APPENDIX D

Statistical Methods Used for Data Analysis

Statistical Methods for data analyses were calculated by the computer from No.1-5 as follows:

i. Means

ii. Standard Diviations

iii. Coefficient of Correlations

iv. Multiple Regression Equations

v. Factor Analysis

vi. Stepwise Multiple Correlation was calculated by the investigator himself. The formulas for computing in Partial and Multiple Correlation are mentioned below:

a) Partial r's

$$r_{12.34...n} = \frac{r_{12.34...(n-1)} - r_{1n.34...(n-1)}\, r_{2n.34...(n-1)}}{1-r^2_{1n.34...(n-1)}\sqrt{1-r^2_{2n.34...(n-1)}}}$$

(partial r in terms of the coefficients of lower order - n variables)

b) Partial σ's

$$\sigma_{1.234\ldots n} = \sigma_1 \sqrt{1-r_{12}^2}\sqrt{1-r_{13.2}^2}\ldots\sqrt{1-r_{1n.23\ldots(n-1)}^2}$$

(Partial σ for n variables)

c) Partial regression coefficients (b's)

$$b_{12.34\ldots n} = r_{12.34\ldots n}\,\frac{\sigma_{1.234\ldots n}}{\sigma_{2.134\ldots n}}$$

(partial regression coefficients in terms of partial coefficients of correlation and standard errors of estimate - n variables)

d) Multiple Regression Equation

$$\bar{X}_1 = b_{12.34\ldots n}\, X_2 + b_{13.24\ldots n}\, X_3 + \ldots$$

$$b_{1n.23\ldots(n-1)}\, X_n + K$$

(regression equation in score form for n variables)

e) The Coefficient of Multiple Correlation, R

$$R_{1(23\ldots n)} = 1 - \sqrt{\frac{\sigma_{1.23\ldots n}^2}{\sigma_1^2}}$$

(multiple correlation coefficient in terms of the partial σ's for n variables) ---------- (1)

f) <u>Significance of a Difference Between Multiple R's</u>

We sometimes want to know whether the Multiple R with more independent variables included is significantly greater than the R with a small number of variables. There is available an F test for such a difference. The formula for computing F this purpose reads

$$F = \frac{(R_1^2 - R_2^2) \ (N - m_1 - 1)}{(1 - R_1^2) \ \ (m_1 - m_2)}$$

Where R_1 = Multiple R with larger number of independent variables

R_2 = Multiple R with one or more variables omitted

N = Number of the case in the sample

m_1 = larger number of independent variables

m_2 = smaller number of independent variables

In the use of F table, the df_1 degrees of freedom are given by $(m_1 - m_2)$, and the df_2 degrees of freedom by $(N-m_1 - 1)$ ----------(2)

g) <u>The Beta (B) coefficients</u>

When expressed in terms of σ scores, partial regression coefficients are usually called beta coefficients. The beta coefficients may be calculated directly from the b's as follows:

$$B_{12.34\ldots n} = b_{12.34\ldots n} \frac{2}{1}$$

(beta coefficients calculated from partial regression coefficients).

The Multiple regression equation for n variables may be written in σ scores as

$$\bar{Z}_1 = B_{12.34\ldots n}Z_2 + B_{13.24\ldots n}Z_3 + \ldots B_{1n.23\ldots(n-1)}Z_n$$

(Multiple regression equation in terms of σ scores) --------(1)

References:

(1) Garrett, H.E.(1967): <u>Statistics in Psychology and Education.</u> David Mckay Co.

(2) Guilford, J.P.(1973): <u>Fundamental Statistics in Psychology and Education,</u> 5th Ed., McGraw-Hill, Inc.:368.