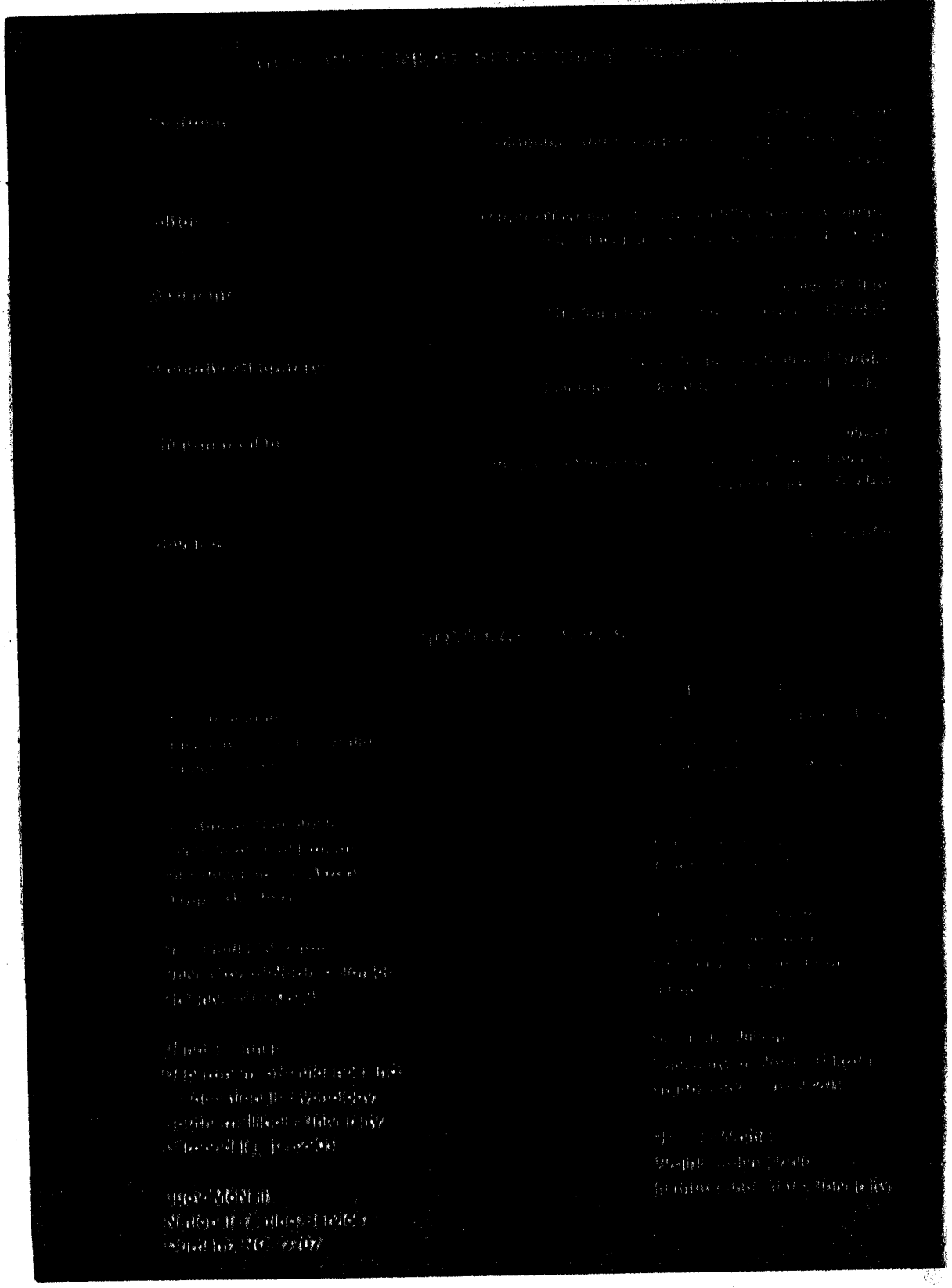


MULTIPLE LINEAR REGRESSION

SPECIAL INTEREST GROUP MEETING

Thursday, April 16, 1981
8:15 am - 10:15 am

Biltmore Hotel - Grecian Room, Conference Level

CHAIR: Lee M. Wolfle
Virginia Polytechnic Institute
and State University

Presentations:

"Causal Models with Unmeasured Variables: An Introduction to LISREL." Lee M. Wolfle, Virginia Polytechnic Institute and State University

"Specification Bias in Causal Models with Fallible Indicators." Barbara J. Patteson and Lee M. Wolfle, Virginia Polytechnic Institute and State University

"A Comparative Analysis of Texts of Multiple Regression." Dennis W. Leitner and Randall E. Schumacker, Southern Illinois University, Carbondale

Discussant: Thomas E. Jordan, University of Missouri, St. Louis

Chair-elect: Joe Ward, Brooks Air Force Base

ACKNOWLEDGEMENT

THIS BEING THE TENTH YEAR OF MULTIPLE LINEAR REGRESSION VIEWPOINTS, OF WHICH THE LAST SEVEN HAVE BEEN PUBLISHED AT THE UNIVERSITY OF AKRON, I WOULD LIKE TO ACKNOWLEDGE THE SUPPORT OF THE UNIVERSITY OF AKRON IN PUBLISHING M.L.R.V. WITHOUT THEIR SERVICES, THIS PUBLICATION COULD NOT HAVE BEEN PUBLISHED. SPECIFICALLY, I WOULD LIKE TO PUBLICLY THANK DEAN BARKER AND DEAN CARRINO FOR THEIR INITIAL ENCOURAGEMENT AND SUPPORT.

Introduction

Multiple Linear Regression Viewpoints has completed its tenth year of publication, 1980.

Viewpoints is a journal of the Special Interest Group on Multiple Linear Regression of the American Educational Research Association, although not a journal sponsored by AERA nor bound by its rules.

The journal was begun in order to provide a forum for publishing articles of both theory and application of multiple linear regression. Exchange and sharing of ideas and methodology has always been strongly encouraged.

Viewpoints can be located on the ERIC system library data base. The total collection of Viewpoints is now housed in the Library of Congress, having been acquired and catalogued in January, 1981.

This special issue of Viewpoints contains a retrospective list and abstracts of all the papers published in Viewpoints since its inception. They are presented chronologically from Volume 1 through Volume 10.

MULTIPLE LINEAR REGRESSION VIEWPOINTS: A TEN-YEAR RETROSPECTIVE INDEX

Ronald F. Bobner and Carolyn R. Benz
The University of Akron

VOLUME 1, No. 1

McNeil, K. A. The negative aspects of the eta coefficient as an index of curvilinearity. Viewpoints, 1970, 1(1), 7-17.

The objective of this paper is to discuss the eta coefficient and to point out some limitations and misconceptions about the coefficient. Specifically, we will discuss the fact that (a) the eta coefficient is a global measure of curvilinearity, (b) the eta coefficient has limited interpretability, (c) there are a number of other curvilinear relationships that might be of more significance and of more interpretability, (d) these other curvilinear relationships do not suggest nor encourage grouping of data as does the eta coefficient, and (e) these other curvilinear relationships may tend to be more amenable to replication than is the eta coefficient.

Stone, L. A., & Skurdal, M. A. Estimation of product moment correlation coefficients through the use of the ratio of contingency coefficient to the maximal contingency coefficient. Viewpoints, 1970, 1(1), 19-25.

The authors attempt to demonstrate that the ratio, contingency coefficient/maximal contingency coefficient, (C/C_{max}), is directly comparable to the product moment correlation coefficient. Inspection of all of the computed C/C_{max} ratios, from 2x2 tables, showed that the ratios which correspond most closely to the product moment correlation coefficients were not always the ones which were associated with fourfold tables having dichotomies nearer to .50 - .50 proportions. However, the authors were led to believe that the C/C_{max} ratios which best approximated the product moment correlation coefficients generally were from the fourfold tables where there was an approximate 50/50 split. The C/C_{max} ratio may be used as a "quick and dirty" estimate of the relationship measure provided by the product moment correlation model. No mathematical justification is offered for this contingency coefficient ratio.

Williams, J. D. Multiple comparisons in a regression framework. Viewpoints, 1970, 1(1), 26-39.

In using multiple regression as a problem-solving technique, one problem that might arise is the overuse of a full model with several restricted models, without adjusting the probability level. Such an approach would violate the apparent probability level. This has long been a concern in statistics. Several multiple comparison procedures have been developed for different situations.

The intent of the present paper has been to extend some of the better known multiple comparison procedures (Duncan's Multiple Range Test, Dunn's "C" Test, and Scheffe's Test) to a multiple regression approach. The major change in the regression approach is to assess the result of multiple uses of a full model to a correct distribution, rather than a straight-forward usage of the F distribution.

Goff, A. F., & Houston, S. R. Concurrent validity of the Koppitz scoring system for the Bender Visual Motor Gestalt Test. Viewpoints, 1971, 1(1), 45-52.

The study examined correlations between assessed visual-motor perception, intelligence, and academic achievement. In addition, efficiency of prediction for criterion variables was investigated by employing two approaches of analysis: (a) regression model and (b) Bender z model. The following conclusions were formulated on the basis of the obtained data and from the comparison of the two predictive models.

1. The significant negative correlation found between age and the Bender error score adds further substantiation to the fact that the ability to correctly execute the Bender protocol improves with increased age.

2. The Bender z score correlated to a greater degree with intelligence, reading, and arithmetic achievement than did the Bender error score with the three specified variables.

3. The obtained correlations of the Bender z score with the three criterion variables agrees with the literature in directionality and in significance with assessed intelligence.

4. However, efficiency is enhanced by using the Bender error score and age rather than the single variable of the Bender z score to predict achievement in reading and arithmetic and assessed intelligence.

Jordan, T. E. Curvilinearity within early developmental variables. Viewpoints, 1971, 1(1), 53-77.

Squared and cubed vectors were introduced into 18 regression models each applied to nine criteria. Data came from study of several hundred children in the first three years of life. Departure from linearity did not provide better accounts of the relationship between five predictors and development at 12, 24, and 36 months of age. Illustrations of various patterns of squared vectors and cubed vectors were presented from the data.

Reed, C. L., Feldhusen, J. F., & Van Mondfrans, A. P. Regression models in educational research. Viewpoints, 1971, 1(1), 78-88.

Results of this study do not support the findings of Rock (1965) that the interaction term regression was superior to the quadratic form in predictive efficiency. The most efficient regression model will depend upon (a) how the variables and criterion are related, (b) the reliability of the predictor variables, and (c) the research question asked.

The studies reviewed in this paper seem to indicate that complex regression models are in some cases more efficient predictors of complex behavior than the most frequently assumed first-order model. When quadratic and interaction terms are significant, however, interpretation is made more difficult. Still, an attempt at interpretation seems somewhat better than ignoring the problem or assuming it does not exist.

McNeil, K. A., & Beggs, D. L. Directional hypotheses with the multiple linear regression approach. Viewpoints, 1971, 1(1), 89-102.

Two well-known directional tests of significance are presented within the multiple linear regression framework. Adjustments on the computed probability level are indicated. The case for a directional interaction research hypothesis is defended. Conservative adjustments on the computed probability level are offered and a more precise computation is requested of statisticians. Emphasis is placed more on the research question being asked than on blind adherence to conventional formulae.

VOLUME 2, No. 1

McNeil, K. A. On the unit vector. Viewpoints, 1971, 2(1), 2.

Short article presents several interpretations of the unit vector -- one of which conceptualizes the unit vector as any predictor to the zero power.

McNeil, K. A. On attenuating a multiple R. Viewpoints, 1971, 2(1), 3.

A brief conceptual argument questioning the value of attenuating a multiple R.

Duff, W. L., Houston, S. R., & Bloom, S. A regression/principal components analysis of school outputs. Viewpoints, 1971, 2(1), 5-18.

The objective of this study is to identify the correlates of student performance and teacher retention in an inner-city elementary school district. The purpose is to provide urban school administrators with information necessary to cope with the special problems they face in organizing and administering their educational resources.

The study is divided into two parts: a descriptive section and an analytic section. In the descriptive section the writers are concerned with describing the inner urban school system. Here the data to be analyzed are presented and classical regression techniques are used to specify the three basic teacher retention and student performance models. In the second section the data are further analyzed in terms of the unique contribution of a priori specified subsets of predictor variables. This section ends with a comparison of a principal component regression approach to the a priori grouping of predictors used in the unique analysis.

Bolding, J. T. Empirical exercises for the study of multiple regression. Viewpoints, 1971, 2(1), 21-22.

Six short exercises are presented which utilize random data and illustrate several properties of MLR. Specifically, if 10 random variables are added together to produce a criterion, then the 10 variables will yield an R^2 of 1.00 when predicting that criterion. Variations of the above situation are presented.

Connett, W. A note on multiple comparisons. Viewpoints, 1971, 2, 23-24.

Two general methods are available for controlling the overall alpha level. One method is to adjust the F value required for significance. This method in relation to multiple regression was recently discussed in Viewpoints (Williams, 1970). The second way to maintain an overall alpha level is by proper choice of the alpha levels for the individual comparisons. The purpose of this note is to review a method for determining the individual alpha levels necessary to maintain some selected overall alpha level.

Williams, J. D., & Lindem, A. C. Setwise regression analysis: A new data-analytic tool. Viewpoints, 1971, 2(2), 25-27.

The setwise procedure drops one set at a time in a stepwise fashion. There will be as many stops as there are sets. Statistically, the steps are accomplished by an iterative procedure that allows the R^2 term to be maximized at each stage in a backward stepwise procedure. Once a set is discarded, the set is no longer considered at later stages.

While the difficulty regarding the use of binary and predictors has been at least partially solved, other difficulties in regard to the stepwise procedure are also involved in the setwise procedure; additionally, the setwise procedure has a new problem unique to itself.

It has been pointed out several times that probability levels in the stepwise procedure are usually violated. Further, when k of the N variables has been dropped, the N - k remaining variables are not necessarily the set of N - k variables that would yield the highest R^2 value. These criticisms would also be valid in regard to the setwise procedure. Additionally, the differences in the number of variables in a set will have some effect upon when that set of variables would be dropped. Other things being equal, a set with six variables will be retained longer than a set with three variables. Notwithstanding these difficulties, if the setwise procedure is judiciously employed by researchers, then addition data analysis power can be obtained.

Greenup, H. Watch that first step. Viewpoints, 1972, 2(1), 32-33.

Author discusses the interactive system at UCLA. "Biomed" programs can be directed by (a) the 2250's typewriter-like keyboard, (b) an attached lightpen, or (c) some specially programmed keys located near the keyboard.

McClaran, R. V., & Brookshire, W. K. A comment on multiple comparisons in a regression framework. Viewpoints, 1972, 2(1), 34-35.

Authors clarify an error in an earlier article in Viewpoints. The error occurred in the Williams' paper dealing with multiple comparisons. One restricted model was inaccurate.

Newman, I., & Fry, J. A response to "a note on multiple comparisons and a comment on shrinkage." Viewpoints, 1972, 2(1), 36-38.

Connett (1971) presented Kimball's (1951) formula for keeping α levels constant when making a number of comparisons.

A simplified formula, developed by the authors, for computing these levels is presented along with a brief mathematical proof that Kimball's technique and that of the authors' are approximately equivalent.

The method simply takes the desired α level desired to keep constant across a number of comparisons (α_o) and divides that specific α_o by the number of comparisons one wishes to make (N). Authors suggest that when the ratio of subjects to variables is 10:1 or less, a shrinkage estimation should be used and reported.

If this is done, research based on multiple correlations will tend to be more replicable and therefore more desirable and useful.

Newman, I. A suggested format for the presentation of multiple linear regression. Viewpoints, 1972, 2(1), 42-45.

Multiple regression, when presented in the literature, has usually been formatted in an idiosyncratic manner. In addition, the format rarely presents all the relevant information in a concise, easy-to-inspect manner. Instead, one tends to find himself thumbing through pages of the article to find the relevant information.

Author presents a format for the presentation of multiple regression models and the information required for their interpretation.

Connett, W. E., Houston, S. R., & Shaw, D. G. The use of factor regression in data analysis. Viewpoints, 1972, 2 (1), 46-49.

Suppose that it is desired to express the criterion variable as a function of a set of independent variables in which the intercorrelations between the various independent variables is near zero. The procedure involves restructuring the full regression model in such a way that the criterion variable is expressed as a function of several mutually orthogonal factor variables. This principal components-regression approach permits one then to investigate the unique contribution of each of the factor variables to explaining the dependent variable.

The "factor regression" procedure begins with the complete orthogonal factoring of the set of predictors.

Factor scores are then computed.

If a regression model is cast, regressing some criterion variable onto the set of factor score predictors, several interesting properties are noted. The beta weight for a predictor is equal to the validity for that predictor. The R^2 value for any model is equal to the sum of squares of the beta weights for the model. The exclusion of a factor score variable from the predictor set will result in a drop in R^2 equal to the square of the beta weight for the variable dropped. And, perhaps most important, the dropping of any predictor variable from the predictor set will not affect the beta weights (predictive contribution in this case) of any of the other variables. These properties are demonstrated in the following example.

This procedure is not a substitute for the long-established principles of statistical inference, those being hypothesis building and testing; rather it provides data organization preliminary to hypothesis development and testing.

VOLUME 3, No. 1

Williams, J. D., Maresh, R. T., & Peebles, J. D. A comparison of raw gain scores, residual gain scores, and the analysis of covariance with two modes of teaching reading. Viewpoints, 1972, 3(1), 2-16.

It should be abundantly clear from the 16 tables that the three approaches to psycho-educational change are different. While this set of data does not exhibit strong relationships between the dichotomous predictor and the various criteria, the use of the statistical significance approach would occasionally yield different interpretations. Perhaps the most objective comparison between the three measures would be the R^2 term (for the analysis of covariance, or adjusted means approach, $R^2_{FM} - R^2_{RM}$). Only one significant difference is found in the three measures. In Table 6, the raw gain is significant ($p < .05$), but under exactly the conditions that would tend to make this occur, the vertical group was significantly smaller than the graded group on the pretest, but this difference was almost erased on the posttest. In terms of the raw gains score, this produced a significant difference in favor of the vertical group.

Jennings, E. Linear models underlying the analysis of covariance, residual gain scores and raw gain scores. Viewpoints, 1972, 3(1), 17-24.

The problem of investigating "change" or "gain" that can be attributed to "treatments" has been discussed extensively over a number of years without a noticable consensus emerging. Cronbach (1970) has even suggested that many questions that appear to involve "change" can be effectively resolved without reference to the concept of change.

Koplyay, J. B. Automatic interaction detector AID-4. Viewpoints, 1972, 3(1), 25-38.

The primary value of AID-4 to the task scientist is its ability to identify the maximum amount of variance in the criterion which can be accounted for by the predictors available; it relieves the task scientist of the trial-and-error task of attempting to identify the various relevant combinations of linear and nonlinear interaction terms presently required by the multiple linear regression technique. The splitting process of AID-4, being based upon maximizing the between sums-of-squares and minimizing the within-sums-of-squares, automatically takes all present interactions into account, indicating the maximum variance predictable in the criterion from the predictors. The interactions and patterns or trends are identifiable from the AID-4 output.

Newman, I. Some further considerations of using factor regression analysis. Viewpoints, 1972, 3(1), 39-41.

Presents four major points concerning factoring the data before using MLR. When using factor regression procedures, it is important to keep in mind that if one does not use all of the factors (that is, accounting for 100% of the trace) he may be overlooking a suppressor factor (suppressor variable).

If one is interested in improving the multiple regression equation by using factor techniques, there is only one way this can be done--by using fewer factors than the number of original variables. This will increase the df and also possibly decrease shrinkage estimates. However, when this is done one may be losing information that can account for criterion variance by eliminating a factor that accounts for very little trace of the factored matrix but is highly correlated with the criterion scores.

Using only the factors that account for most of the trace should be avoided when the predictor variables that are being factored are likely to be highly reliable. Under these conditions a variable that accounts for little of the trace variance may be a good and highly reliable predictor of criterion variance.

Newman, I., & Fry, J. Proof that the degrees of freedom for the traditional method of calculating analysis of covariance and the multiple regression method are exactly the same. Viewpoints, 1972, 3(1), 42-45.

Authors provide a proof that the degrees of freedom for traditional analysis of covariance and for the "over and above" analysis with MLR are exactly the same.

Brebner, M. A. Conditions for no second-order interaction in multiple linear regression models for three factor analysis of variance. Viewpoints, 1972, 3(1), 46-57.

Author provides pictorial, algebraic, and regression models for investigating second-order interaction in a three-way design.

Newman, I., & McNeil, K. A note on the independent variance of each criterion in a set. Viewpoints, 1972, 3(1), 58-60.

Frequently a researcher is interested in a number of criterion variables which may not be uncorrelated with each other. The chances are that these variables are likely to be significantly correlated with each other.

If one is interested in accounting for the independent piece of a criterion variable's variance, then the procedures outlined here should be used. By covarying other nonindependent criteria as explained in the paper, one can actually treat each test of each criterion as if the criterion variable were independent of each other.

Newman, I., Lewis, E. L., & McNeil, K. A. Multiple linear regression models which more closely reflect Bayesian concerns. Viewpoints, 1972, 3(1), 71-77.

The purpose of this paper is to discuss several relationships between the Bayesian approach and the multiple linear regression approach.

The testing of interaction is what distinguishes the regression procedure outlined in the present paper from that commonly used in prediction studies. Too often, even plausible interactions are ignored and all subjects are lumped together and, hence, treated as similar. Our conceptual theories have long ago turned to distinct groupings, and it is about time that our statistical procedures reflect this empirical possibility, whether they be Bayesian or multiple linear regression. Until the Bayesian methodology has empirically been shown to be more predictive than multiple regression analysis, the availability and relative mathematical simplicity of multiple regression analysis would seem to indicate preference for its utilization rather than the Bayesian approach.

VOLUME 4, No. 1

Brookshire, W. K., & Bolding, J. T. Using coefficients of orthogonal polynomials as predictor variables in multiple regression. Viewpoints, 1973, 4(1), 1-6.

Coefficients of Orthogonal Polynomials are presented by some authors (Snedecor & Cochran) as a means of simplifying the computation required in trend analysis. Linear regression addicts who are computer oriented can still make good use of such coding in the analysis of complicated designs.

Consider a two-factor design where the factors are assumed to be quantitative with levels selected at equal intervals. Testing for main effects and trend analysis can both be simplified by the use of coefficients of orthogonal polynomials as predictor vectors.

McNeil, K. A. Testing an hypothesis about a single population mean with multiple linear regression. Viewpoints, 1973, 4(1), 7-14.

The recent emphasis on criterion-referenced testing and on the explicit stating of objectives implies that more researchers will be testing hypotheses about a simple population mean. The generalized regression procedure is one way to test such an hypothesis. The appropriate regression models are presented in this paper.

Halasa, O. Identification of significant predictors of children's achievements and attendance. Viewpoints, 1973, 4(1), 15-22.

The identification of variables other than the treatment process, which are affecting the criterion measure variance, has always been a problem.

Most of the regression coefficients failed a statistical test of significance. Of the six predictors, the pretest score evidence consistent significant contributions to the criterion variance. The percent of predictable variance, however, indicates that a significant proportion of the variance remains unaccounted for.

Newman, I., & McNeil, K. Application of multiple regression analysis in investigating the relationship between the three components of attitude in Rosenberg and Hovland's theory for predicating a particular behavior. Viewpoints, 1973, 4(1), 23-39.

Multiple regression and factor analysis techniques were used to investigate the relationship between the components of attitude and their differential predictive power. It was found that the different components of attitude and their linear interaction are more likely to be predictive for intimate rather than non-intimate behaviors. The cognitive component was found to be significantly predictive of intimate behavior but not predictive for non-intimate behavior. Out of the three measures used, the behavioral differential was the most predictive scale for both intimate and non-intimate behavior.

Ward, J. M., Jr. Guidelines for reporting regression analyses. Viewpoints, 1973, 4(1), 40-41.

Suggests including in a report of regression analyses:

1. General Comments
2. Regression Analysis Discussion
   a) natural language statements of the hypotheses
   b) identification of the assumed model
   c) hypotheses in terms of assumed model
   d) identification of the restricted model
   e) results of the test
3. Vector definitions
4. Analyses
   a) model specifications
   b) model comparisons
5. Regression Computer Output

McNeil, K. Reaction to Ward's "Guidelines for reporting regression analysis" and some alternatives. Viewpoints, 1973, 4(1), 42-44.

Suggests guidelines other than Ward's.

1. Statement of research hypothesis
2. Statement of statistical hypotheses
3. Statement of alpha
4. Formulation of full model
5. Statement of restrictions
6. Formulation of restricted model
7. Definition of vectors
8. Reporting of the probability of the calculated F, and the subsequent decision.

Newman, I. A revised "Suggested format for the presentation of multiple regression analyses." Viewpoints, 1973, 4(1), 45-57.

Presents a format for displaying the hypotheses and results for those hypotheses. This format could be used in conjunction with either Ward's or McNeil's earlier stated formats.

Williams, J. D. Applications of setwise regression analysis. Viewpoints, 1973, 4(2), 1-7.

One of the earlier applications of the setwise technique was made by Grooters (1971). Grooters was interested in predicting costs per student credit hour in four state colleges. The input data were means by department for 16 variables, forming nine sets. Four of the sets were single variables, four sets were logical sets and one set was formed among mutually exclusive binary sets similar to the religious set described earlier. Such a situation typically involves a linear dependency within the total set. To remove the dependency, any one of the variables within the set can be excluded, and the analysis can be performed. Using the setwise technique, Grooters was able to isolate a rather intriguing result; student costs are in some measure higher in departments that have a higher incidence of outside of school professional activity (consulting, speaking, local community work, artistic endeavors outside the college setting, etc.). Yet another interesting result was that the average salary paid per member in the department was the first set to drop out.

Cummins, M. E. Utilization of multiple regression analysis in changing the verbal behavior patterns of elementary classroom teachers through self-evaluation. Viewpoints, 1973, 4(2), 8-17.

Multiple regression analysis was used to investigate the effectiveness of a self-evaluation technique in changing the verbal behavior patterns of elementary classroom teachers. Three ratios were employed: the I/D ratio, or ratio of indirect to direct statements by the teacher; the TRR, or teacher response ratio which eliminates questioning and lecturing from the total I/D ratio; and the PIR, or the ratio of pupil talk-response to pupil talk-initiated. The self-evaluation technique for changing the verbal behavior patterns of elementary classroom teachers was not found to be significant for any of the three measures.

Pohlmann, J. T. Incorporating cost information into the selection of variables in multiple regression analysis. Viewpoints, 1973, 4(2), 18-26.

The problem of finding the best regression equation is considered from the standpoint of predictor costs. Typically, variables are selected for inclusion in prediction equations on the basis of their unique contribution to the prediction of a criterion. A method is presented whereby losses due to lack of predictability and predictor costs are combined in a loss function. The best predictor set is then chosen that simultaneously minimizes losses incurred in measuring the predictors and losses incurred from lack of predictability of a criterion variable.

Lewis, E. L., & Mouw, J. T. The use of contrast coding to simplify ANOVA and ANCOVA procedures in multiple linear regression. Viewpoints, 1973, 4(2), 27-44.

Multiple regression (MR) is a powerful and flexible technique for handling data analysis. The present paper presents a discussion of the use of "contrast coding" in performing analysis of variance and analysis of covariance procedures in MR. Contrast coding provides a method for coding nominal variable in the set of predictor vectors in MR so that such vectors reflect a set of orthogonal comparisons. As a result, one is able to test hypotheses concerning more specific research questions than those usually tested in more traditional MR coding procedures. By adding more components to the general linear model, contrast coding provides a relatively simple and logical basis for extending analysis of variance to its various subclassifications.

Newman, I. Variations between shrinkage estimation formulas and the appropriateness of their interpretation. Viewpoints, 1973, 4(2), 45-48.

This is a discussion paper dealing with the use of shrinkage, different methods for estimating shrinkage, and the accuracy of shrinkage estimates when variables are preselected as in stepwise regression and when variables are not preselected.

Pyle, T. W. The analysis of split-plot and simple hierarchical designs using multiple linear regression. Viewpoints, 1973, 4(3), 1-9.

For those researchers who are interested in using multiple linear regression (MLR) as a general data analytic technique, it is of some importance to recognize what types of models and restrictions on models generate F ratios that correspond to classical hypothesis-testing procedures. One of these is the split-plot factorial design and another is the completely randomized hierarchical design. What will be demonstrated here is that MLR models can be constructed for these designs which generate F ratios that are equivalent to those obtained by traditional computing formulas.

Buzahora, R. C., & William, J. D. An empirical comparison of residual gain analysis and the analysis of covariance. Viewpoints, 1973, 4(3), 10-17.

Summary: An extensive comparison of the analysis of covariance and the residual gain analysis was made. Using subtests of the Iowa Tests of Basic Skills, the School Attitude Inventory and School Sentiment Index independently at each grade level, grades 3-8, 258 analyses were compared. While the analysis of covariance gave some indication of being more powerful, this result was not uniform over the various analyses.

Houston, J. A., & Houstin, S. R. Judgement analysis and pornography. Viewpoints, 1973, 4(3), 18-31.

Judgement Analysis (JAN) was used as a methodology for determining what is pornographic by testing this technique with three groups concerned with this issue. These groups included doctoral students majoring in Psychology, Counseling and Guidance (PCG) at the University of Northern Colorado, lawyers and police officers from the city of Greeley, Colorado. JAN proved to be an effective technique in the identification of policies. The problem of what is pornographic is indeed a complex one as evidenced by the many specific categorical and complex policies present in the PCG judges, lawyers and police officers.

Houston, S. R. Identifying faculty policies of teaching effectiveness. Viewpoints, 1973, 4(3), 32-38.

Judgment Analysis (JAN) was employed to capture the teacher effectiveness policy(ies) of College of Education faculty at the University of Northern Colorado (UNC). Fifty-seven judges evaluated 60 hypothetical faculty members, each on four characteristics. Results indicated that possibly three different judgemental systems or policies existed.

Brebner, M. A. Multiple linear regression models for analysis of covariance including test for homogeneity of regression slope: Part 1--one-way designs with one covariate. Viewpoints, 1973, 4(3), 39-50.

The objective of the paper is to describe the multiple linear regression models which correspond exactly in all respects to the classical analysis of covariance and tests for homogeneity of regression slope. It is the author's opinion that the approach pioneered by Bottenberg and Ward gives a much clearer and more meaningful understanding of analysis of covariance than the classical method.

Pohlman, J. T., & Newman, I. Regression effects when the assumption of rectilinearity is not tenable. Viewpoints, 1973, 4(3), 51-59.

When analyzing data which deals with repeated testing, one may find that extreme scorers on a pretest regress away from the mean upon posttest, contrary to what one would expect from the regression effect. This paper discusses regression effects and presents the argument that when contrary results occur, they are indicative of violation of an underlying assumption of rectilinearity for the Pearson r. Therefore it is recommended that one should look for nonlinear relationships when interpreting such data. In addition, three methods for determining if nonlinear relationships exist in data are suggested and briefly discussed.

Olson, G. H. A general least squares approach to the analysis of repeated measures design. Viewpoints, 1973, 4(3), 60-69.

Two procedures for computing general least squares analyses of repeated measures designs are discussed. The first procedure, appropriate for small N, is a straight-forward application of the usual regression approach to the analysis of variance. The second approach, appropriate for large N, also utilizes the regression approach but requires some minor calculation in addition to that typically performed by most computer programs.

VOLUME 4, No. 4

Williams, J. D. A note on contrast coding vs. dummy coding. Viewpoints, 1973, 4(4), 1-5.

A comparison is made between the contrast coding system for solution to the analysis of variance design presented by Lewis and Mouw (1973), and the use of dummy coding for solution to the analysis of variance designs. Some of the limitations and advantages of each approach are given.

Klein, M., & Newman, I. Estimated parameters of three shrinkage estimate formuli. Viewpoints, 1973, 4(4), 6-11.

This paper examines the shrinkage formuli of Wherry, McNemar and Lord in relation to overcorrection. A table is given which shows the number of times that each formula resulted in a negative value of R^2 for different numbers of variables and sample sizes.

McNeil, K., & McShane, M. Complexity in behavioral research as viewed within the multiple linear regression approach. Viewpoints, 1973, 4(4), 12-15.

The paper attempts to clarify the notion of complexity in research. Perhaps, in the past, researchers have oversimplified the variables and their interrelationships. Thinking of interaction variance as bad variance or as producing an undesired result, or lamenting the complexity of the phenomena under consideration does little or nothing to advance research in the behavioral sciences. The authors examine two views of complexity which seem to exist: (a) complexity is indicated by the number of predictor variables needed to account for a criterion behavior, and (b) complexity as indicated by the nature of the predictor variables. The authors argue that the second view of complexity is not valid, and that the multiple linear regression technique provides an easy way to index the first view.

Wyshak, G. Modification of multiple regression when an independent variable is subtracted from the dependent variable. Viewpoints, 1974, 4(4), 16-20.

Behavioral scientists are often concerned with regressing some dependent or outcome variable, Y, on a number of independent or explanatory variables, X_i, i = 1.2,...,k (Model 1). If Y is a final score or measurement and X_1 an initial score, the investigator may be interested in some measure of change, say $Y - X_1$, and its relation to the several explanatory variables including X_1 (Model 2). Analyses would be based on two multiple regression equations, one relating to the regression of Y on X_1, $X_2,...,X_k$, and the other to the regression of $(Y - X_1)$ on the same X's.

The note calls attention to the fact that one analysis would suffice for the two models because the regression coefficients, the total sums of squares, deviations sums of squares and regression sums of squares are readily obtained for Model 2 once the calculations have been made under Model 1.

St. Pierre, R. G. VARGEN: A multiple regression teaching program. Viewpoints, 1974, 4(4), 21-29.

VARGEN (Variable Generator) creates sets of data with known statistical properties by generating user-specified variables which are functions of uniformly distributed random numbers for each of a group of subjects. The user specifies the relative size and location of from one to nine predictor variables and one criterion variable within a 10 x 10 matrix (hereafter called the "universe") and, therefore, the amount of variance accounted for by each variable. A visual display is produced showing the size and location within the universe of any five variables.

Williams, J. D., & Lindem, A. C. Regression computer programs for setwise regression and three related analysis variance techniques. Viewpoints, 1974, 4(4), 30-46.

Four computer programs using the general purpose multiple linear regression program have been developed. Setwise regression analysis is a stepwise procedure for sets of variables; there will be as many steps as there are sets. COVARMLT allows a solution to the analysis of covariance design with multiple covariates. A third program has three solutions to the two-way disproportionate analysis of variance: (a) the method of fitting constants, (b) the hierarchical model, and (c) the unadjusted main effects solution. The fourth program yields three solutions to the two-way analysis of covariance, with or without proportionality, and with multiple covariates. The three solutions are similar to those described for a two-way analysis of variance with disproportionate cell frequencies.

Mason, R. L., & McNeil, K. A. Mashit--For ease in regression program communication. Viewpoints, 1974, 4(4), 47-64.

This regression system is an intermediate result of a project to develop a comprehensive regression computer system as a foundation for a complete statistical man-machine interface. The outstanding features of the system can be condensed into two principle concepts. First, the program dynamically allocates core resulting in no limit on title cards, question cards, etc. Secondly, "english-type" user commands are used in a free format mode to save computer instruction time. The resulting system is two-phase constructed in such a manner that additional capabilities can be added efficiently.

Fanning, F. W., & Newman, I. The development and demonstration of multiple regression models for operant conditioning questions. Viewpoints, 1974, 4(4), 65-87.

Based on the assumption that inferential statistics can make the operant conditioner more sensitive to possible significant relationships, regression models were developed to test the statistical significance between slopes and Y intercepts of the experimental and control group subjects. These results were then compared to the traditional operant conditioning eyeball technique analysis.

One major advantage of using the regression procedure, rather than the traditional eyeball technique, is that probability estimates can be attributed to the accuracy of the statements.

Another advantage of the regression procedure used is the ability to test the curvilinear relationships above and beyond linear ones, which is not feasible with the eyeball technique on multiple baseline analysis. Similarly, one cannot test to see if the slopes of the control group are significantly different statistically.

In addition, as demonstrated in this paper we can also test to see if the functional relationship of one treatment is significantly different from the functional relationship of some other treatment (across some area of interest).

VOLUME 5, No. 1

Haynes, J. R., & Swanson, R. G. Method for comparison of non-independent multiple correlations. Viewpoints, 1974, 5 (1), 1-6.

The technique for the comparison of related R's is based on the residual criterion scores rather than directly on the R or R^2 values. The procedural steps are: (a) generate predicted criterion scores for each set of predictor variables; (b) for each set of predicted scores, obtain the absolute difference between each predicted and corresponding actual criterion scores; (c) analyze these difference scores by a single classification analysis of variance for repeated measures. If a significant F is obtained from the ANOVA, some or all of the multiple correlations would be considered different. Multiple comparisons to determine which R's differ from each other are then conducted using techniques such as the Newman-Keuls studentized range statistical test.

Maola, J. F. The multiple regression approach for analyzing differential treatment effects--the reverse Gestalt model. Viewpoints, 1974, 5(1), 7-10.

This paper was written in order to demonstrate a method of using multiple regression for determining the effect of independent differences of providing treatment. The procedures involve a model of comparing differential treatment effects to the total treatment and was, therefore, named the "Reversed Gestalt Model" because of its theoretical base.

Byrne, J. The use of regression equations to demonstrate causality. Viewpoints, 1974, 5(1), 11-22.

A universal objective of scientists involved with explanations of behavior or phenomenon is to demonstrate their knowledge of what is causing it. Explanations of causality usually entail knowledge of a number of elements or underlying variates that interrelate to produce the phenomenon.

An R^2 of 1.00 means that 100% of the change that takes place in the phenomenon has been numerically connected to changes that take place among the variables and experimental manipulations controlled by the scientist. As the R^2 value approaches 0.0, it means that more and more things outside of the comprehension of the scientist are appearing which cause the phenomenon.

Pyle, T. W. Classical analysis of variance of completely within-subject factorial designs using regression techniques. Viewpoints, 1974, 5(1), 23-32.

The use of regression analysis in analyzing data obtained from between-subject experimental designs is well-documented and easily obtainable. In addition, some texts cover the classical analysis of variance (ANOVA) of single factor repeated measurements designs, and an identification has also been made of regression models which yield F ratios (for Main and Interaction effects) equivalent to those obtained by standard computing formulas for split-plot factorial and simple hierarchical designs (Pyle, 1973). However, documentation for the standard ANOVA of completely within-subject factorial designs using regression analysis is not available as far as this author is aware. The purpose of this article is to provide such documentation by means of an example.

Gloeckler, T. L. Use of multiple linear regression on analysis of intelligence test score changes for visually handicapped adults. Viewpoints, 1974, 5(1), 33-39.

Multiple linear regression was used to analyze complex data-assessing longitudinal changes in IQ test performance of visually handicapped adults. Results indicated: (a) patterns of performance similar to those found in sighted populations, and (b) no influence on IQ changes by a variety of ontological factors.

Newman, I. Dinner with Dr. Earl Jennings. Viewpoints, 1975, 5 (1), 40-44.

Dr. Newman discusses his informal dinner conversation with Dr. Jennings at the last AERA convention. The major part of the discussion centered around "shrinkage." Dr. Jennings stated: "Shrinkage is O.K. if you're interested in interpreting R^2." The article provides good fuel for thought.

VOLUME 5, No. 2

Maola, J. F. Causality and prediction: Similar but not synonymous. Viewpoints, 1974, 5(2), 1-2.

A short critique of Byrne (Viewpoints, 1974, 5(1), 11-22) and his article on causality.

Williams, J. D. Regression solutions to the AxBxS Design. Viewpoints, 1974, 5(2), 3-9.

An alternative regression solution to the repeated measures design (AxBxS) is given, contrasting to a solution given earlier by Pyle (Viewpoints, 1974, 5(1), 23-32). The solution given here can be completed without altering the criterion measures to find the A and B effects. Also, the presenting solution can be translated quite easily into experimental design terminology.

St. Pierre, R. S. Possible relationships between predictor and criterion variables. Viewpoints, 1974, 5(2), 10-27.

This article defines possible relationships between a set of predictors and a criterion, and presents a modified Vargen visual display and regression analysis appropriate to that relationship (sample N = 1000). Primary focus of article is on effect of each relationship on the square multiple correlation (R^2). Three cases are presented.

Houston, S. R., & Bolding, J. T., Jr. Regression chi-square: Testing for a linear trend in proportions in a 2xc contingency table. Viewpoints, 1975, 5(2), 28-31.

The usual chi-square test for a 2xc contingency table can fail to produce statistical significance when, in fact, a significant linear trend in proportions is present in the data. The ordinary chi-square test lacks power in the case when the variables can be considered ordered classifications. A regression chi-square test is described and illustrated with hypothetical data in which the usual chi-square test produced nonsignificant results even though a significant linear trend was present in the data.

Williams, J. D. Four-way disproportionate hierarchical models. Viewpoints, 1974, 5(2), 32-40.

A solution for the four-way disproportionate fixed effects hierarchical model is given. Because there are 15 effects to be ordered, and the ordering will have a major impact on each different effect, the N - way hierarchical model should be used only when there is a strong a priori ordering suggesting itself to the researcher.

Houston, S., & Ohlson, E. L. Issues in teaching multiple linear regression for behavioral research. Viewpoints, 1974, 5 (2), 41-44.

Several questions, issues, and approaches to teaching a basic course in multiple linear regression (MLR) are raised in this article. These include the following: (a) MLR as a generalized procedure, (b) use of matrix algelua in MLR, (c) redundant models in MLR, (d) orthogonal coding, and (e) data analysis and MLR. Suggestions and recommendations are made for the issues raised.

Deitchman, R., Newman, I., Burkholder, J., & Sanders, R. E. An application of the higher order factorial analysis design with disproportionality of cells. Viewpoints, 1974, 5(2), 45-57.

The results of the application of several techniques available for analyzing data when there is disproportionality of cells reported. How accurately they answer the research questions asked is also discussed.

VOLUME 5, No. 3

Williams, J. D., & Klimpel, R. J. Path analysis and causal models as regression techniques. Viewpoints, 1975, 5 (3), 1-20.

Using regression as a point of comparison path analysis and causal models get a detailed explanation. Land tenure and community leadership is an example in the article to draw conclusions as to the analogous relationship between the recursive equations and the dropping of the corresponding partial regression coefficient.

Houston, S. R., & Ohlson, E. L. From educational evaluation to decision making: JAN to the rescue. Viewpoints, 1975, 5(3), 21-29.

Judgement analysis (JAN) and its application in several areas--general applications, evaluations, applications, evaluation of research proposals, and instructional program evaluation--were presented by the authors as a method for decision-capturing for decision makers. Examples of how the technique can be applied in each of the areas were presented.

Maola, J. F., & Weis, D. M. Unique variances of creativity and dogmatism for predicting counseling success. Viewpoints, 1975, 5(3), 30-35.

In this article the authors are comparing the results of stepwise multiple regression of unique variances for predicting counseling success from creativity and dogmatism, and are describing the unique prediction of creativity and dogmatism for predicting counseling success. Twenty-three graduate students in guidance and counseling were administered the Torrance Test of Creative Thinking Figural B (1966) and the Rokeach D Scale (1960). Stepwise multiple regression was used to interpret the data. It was found that dogmatism accounted for 29% of the variance and creativity accounted for 11.1% of the variance. The analysis of unique variance found dogmatism accounting for 2.6% and creativity accounted for 3.7% of the variance.

Huston, S. R., & Bolding, J. T., Jr. Part, partial, and multiple correlation in commonality analysis of multiple linear regression models. Viewpoints, 1975, 5(3), 36-40.

The method of commonality analysis which partitions variance of a linear model is presented as a technique for explaining and analyzing data. An example with hypothetical data is presented and analyzed. The interrelationships and roles of part, partial, and multiple correlation to the process of commonality analysis are identified.

McNeil, K., & McNeil, J. Some thoughts on continuous interaction. Viewpoints, 1975, 5(3), 41-46.

In this article the authors emphasize by example the importance of specifying your expectations of the interaction of your variables. You must specify interaction as linear or curvilinear and which culminations of the predictor variables will yield high/low criterion scores.

Edelburn, C. E., & Ochsnes, D. P. STWNULTR: A computer program to expedite the retrieval of residual scores. Viewpoints, 1975, 5(3), 47-48.

Residual gain analysis is described in general terms and a new computer program, STWMULTR, designed to retrieve and punch residual scores, is described. Input and output sample data are included.

George, J. D. Multiple regression techniques applied to test the effect of three types of special class placement on the reading achievement of educable mentally retarded pupils. Viewpoints, 1975, 5(3), 51-70.

Multiple regression analysis was used to examine the different effects of special class placement on the reading achievement of educable mentally retarded (EMR) pupils. Self-contained classes, selected academic placement programs, and learning resource centers were the types of placement studied. A significant difference was found between the reading score of EMR boys in learning resource centers and EMR girls in the same classes. The boys scored higher. Further, boys scored higher in learning resource centers than they did in any other placement, and girls scored higher in selected academic placement programs than they did in any other placement.

VOLUME 5, No. 4

Byrne, J. F., & McNeil, K. A. A further discussion of issues related to causal inference. Viewpoints, 1975, 5(4), 1-10.

The role of causality in scientific investigation, and in particular as it relates to multiple regression, needs to be further discussed in this journal. Statistical pragmatism (as measured by R^2) is seen as a necessary but not sufficient condition for ascertaining causality. A research strategy is described which will help the researcher define the level of causal inference to which he is entitled. Interpretations of R^2 will vary depending upon the level which the researcher has allowed.

Evaluation of Maola's criticisms (1974B) of Byrne (1974) is also included.

Ross, M., & McCabe, G. P. A comment on Pohlmann's algorithm for subject selection in multiple regression analysis. Viewpoints, 1975, 5(4), 11-15.

Pohlmann's algorithm for incorporating cost criteria into the valuable selection problem in multiple regression is examined. It is pointed out that this algorithm has the property that the choice of the optimal subset can be artificially changed by the addition of another variable. An example is included to illustrate this property.

Burkholder, J., Kapusenski, D., & Deitchman, R. The use of regression analysis in rodent maternal behavior: Multiple regression's answer to the age confound. Viewpoints, 1975, 5(4), 16-26.

This article presents the use of regression analysis as the most logical and meaningful way to analyze continuous developmental change. An experiment is presented using both a conventional analysis of variance for repeated measures and multiple linear regression for purposes of comparing the two techniques.

McNeil, K. A., McNeil, J. T., & Kelly, F. J. Another viewpoint of issues in multiple linear regression. Viewpoints, 1975, 5(4), 27-33.

Disagreement with Houston and Ohlson (Viewpoints, 1975, 5(4)) and their presentation of five issues in the teaching of MLR. The basis of the disagreement is the feeling by the authors that many statisticians fail to make distinctions between behavioral science researchers and statistics majors and the degree to which blind learning replaces true comprehension of the subject material.

Newman, I., & Newman, C. A discussion of component analysis: Its intended purpose, strengths, and weaknesses. Viewpoints, 1975, 5(4), 35-48.

An examination of commonality analysis, elements analysis, or component analysis. This article was presented at the 1975 American Educational Research Association, Multiple Linear Regression Special Interest Group.

VOLUME 6, No. 1

Jennings, E., & Ward, J. H., Jr. Logical steps in the creation and manipulation of fixed linear models. Multiple Linear Regression Viewpoints, 1975, 6(1), 2-7.

The authors present an 11-step procedure for creating linear models. The first four steps, the most challenging in their opinion, involve translating the research question into a symbolic expression of expected relationships, while the final steps are routine algebraic manipulations.

Karabinus, P. A., & McCormick, C. H. Comparison of regression coefficients in multivariate regression equations. Multiple Linear Regression Viewpoints, 1975, 6(1), 8-20.

The authors describe eight methods of comparing regression coefficients in multivariate regression equations containing the same variables for independent groups. The study investigated the relationship of the variables (Coopersmith Self-Esteem Inventory and Sarason's Test Anxiety Scale for Children) along with certain demographic data in predicting academic success among children in three ethnic groups. The F ratio of the SS residual ($F = \frac{(SSres./df)_1}{(SSres./df)_2}$ was considered the most fair and logical method.

Vasu, E. S., & Elmore, P. B. The effect of multicollinearity and the violation of the assumption of normality on the testing of hypotheses in regression analysis. Multiple Linear Regression Viewpoints, 1975, 6(1), 21-50.

This study investigated the effects of the violation of the assumption of normality coupled with the condition of multicollinearity upon the outcome of testing the hypothesis $\beta' = 0$ in the two-predictor regression equation. A monte carlo approach was utilized in which three different distributions were sampled for two sample sizes over 34 population correlation matrices. The preliminary results indicate that the violation of the assumption of normality has no significant effect upon the outcome of the hypothesis testing procedure. As was expected,

however, the population correlation matrices with extremely high collinearity between the independent variables resulted in large standard errors in the sampling distributions of the standardized regression coefficients. Also, these same population correlation matrices revealed a larger probability of committing a type II error. Many researchers rely on beta weights to measure the importance of predictor variables in a regression equation. With the presence of multicollinearity, however, these estimates of population standardized regression weights will be subject to extreme fluctuation and should be interpreted with caution, especially when the sample size involved is relatively small.

McNeil, J. T. Regression analysis for repeated measures designs. Multiple Linear Regression Viewpoints, 1975, 6(1), 52-63.

Based on repeated measures designs using person vectors, this paper focuses on two concerns: (1) a proposed solution to the problem of missing data, and (2) the use of covariates as an alternative to person vectors in controlling for differences between individuals.

Edeburn, C. E., & Ochsner, D. P. STWMULTR: A computer program to expedite the retrieval of residual scores. Multiple Linear Regression Viewpoints, 1975, 6(1), 64-67.

Residual gain analysis was described in general terms and a new computer program, STWMULTR, designed to retrieve and punch residual scores was described. Samples of input and output data cards were included.

Williams, J. D., & Watson, J. G. The analysis of covariance with randomized blocks designs by regression. Multiple Linear Regression Viewpoints, 1975, 6(1), 68-73.

A regression solution is given for a research situation that includes both the analysis of covariance and randomized blocks. Basically, the solution includes the successive use of three linear models. The first model uses the covariate as the predictor while the second model uses both the covariate and the group membership variables; the difference (in R^2 units) between these two models is the proportion of the variance that is attributable to the group membership variables independent of the covariate. The third model includes the covariate, the group membership variables and the blocks. The difference (in R^2 units) between the third model and the second model is the proportion of the variance due to the blocks independent of both the group variables and the covariate.

Williams, J. D. A regression formulation of Dunn's and Scheffé's tests. Multiple Linear Regression Viewpoints, 1975, 6(1), 74-82.

Regression formulations of Dunn's and Scheffé's multiple comparison procedures are presented. The advantages and disadvantages of using the Dunn's, Scheffé's, Dunnett's, and Tukey's tests are explored.

Gillham, J., & Napady, D. Three reasons why percent variance accounted for is important to the development of theory. Multiple Linear Regression Viewpoints, 1975, 6(1), 83-89.

Percent variance accounted for describes the degree of ambiguity in a test of a theory. This percentage is a parsimonious statement of the relative success of each attempt to solve a particular puzzle; it is also a guide to forming still better solutions.

VOLUME 6, No. 2

Root, W., Newman, I., & Novak, E. The relationship between academic performance, test anxiety, race, sex, scholastic ability, and school organization: A multi-variable approach. Multiple Linear Regression Viewpoints, 1975, 6(2), 1-16.

The relationships between academic performance, test anxiety, race, sex, scholastic ability, and school organization were investigated. It was found that the scholastic ability variable was the most predictive factor of academic performance. When covarying the scholastic ability variable, initial differences favoring Caucasian students in graded schools for academic performance and test anxiety became nonsignificant but significant differences between the sexes remained for test anxiety. Caucasians, females, and those from graded schools scored significantly higher; however, when test anxiety was covaried, differences within school organizations became nonsignificant. Only linear significances were found, and all interactions were nonsignificant for the 206 students.

Duff, W., & Houston, S. Parental involvement in the education of their children. Multiple Linear Regression Viewpoints, 1975, 6(2), 17-34.

The investigators surveyed 631 educational professionals as to their perception of parental role involvement, and attempted to determine if the subgroups differed in those perceptions. The responses (yes or no) to each item were used to group the respondents into two clusters for each item. Role variables, district variables, and interaction variables were used as predictors of group membership.

Weber, D. C. The analysis of incomplete data using regression. Multiple Linear Regression Viewpoints, 1975, 6(2), 35-44.

He compares traditional ANOVA approach and multiple linear regression, pointing out the advantages of the latter. Specific examples are given.

VOLUME 6, No. 2, continued

Jordan, T. E. Influences on preschool cognitive attainment. Multiple Linear Regression Viewpoints, 1975, 6(3), 1-108.

An analysis of measures of cognitive attainment, two at two years, one measure at age three years, two at age four years, and three at age five years is reported. In part one a multiple linear regression analysis examined the contribution of 12 variables to prediction of the eight criteria. In the second part of the analysis the most influential variables were explicated by maximizing their interactions in a second regression analysis. Criteria were the same eight cognitive tests at child ages two to five years. All data were developed through prospective longitudinal case studies begun at birth.

VOLUME 6, No. 3

Jordan, T. E. Influences on preschool cognitive attainment. Multiple Linear Regression Viewpoints, 1975, 6(3), 1-108.

An analysis of measures of cognitive attainment, two at two years, one measure at age three years, two at age four years, and three at age five years is reported. In part one a multiple linear regression analysis examined the contribution of 12 variables to prediction of the eight criteria. In the second part of the analysis the most influential variables were explicated by maximizing their interactions in a second regression analysis. Criteria were the same eight cognitive tests at child ages two to five years. All data were developed through prospective longitudinal case studies begun at birth.

VOLUME 6, No. 4

Newman, I., Deitchman, R., Burkholder, J., & Sanders, R. Type VI error: Inconsistency between the statistical procedure and the research question. Multiple Linear Regression Viewpoints, 1976, 6(4), 1-19.

Type VI error is defined as inconsistency between the statistical procedure and the research question of interest. Six problems associated with Type VI error are explored and techniques for avoiding them are presented. Attention is focused on the impact that poor research has on the field of education.

Williams, J. D. Canonical analysis as a generalized regression technique for multivariate analysis. Multiple Linear Regression Viewpoints, 1976, 6(4), 20-38.

The use of characteristic coding (dummy coding) is made in showing solutions to four multivariate problems using canonical analysis. The canonical variates can be analyzed by the use of multiple linear regression. When the canonical variates are used as criteria in a multiple linear regression, the R^2 values are equal to θ, where θ is the squared canonical correlation coefficient. Several different methods exist for testing multivariate hypotheses. Where the interest is in a two-way disproportionate multivariate analysis of variance, the trace criterion ($\Sigma\theta_i$) seems particularly applicable.

McNeil, K., & Platt, J. Causal inference: Multiple linear regression vs. analysis of variance orthogonal and non-orthogonal designs. Multiple Linear Regression Viewpoints, 1976, 6(4), 39-41.

Artificial categorization of continuous variables and artificial orthogonalizations of correlated variables are discussed as limitations of analysis of variance's ability to make causal inferences. Noting that current methodology (1976) does not permit precise causal inferences using correlated predictors, several methods of limiting the problem are suggested.

Williams, J. D. Should a first course in ANOVA be through MLR? Multiple Linear Regression Viewpoints, 1976, 6(4), 42-45.

Practical and pedagogic concerns that need to be examined prior to deciding on a traditional or MLR approach to a first ANOVA course are presented. Guidelines are suggested concerning the extent to which an MLR approach should be oriented toward a direct translation of ANOVA type questions to MLR solutions.

McNeil, K. Position statement on the roles and relationships between stepwise regression and hypothesis testing regression. Multiple Linear Regression Viewpoints, 1976, 6(4), 46-49.

Hypothesis testing regression and stepwise regression are defined and their roles are explained. The relationships between them are explored in terms of the kinds of data analyzed, shrinkage estimates, nonlinear terms, and causal inferences.

Newman, I. Brief note on the justification for using multiple linear regression. Multiple Linear Regression Viewpoints, 1976, 6(4), 50-52.

Noting that the F test is a least squares solution and that Multiple Linear Regression is the general case of the least sum of squares solution, Newman presents seven justifications for the use of MLR.

VOLUME 7, No. 1

Williams, J. D. Multiple comparisons by multiple linear regression. Multiple Linear Regression Viewpoints, 1976, 7(1), 1-64.

Several of the more common multiple comparison techniques are explored in a regression approach. Dunnett's test for comparing several groups to a single group, Tukey's(a) honestly significant different test, Newman-Keul's, Tukey's(b), and Duncan's tests are considered. Complex comparisons (contrasts) are shown through Dunn's and Scheffe's tests and through orthogonal comparisons. Orthogonal polynomials are also shown for testing for trend. A method for finding a maximized Scheffe contrast such that the contrast will yield the same R^2 value as the original full model is also included. The intent of the present monograph is to more fully explore the use of alternate methodologies to the usual multiple F tests when more than one restriction is placed on a full model.

VOLUME 7, No. 2

Poynor, H. Spurious aggregation and the units of analysis. Multiple Linear Regression Viewpoints, 1977, 7(2), 1-11.

The author stresses that the choice of unit of analysis (pupil, school district, etc.) is rarely considered a serious issue but should not be ignored. Sampling a population can cause spurious outcomes. Aggregation of units of analysis is often done without thought of its effects. He describes a technique (defining the G variables) for determining sample heterogeneity.

Jennings, E. Comments on Poynor's paper. Multiple Linear Regression Viewpoints, 1977, 7(2), 12-13.

The author offers a critique of Poynor's paper. Claiming it is an abstract concept, he questions the utility of determining the unit of analysis by the G variable.

Poynor, H. Rejoiner to Jennings. Multiple Linear Regression Viewpoints, 1977, 7(2), 14-15.

Poynor clarifies his concept of the G variable. Besides assuring that the models reflect the research questions, the statistical features of data sets cannot be ignored.

Dalton, S. Regression approaches and approximate solutions to analysis of variance with disproportionality varied. Multiple Linear Regression Viewpoints, 1977, 7(2), 16-32.

The degree of nonorthogonality in a factorial design was systematically increased. Five methods of dealing with nonorthogonality were selected and applied: two were least squares solutions (Method 1 and Method 2); two were approximate solutions (the unweighted means analysis and the method of expected frequencies); and the fifth was the alternative of data elimination. Under extreme nonorthogonality all methods converged in yielding conclusions which while erroneous were similar across methods. Under moderate nonorthogonality, however, the unweighted means analysis and Method 1 were superior. Overall, the data elimination alternative was inferior in that it led to more type II errors than any of the other four methods.

Wolfle, L. M. Path analysis and causal models as regression techniques: A comment. Multiple Linear Regression Viewpoints, 1977, 7(2), 33-40.

The author comments on Williams and Kimpel's (1975) paper, "Path Analysis and Causal Models as Regression Techniques." He describes their incorrect designation of indirect effects saying that, in essence, three different effects were occurring. First, there was an indirect causal effect through intervening variables; second, a spurious association due to joint dependence on prior variables; and third, a correlation between predetermined variables.

Williams, J. D., & Klimpel, R. M. Path analysis: A comment on Wolfle's comment. Multiple Linear Regression Viewpoints, 1977, 7(2), 41-42.

The authors react to Wolfle's critique of their original work on path analysis, accepting his breakdown of their "indirect effect" categories into three classifications. They reiterate Wolfle's statement that for MLR practitioners the concept of path analysis can be an assist in writing models.

George, J. D. Multiple regression techniques applied to test the effects of three types of special class placement on the arithmetic achievement of educable mentally retarded pupils. Multiple Linear Regression Viewpoints, 1977, 7 (2), 43-61.

Multiple regression analysis was used to examine the different effects of special class placement on the arithmetic achievement of Educable Mentally Retarded (EMR) pupils. Self-contained classes, selected academic placement programs, and learning resource centers were the types of placement studied. A significant interaction between sex and type of placement was observed with respect to arithmetic achievement. Girls in self-contained classes gained more than boys in the same classes. Boys gained more in selected academic placement programs than in the other two types of placement; girls did best in selected academic placement programs.

Spaner, S. D. What inferences are allowable with a significant F in regression analysis? Multiple Linear Regression Viewpoints, 1977, 7(2), 62-74.

Spaner reviews the underlying assumptions of the F statistic and those underlying regression. He relates these to model testing in multiple linear regression and discusses inference limitations that can be made from outcomes in both a statistical and practical sense.

VOLUME 7, No. 2, continued

Dinero, T. E. An empirical example of the use of interaction terms in the multiple regression model. Multiple Linear Regression Viewpoints, 1977, 7(2), 75-100.

This study compared empirical results from an analysis of variance and a multiple linear regression solution when appropriate interaction terms were included in the regression model. A rationale for deciding which interaction terms should be included was presented.

VOLUME 7, NO. 3

Newman, I., & Oravecz, M. T. Solutions to the problem of disproportionality: A discussion of the models. Multiple Linear Regression Viewpoints, 1977, 7(3), 1-51.

This paper has two major purposes. The first is to investigate the usefulness of a χ^2 technique in differentiating between varying degrees of disproportionality and their effects on a Type I error. The second purpose is to present and support the position that the major concern for any research model, whether disproportionate or not, is the research question and how well that question is reflected by the model. Three "exact solutions" for disproportional situations, the hierarchial, unadjusted main effects, and fitting constant methods, will also be discussed in terms of the research question that each reflects, and examples will be presented to demonstrate the most appropriate situation for using each solution.

Dalton, S. Shrinkage in R^2 and unbiased estimates of treatment effects using $\hat{\omega}$. Multiple Linear Regression Viewpoints, 1977, 7(3), 52-59.

The amount of variance accounted for by treatment can be estimated with $\hat{\omega}^2$ or with R^2 (symbolized as R^2_c after a shrinkage formula has been applied). Monte Carlo methods were employed to compare $\hat{\omega}^2$, R^2_c, and R^2 in terms of bias and precision. R^2_c and $\hat{\omega}^2$ produced estimates which were negligibly biased. The bias in R^2, while consistently positive, decreased as sample size increased and was too small to be of practical importance when $n \geq 50$. $\hat{\omega}^2$, R^2_c, and R^2 were all most precise with large samples and least precise when treatment effects were moderate in magnitude.

Walton, J. M. The use of multiple regression analysis in predicting success in the counseling practicum. Multiple Linear Regression Viewpoints, 1977, 7(3), 60-66.

The present exploratory study investigated the relationship between several predictor variables and the criterion of success in the counseling practicum among 93 recent graduates of a counselor education program. Forward stepwise regression was used. The investigation revealed that the best predictor of success in the counseling practicum was the square of the graduate grade point average ($ggpa^2$). This suggests the possibility of a curvilinear relationship between this predictor and the criterion. The interaction of female by Miller Analogies Test score (MAT) and the single variable of undergraduate grade point average (Ugpa) also appeared early in the equation. Type of undergraduate institution, type of graduate degree earned, and sex as a single independent variable demonstrated little relationship to the criterion.

Gantner, R. K., George, J. D., & Meadows, M. E. Relationships between results obtained on the Ertl machine and the Wechsler Intelligence Scale for Children (WISC). Multiple Linear Regression Viewpoints, 1977, 7(3), 67-83.

The purpose of this study was to examine relationships between the neural efficiency (NE), symmetry, and time difference (TD) scores on the Ertl machine and WISC scale scores for a group of 22 normal children and a group of 22 children with suspected learning disabilities, all ranging from 8 to 10 years of age. Multiple linear regression techniques were used to analyze the data. Some statistically significant relationships did occur between Ertl machine scores and WISC-V, WISC-P, and WISC-F scale scores for groups 1 and 2. Results supported Ertl's findings that normals and children with learning disabilities (LDs) would have similar NE scores (learning potential). Several symmetry scores (Hemispheric synchronization) and WISC scores correlated significantly in positive directions for both groups. Significant differences occurred between the TD scores (indicator of LDs) but results were in direct contrast to Ertl's claim since group 1 (normals) obtained higher mean scores than group 2.

Williams, J. D. Full rank and non-full rank models with contrast and BJ binary coding systems for two-way disproportionate cell frequency analyses. Multiple Linear Regression Viewpoints, 1977, 8(1), 1-31.

The two-way non-orthogonal design has been a source of considerable controversy. Several recent publications have emphasized the full rank model solution and discouraged the use of the fitting constants solution, the hierarchical model and the unadjusted main effects solution. By using a cell coding system instead of an effects coding system, a full rank model different from that of Timm and Carlson (1975) is found: this model was first suggested by Jennings (1967). The second full rank solution can be found to be computationally identical to the unadjusted main effects solution.

Williams, J. D. A note on coding the subjects effect in treatments x subjects designs. Multiple Linear Regression Viewpoints, 1977, 8(1), 32-35.

Using a recent innovation described by Pedhazur (1977), a simpler regression solution to the repeated measure design is shown. Instead of coding N-1 vectors to represent the subject effect, the sum of each subject's criterion scores is entered as a vector. This single vector yields the same R^2 value as does the N-1 binary coded subject vectors.

Wolfe, L. M. An introduction to path analysis. Multiple Linear Regression Viewpoints, 1977, 8(1), 36-61.

An introduction to path analysis is posited. The manner in which causal effects can be decomposed is presented. This is followed by a discussion of some recent applications of path analysis to educational topics.

MLR/SIG Annual Meeting (1977). Minutes of annual meeting. Multiple Linear Regression Viewpoints, 1977, 8(1), 63-65.

The official minutes of the 1977 annual meeting of MLR/SIG are reproduced.

Marquette, J. F., & Dufala, M. M. An interactive approach to ridge regression. Multiple Linear Regression Viewpoints, 1978, 8(2), 1-7.

The use of ridge regression is suggested as a method of limiting the problems caused by multi-collinearity of predictor variables in least squares solutions. An approach to choosing an appropriate ridge value is suggested. Example data are presented and an interactive computer solution (ADEPT) is included.

Walton, J. M., Newman, I., & Fraas, J. W. Ridge regression: A panacea? Multiple Linear Regression Viewpoints, 1978, 8(2), 8-15.

The technique of ridge regression is described along with its advantages and disadvantages. The authors conclude that while it may be an appropriate technique for some analyses, it may not be useful in instances where shrinkage estimates produce little shrinkage, or where the proportion of subjects to variables is sufficient.

Leitner, D. W. A teaching example of a replicable suppressor variable. Multiple Linear Regression Viewpoints, 1978, 8(2), 16-21.

The author describes a procedure to use in teaching the concept of suppressor variable to a statistics class. He uses the prediction of height, using weight and age (the suppressor). A brief review of the literature (and definition of) concerning suppressor variables is included.

Burkholder, J. H. An interactive version of MULR04 with enhanced graphics capability. Multiple Linear Regression Viewpoints, 1978, 8(2), 22-44.

A version of MULR04 employing random access Read/Write to simulate core memory for RT11 configured mini-computers is discussed. This version of MULR04 couples the flexibility of complex multiple regression with the interactive capability of the mini-computer. The program provides the user with the opportunity to enter data and regression models online while allowing examination of results and high quality graphics when desired.

VOLUME 8, No. 3

Rakow, E. A. Ridge regression: A regression procedure for analyzing correlated independent variables. Multiple Linear Regression Viewpoints, 1978, 8(3), 1-17.

Ridge regression analysis is presented as a technique to be utilized in multiple linear regression situations when predictor variables are highly correlated. The presence of those variables impose several problems, the solutions to which are are described using ridge regression analysis. The advantages of ridge regression as well as its calculation are offered.

Hick, T. L., & Irvine, D. J. An analysis of the historical regression method of predicting posttest grade equivalents for categorically-aided programs. Multiple Linear Regression Viewpoints, 1978, 8(3), 18-26.

Historical Regression follows directly from the assumption that, without specific intervention, growth will continue at the rate (grade equivalents per year of schooling) obtained at the time of the pretest. When compared with program-level data (n = 213) it was found that Historical Regression underestimated final achievement for short programs with older children. It overestimated for younger children in long programs. An alternative method was developed which eliminated the bias, removed half of the error, and eliminated much computation since an expected achievement level for each child was not required.

Kukak, C. R., Levine, D. U., & Meyer, J. K. Neighborhood predictors of reading achievement in six big city school districts: A path analysis. Multiple Linear Regression Viewpoints, 1978, 8(3), 27-43.

The effects of neighborhood characteristics, i.e., race, socioeconomic status, family structure, and density on reading achievement is analyzed using path analysis. Two major hypotheses are analyzed and conclusions drawn from 1970 census sample data. An explanation is given for the selection of multiple regression path analysis.

Morse, P. K. Evaluation of sex-related salary discrimination. Multiple Linear Regression Viewpoints, 1978, 8(3), 44-50.

Using constructed data, the use of multiple regression is demonstrated for "School A," where salaries are fair but where women have been hired only recently, and for "School B," where there is evidence of sex-related bias in salary. The regression analysis identifies the presence or absence of salary bias, although mean salary by sex presents a different picture.

Martin, M. P., & Williams, J. D. Effects of state-wide salary equity provisions on institutional salary policies: A regression analysis. Multiple Linear Regression Viewpoints, 1978, 8(3), 51-65.

Presented is the process whereby a state-wide North Dakota faculty committee seeks to equalize salaries within higher education. Salary discrepancies between the eight North Dakota institutions of higher education prompted the committee to investigate salary inequities. The results are obtained using regression analysis. The impact of the equalization process on one institution's decision-making machinery is interpreted.

Vasu, E. S. The use of prediction intervals in multiple regression analysis. Multiple Linear Regression Viewpoints, 1978, 8(3), 66-81.

Using simulated data, an explanation is offered stressing the advantages of employing prediction intervals rather than predicting for individual cases. The three cases presented use classical regression analysis and vector notation to calculate prediction intervals. A discussion of results is included followed by an appendix with statistical program dataset manipulations.

VOLUME 8, No. 3, continued

Rosenthal, W., & Spaner, S. D. A study of three treatments for menstrual difficulties: An analysis using multiple linear regression. Multiple Linear Regression Viewpoints, 1978, 8(3), 82-105.

A regression approach is offered as an alternative procedure to traditional analysis of variance to investigate menstrual distress. Authors state objectives to facilitate the practitioner's understanding of regression solutions for a problem originally posed for analysis of variance solutions for three treatment groups. The tables in the appendix show that directly comparable results are obtained using regression and ANOVA.

Cohen, P. Selecting an appropriate model for data analysis. Multiple Linear Regression Viewpoints, 1978, 8(3), 106-115.

Comments are made on papers presented in this convention issue. The remarks refer to content concerns since the successful application of multiple regression hinges on the selection of relevant data. Each paper review includes a statement of strengths, areas of concerns, and suggestions for improvement.

VOLUME 9, No. 1

Fraas, J. W., & Newman, I. The malpractice of statistical interpretation. Multiple Linear Regression Viewpoints, 1978, 9(1), 1-23.

This paper examines problems that researchers may confront when interpreting statistical research results. The first section of the paper examines the problems associated with the use of gain scores. The second portion of the paper examines why the use of analysis of covariance is superior to the analysis of gain scores in aiding the researcher to avoid misinterpreting the data. The third section of the paper discusses the problem of disproportionality as it produces multicollinearity. The fourth section of the paper examines the difference between the interpretation of research results analyzed by part correlation as opposed to partial correlation. The final section presents a brief discussion of the effect of violating the assumption of rectilinearity in the regression effect.

House, G. D. A three-year ex post facto study of arithmetic achievement for elementary pupils eligible for a remedial arithmetic program. Multiple Linear Regression Viewpoints, 1978, 9(1), 26-48.

This study traced the three-year impact of a remedial arithmetic program on eligible St. Louis Public School pupils. Hypotheses were tested through multiple linear regression models for analyses of covariance. No treatment effects were found. The study reveals that changes in future program evaluation designs are needed.

Ryan, T. P. An approximation technique for variable selection using cost criteria. Multiple Linear Regression Viewpoints, 1978, 9(1), 49-56.

The problem of selecting regression variables using cost criteria is considered. A method is presented which approximates the global minimum of one of several criterion functions which might be employed. Examples are given and the results are compared with the results of other methods. The outcome of a simulation study is also discussed, and suggestions are made as to the practical use of the method.

Huitema, B. E. Univariate nonparametric analysis of variance through multiple linear regression. Multiple Linear Regression Viewpoints, 1978, 9(1), 57-62.

Many methodologists are aware that parametric tests associated with the analysis of variance and the analysis of covariance can be computed using regression procedures. It is shown that multiple linear regression can also be employed to compute the Kruskal-Wallis nonparametric analysis of variance.

Wolfle, L. M. Univariate nonparametric analysis of variance: A comment. Multiple Linear Regression Viewpoints, 1978, 9(1), 63-67.

The relationship between the Kruskal-Wallis H statistic and the multiple R^2 based on regressing ranks on k-1 dummy variables used to identify the groups is explored. A proof is presented and the utility of the regression approach over the traditional computation is considered.

VOLUME 9, No. 1, continued

Voehlke, P. L., Leitner, D. W., & Lewis, E. L. A defense of inferential statistics in education. Multiple Linear Regression Viewpoints, 1978, 9(1), 68-74.

Specific refutations to Brown's (1975) and Derrick's (1976) criticisms of inferential statistics and the techniques based on the general linear model are presented.

Huitema, B. E. A closer look at statistical independence, analysis of covariance and directional hypothesis. Multiple Linear Regression Viewpoints, 1978, 9(1), 75-80.

Statistical independence of observations, analysis of covariance, and directional hypothesis are discussed in regard to the inferences that are allowable with a significant F in regression analysis.

Jordan, T. E. On the comparability of multiple linear (MULR-05) and interaction (AID-4) regression techniques. Multiple Linear Regression Viewpoints, 1978, 9(1), 81-89.

Interaction regression and multiple linear regression were compared by analyzing sample data composed of developmental measures on children (N=196). The techniques were compared to see if they identified the same sources of variance and produced comparable R^2 values.

VOLUME 9, No. 2

Williams, J. D. Path analysis from a regression perspective. Multiple Linear Regression Viewpoints, 1978, 9(2), 1-81. (Monograph Series #3)

This monograph presents path analysis to the presumably naive reader who is, on the other hand, a practitioner of multiple linear regression techniques. The major methodological process, recursive structural models, is presented and structural equations are defined, relating these to multiple regression. Sample data sets are used to present practical applications of path analysis to educational research.

Williams, J. D. Contrasts with unequal N by multiple linear regression. Multiple Linear Regression Viewpoints, 1979, 9(3), 1-7.

It is shown that some of the more simplified methods for contrasts with equal N result in erroneous calculations when applied to data sets with unequal N. Instead, the methodology given earlier by Bottenberg and Ward (1963) is effective for finding values for contrasts (where $t = \sqrt{F}$). Also, the unweighted means solution for maximized Scheffé contrasts is shown to fail in finding the maximized contrast with unequal N.

Lewis, E., & Leitner, D. Is the PhD research tool used in the dissertation? Multiple Linear Regression Viewpoints, 1979, 9(3), 8-10.

Students taking Multiple Regression as the PhD research tool from 1970 through 1975 tended to use Multiple Regression as the data analytic tool in the dissertation.

Mouw, J. T., & Nu, V. Increasing power and interpretability in certain repeated measures designs. Multiple Linear Regression Viewpoints, 1979, 9(3), 11-28.

Repeated measures designs offer a relatively powerful procedure for the analysis of behavioral data. In those designs, research questions involve the change of individuals' patterns of responses across time or across a dimension with intervening treatment effects. The addition of one or more between-subject factors allows for the comparison of treatment effects across the repeated measures between groups of subjects. In most of these researches, the grouping variable has been obtained by arbitrarily dichotomizing a continuous variable. This article presents an alternative analysis of data of certain repeated measures designs where the variable is kept in its natural continuous state instead of being dichotomized. Such an analysis is argued to have two advantages: (a) a more realistic interpretation of the results, and (b) a tendency toward an increase in power in the F tests of the repeated dimension and its interaction.

House, G. D. Effects of different types of scores on magnitudes of computed R^2. Multiple Linear Regression Viewpoints, 1979, 9(3), 29-36.

This study compared the magnitudes of R^2 values computed through multiple linear regression models using grade equivalent scores versus raw scores, standard scores, and percentiles as both criterion and predictor variables. It was found that grade equivalent and standard score modes produced similar and higher R^2 values than did raw scores or percentiles.

Fraser, B. J. A multiple regression model for research on teacher effects. Multiple Linear Regression Viewpoints, 1979, 9(3), 37-52.

A description is given of a model for research on teacher effects in which the variance in student outcome posttest performance is attributed to pretest performance, to separate construct domains of student, instructional, and teacher variables, and to interactions between variables in these three construct domains. When the model was applied with a sample of 780 Australian seventh grade pupils, it was found that pretest, an instructional variable, a block of teacher variables, a block of instruction-student interactions, and a block of instruction-teacher interactions were each significant independent predictors of a student attitudinal posttest.

Nowman, I., & Thomas, J. A note on the calculation of degrees of freedom for power analysis using multiple linear regression models. Multiple Linear Regression Viewpoints, 1979, 9(3), 53-58.

This note presents 15 examples worked by Cohen in which he uses different formulas to calculate degrees of freedom, depending on the power analysis situation. It is then demonstrated that the same results can be obtained by using a more general formula for calculating degrees of freedom. It was felt that this information may be of pedagogical value.

VOLUME 9, No. 3, continued

AERA Annual Meeting (April 1979): SIG on Multiple Linear Regression. Multiple Linear Regression Viewpoints, 1979, 9(3), 59.

VOLUME 9, No. 4

Newman, I., & Fraas, J. Some applied research concerns using multiple linear regression. Multiple Linear Regression Viewpoints, 1979, 9(4), 1-49. (Monograph Series #4)

The authors present an examination of the advantages of multiple linear regression as a tool for educational researchers. Concerns for multicollinearity and upward bias and disproportionality R^2 are discussed. Factor regression, component regression, and ridge regression are also discussed.

VOLUME 9, No. 5

McNeil, K., Evans, J., & McNeil, J. Nonlinear transformation of the criterion. Multiple Linear Regression Viewpoints, 1979, 9(5), 1-9.

The utility of a nonlinear transformation of the criterion is established. A well-known law from a field other than education is used as the example to demonstrate the point. The functional relationships may be such (as in the Pythagorean Theorem) that an R^2 of 1.00 cannot be found without making a nonlinear transformation of the criterion. The goal of predictability ($R^2 = 1.00$) thus may not be reached without making a nonlinear transformation of the criterion.

Clegg, A. A., Jr., Prichard, K., & Weigand, P. Multiple regression as a technique for predicting college enrollment. Multiple Linear Regression Viewpoints, 1979, 9(5), 10-19.

This paper deals with the application of multiple linear regression to the problem of identifying appropriate criterion variables and predicting enrollment in college courses during a period of major rapid decline. Data were gathered on course enrollments for 1972-1978 and organized around five criterion

variables. Total college enrollment proved to be the best single predictor with correlations of .89 to .99 with each of 10 departmental course enrollments. The technique has proved to be 96 to 100% accurate in estimating course enrollments in seven of the 10 courses. It is also a valuable means for data-based decision making and long-range planning when faculty committees must advise on administrative decisions.

Wolfle, L. M. Unmeasured variables in path analysis. Multiple Linear Regression Viewpoints, 1979, 9(5), 20-56.

The author discusses measurement error in structural equation models, a potential influence on the explanation of educational phenomena. The author first describes the case of a causal model with a single unmeasured variable: intergenerational occupational mobility from father's socioeconomic status to respondent's educational attainment. Educational attainment in the example is presented as the unobserved variable. Secondly, a more complex example incorporating several unmeasured variables for which multiple indicators were available in a similar situation is presented. A computer program, LISREL, is offered to deal with the latter situation.

Newman, I., Seymour, G. A., & Garver, T. K. A Monte Carlo evaluation of estimated parameters of five shrinkage estimate formuli. Multiple Linear Regression Viewpoints, 1979, 9(5), 57-74.

This study employs a Monte Carlo simulation to determine the accuracy with which the shrinkage in R^2 can be estimated by five shrinkage formuli and cross-validation. The study dealt with the use of shrinkage and cross-validation for different sample sizes, different R^2 values, and different degrees of multi-collinearity.

Williams, J. D., & Wali, M. K. Missing cells and a curious case of degrees of freedom. Multiple Linear Regression Viewpoints, 1979, 9(5), 75-87.

An experimental sampling procedure for plant communities on surface mined areas yielded missing cells and caused a further problem of yielding a "total" number of degrees of freedom equal to N rather than the usual N-1. The discrepancy occurred because the degrees of freedom are not necessarily additive for all missing cell designs. A solution which may circumvent this problem is proposed.

Mouw, J. T., & Vu, N. V. Increasing power and interpretability in certain repeated measures designs. Multiple Linear Regression Viewpoints, 1979, 9(5), 88-106.

Repeated measures designs offer a relatively powerful procedure for the analysis of behavioral data. In these designs, research questions involve the change of individuals' patterns of responses across time or across a dimension with intervening treatment effects. The addition of one or more between-subject factors allows for the comparison of treatment effects across the repeated measures between groups of subjects. In most of these researches, the grouping variable has been obtained by arbitrarily dichotomizing a continuous variable. This article presents an alternative analysis of data of certain repeated measures designs where the variable is kept in its natural continuous state instead of being dichotomized. Such an analysis is argued to have two advantages: (a) a more realistic interpretation of the results, and (b) a tendency toward an increase in power in the F tests of the repeated dimension and its interaction.

VOLUME 10, No. 1

Bertram, F. D., Roblee, K. M., & Tagatz, G. E. Multivariate techniques for meeting federal requirements concerning validation. Multiple Linear Regression Viewpoints, 1979, 10(1), 1-19.

The purpose of this study was to use multivariate techniques in a federally-regulated validation study, and to compare the results obtained from zero-order correlations and multiple correlations with the results obtained using factor scores and canonical correlation. The subjects consisted of 51 individuals who were selected from 532 applicants for the position of patrolman. The investigation revealed that multivariate techniques yield higher correlation coefficients than zero-order correlation or multiple correlation in a number of instances, and thus multivariate techniques may be the method of choice for certain federally-regulated validation studies.

Williams, J. T. Multiple comparisons in the analysis of covariance using multiple linear regression. Multiple Linear Regression Viewpoints, 1979, 10(1), 20-31.

A process is described for multiple comparisons when covariates are involved in the analysis. The method can be accomplished with considerable ease whenever pairwise comparisons are involved. More complex contrasts require the use of full and restricted models.

Roll, S., Hoedt, K., & Newman, I. A demonstration of a type VI error: An applied research problem. Multiple Linear Regression Viewpoints, 1979, 10(1), 31-38.

Roll et al. investigated the effects of three treatments on test anxiety. They present comparative strategies of (a) ANOVA and (b) testing substantive research hypotheses by multiple linear regression. Resulting Type VI error from use of ANOVA and increased power from using MLR are presented as evidence supporting use of MLR.

Leitner, D. W. Using multiple regression to interpret chi-square contingency table analysis. Multiple Linear Regression Analysis, 1979, 10(1), 39-45.

In the analysis of bivariate categorical data, the most common statistical test is the chi-square test of independence. A significant chi-square value leads the researcher to reject the null hypothesis of no relationship between the categorical variables. But the size of the chi-square statistic is a function of its degrees of freedom. This leaves the researcher with no indication of how large (or small) the relationship is. The purpose of this paper is to demonstrate multiple regression analyses of the 2 x 2, R x 2, and R x C contingency tables using "dummy" coding. The multiple correlation coefficient (whose square has a well-known interpretation) will be shown to equal Pearson's r, Cramer's V, and a function of the chi-square statistic.

Pohlmann, J. T. Controlling the Type I error rate in stepwise regression analysis. Multiple Linear Regression Viewpoints, 1979, 10(1), 46-60.

The author defines stepwise regression procedures as well as the problem-wide error rate that can occur with this type of analysis. He presents Monte Carlo data supporting three correction procedures to limit this error value.

Coles, G. J. Two methods of computing matrices of within-group correlations using full model dummy variables. Multiple Linear Regression Viewpoints, 1979, 10(1), 61-65.

Using matrices of pooled within-group correlations in identifying and defining multi-item indices on survey instruments permits the researcher to create indices that will not, for methodological reasons alone, be confounded with those group differences. This paper discusses how full model dummy variables can be used with partial correlation or multiple regression procedures to compute such correlation matrices.

VOLUME 10, No. 1, continued

Wolfle, L. M. Reciprocal causation in regression analysis. Multiple Linear Regression Viewpoints, 1979, 10(1), 65-72.

The author suggests and supports the thesis that least squares is inappropriate analysis when the assumption of reciprocal causation cannot a priori be eliminated. And, further, he suggests that any regression estimate is based on a priori assumptions.

VOLUME 10, No. 2

McCabe, G. P., & McCabe, S. A. S. Estimation and testing of pocket means using multiple linear regression techniques. Multiple Linear Regression Viewpoints, 1980, 10(2), 1-18.

The problem of predicting a continuous criterion variable from two continuous predictors is considered. Stratification on the predictors is one common procedure for construction of subgroups which are easily labeled and discussed. Through the appropriate use of regression techniques, data can be used more efficiently and inferences regarding carefully selected subpopulations, called pockets, can be made. An example using cognitive styles to predict performance on problem-solving tasks is discussed.

Black, K., & Brookshire, W. K. Handling disproportionality in two-way ANOVA's. Multiple Linear Regression Viewpoints, 1980, 10(2), 19-34.

This paper examines three methods of handling disproportionate cell frequencies in two-way analysis of variance. A Monte Carlo approach was used to study the method of expected frequencies and two multiple regression approaches to the problem as disproportionality increased. Four cases were studied: no effects case, row effects case, interaction effects case, and a row and column effects case. Type I and Type II errors were examined. Several conclusions were reached with regard to the appropriateness of each technique in handling disproportionality.

Blixt, S. L. The prediction of faculty rank: A comparison of two multivariate techniques. Multiple Linear Regression Viewpoints, 1980, 10(2), 35-40.

Multiple regression is advocated as the appropriate method when one wishes to predict a criterion measured on an interval or ratio scale. Discriminant analysis often followed by a classification procedure is recommended in the prediction of a nominal variable. The purpose of this empirical study was a comparison of the two techniques when the criterion is ordinal in nature.

The criterion was the current academic rank (Full, Associate, or Assistant Professor) of a faculty member. The predictors used in this study were salary, age, years at the university, years of professional experience before joining the university, and the year that the faculty member gained his/her current rank at the university. The sample totaled 103 faculty members.

A multiple regression equation and a discriminant function were calculated on one-half of the sample. The weights generated from the two models were then applied to the other half to determine which technique provided the more correct prediction of faculty rank.

It was found that the regression technique was better able to predict the ordinal variable for the cross-validation sample. Over all ranks, the regression technique correctly placed 70.59% of the people and the discriminant technique correctly placed 60.78%. Consequently, it appears that even though a scale is ordinal, multiple regression can prove to be a powerful technique. However, it is possible that the regression technique proved to be more powerful because only one discriminant function was significant.

Carbonari, J. P. A note on "A demonstration of a Type VI error: An applied research problem" by Steve Roll et al. Multiple Linear Regression Viewpoints, 1980, 10(2), 41-44.

The author responds to a previously published paper in MLRV, i.e., "A Demonstration of a Type VI Error: An Applied Research Problem" published in Vol. 10, No. 1, p. 31. While the original article supported increased power with use of multiple linear regression over ANOVA for a 3x2x2 design, Carbonari points out the Type I error that resulted and makes further suggestions about the correct application of traditional analysis of variance.

Roll, S., Hoedt, K. C., & Newman, I. A comment on "A note on a demonstration of a Type VI error: An applied research problem by Steve Roll et al. Multiple Linear Regression Viewpoints, 1980, 10(2), 45-58.

The authors here comment on the note by Carbonari (previous abstract) that was, in itself, a reaction to their original article in Vol. 10, No. 1, 1979.

Benz, C. R., Bobner, R. F., & Clemons, A. Abstracts for multiple linear regression viewpoints: Volumes 6-9. Multiple Linear Regression Viewpoints, 1980, 10(2), 58-72.

The authors present abstracts of Multiple Linear Regression Viewpoints, Volumes 6 through 9.

Annual meeting SIG/Multiple Linear Regression of AERA, Boston 1980. Multiple Linear Regression Viewpoints, 1980, 10 (2), 73.

The program for the SIG/MLR meeting held in Boston, April 1980, is presented.

VOLUME 10, No. 3

Williams, J. D. Multiple comparisons in higher dimensional designs. Multiple Linear Regression Viewpoints, 1980, 10 (3), 1-87.

Williams' monograph discusses multiple comparisons at length and emphasizes situations more complex than a one-way ANOVA design. He describes ways to reduce computations by use of traditional MLR computer programs. Chapter Two addresses multiple comparisons in the analysis of covariance. Chapter Three considers repeated measures designs (treatments x subjects designs). Chapters Four and Five describe the two-way ANOVA for the equal cell case and the disproportional case, respectively. The N-way ANOVA is considered in Chapter Six, while Chapter Seven considers situations that are not covered by prior discussions.

Croom, W. C. Multiple linear regression and large scale integration technology: Application to the Texas Instrument TI-59. Multiple Linear Regression Viewpoints, 1980, 10 (4), 1-14.

The Texas Instruments TI-59 programmable calculator can be programmed to perform multiple regression routines of up to seven predictor variables. Croom presents the program, its use, limitations, and applications. The program is presented in detail for the reader's use.

Jordan, T. F. Relationships among predictors in longitudinal data: Temporal-sequential analysis by regression--TSAR. Multiple Linear Regression Viewpoints, 1980, 10(4), 15-28.

In analyses of longitudinal data, attention is appropriately drawn to criterion measures of growth. However, it seems appropriate to consider predictor variables, and to do so in a fashion which helps understand their interrelationships. A method of arranging predictors is described which draws on regression analysis, and so uses powerful inferential tests of statistical significance. Examples are given of patterns of predictors educed by representative analyses. Data are drawn from two data sets with attention to several measures in the first 5-6 years of life of a particular cohort, and to demographic data on childhood from several countries of the world, in the second instance.

Rosenthal, W., Simpson, W., & Spaner, S. Budget allocations at MSU: Linear regression policy capturing analysis. Multiple Linear Regression Viewpoints, 1980, 10(4), 29-40.

Policy capturing, an application of multiple linear regression, was used by the authors to investigate budgetary decisions at Michigan State University. Eight predictor variables over a five-year period are considered. Variables, hypotheses, data, and results are presented and discussed. This paper was presented at the SIG/MLR meeting at AERA in Boston, 1980.

McNeil, K., & Findlay, E. Evaluating Title I early childhood programs: Problems, the applicability of Model C, and several evaluation plans. Multiple Linear Regression Viewpoints, 1980, 10(4), 41-50.

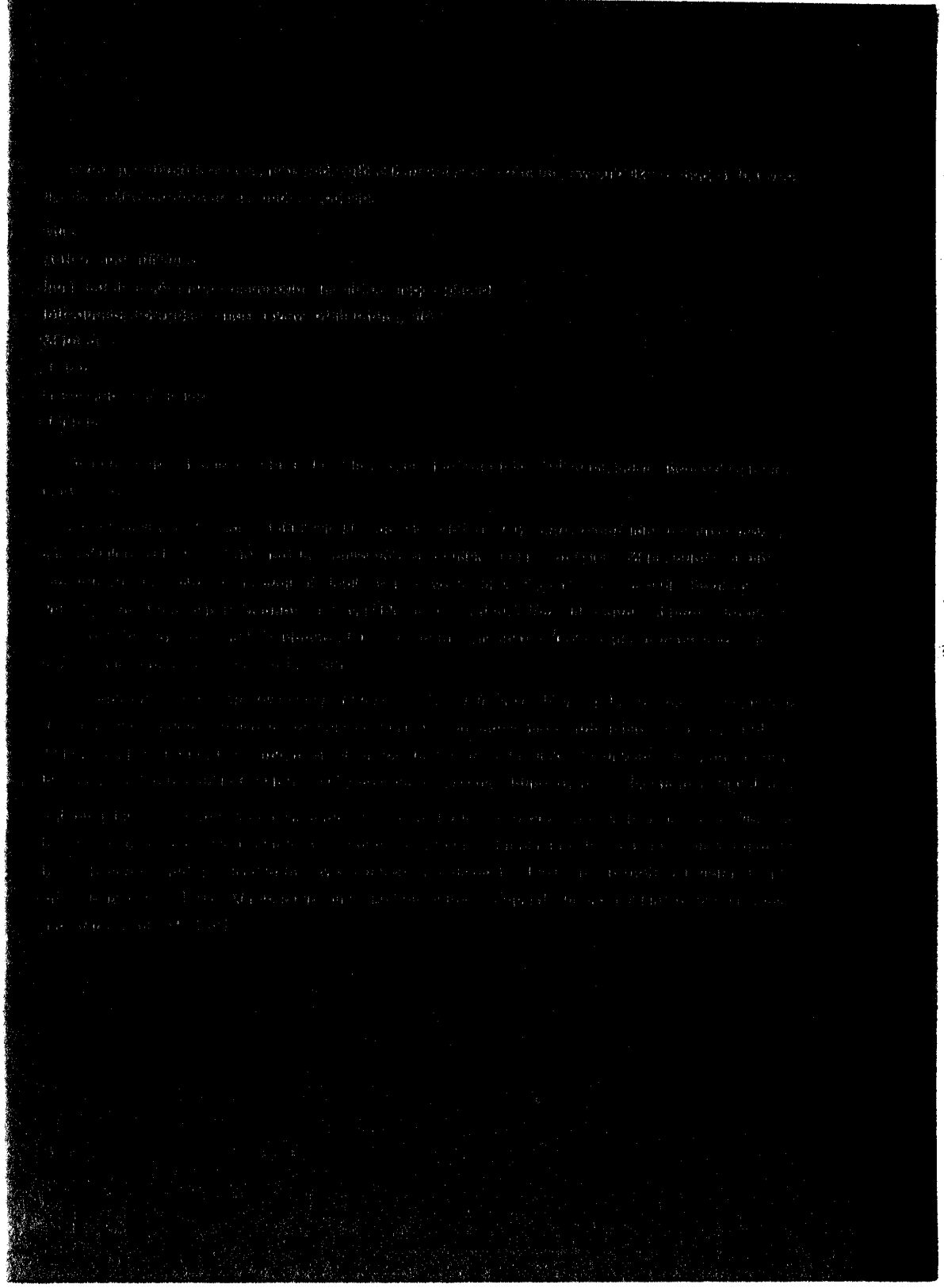
The authors present Model C (a special regression model by Campbell and Stanley) used as an evaluation model for early childhood education programs under Title I. They suggest alternate strategies for using Model C, especially considering the difficulties they enumerated in early childhood program evaluation. This paper was presented at the SIG/MLR meeting at AERA in Boston, 1980.

Newman, I., & Benz, C. R. An estimate of power for intact groups and for individual subjects: A note. Multiple Linear Regression Viewpoints, 1980, 10(4), 51-60.

The authors present strategies for estimating power using alpha, N size, and effect size when using individuals as subjects. They suggest methodology outlined by Barcikowski when estimating power for intact groups as the unit of analysis.

Wolfle, L. M. Unmeasured variables in path analysis: Addendum. Multiple Linear Regression Viewpoints, 1980, 10(4), 61-63.

Wolfle presents an addendum to his previously published paper in MLRV ("Unmeasured Variables in Path Analysis," Vol. 9, No. 5, 1979).



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