A factor analytical study of scores obtained by B.Ed. students of Nagpur region in theory papers

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Abstract: In this paper, the study will be conducted to examine whether there is any communality among the marks obtained by B.Ed. examinees in various papers of this course since there are three major streams into which B.Ed. students are channelized.[1,2] The marks obtained by the examinees in three streams will be studied separately. The three streams are Arts, Commerce and Science even though the B.Ed. courses are open to all University graduates including B.Sc., Agriculture, B.E., B. Tech, and M.B.B.S. However, there are few instances all over the country where B.E., B. Tech, M.B.B.S. degree holders seek and get admission in B.Ed. courses. Thus the marks obtained by B.Ed. examinees belonging to the three streams in 2016-17, 2017-18, 2018-19 in R T M Nagpur University were subjected to factor analysis. While discussing the scope of the present work, it is essential to mention that the factor analysis is one of the advanced procedures of statistical analysis of the data. The marks obtained by the examinees in each of the said streams for every year separately are factorially analyzed and interpreted.

Keywords: factor analysis, two factor theory, correlation matrix, reliability, correlation.

1. Introduction

When we study Statistics we know it consists of the procedures which are used to explain certain phenomena. These procedures are based on mathematical logic. Factor analysis is one such technique. The first major attempt leading to the basic idea of factor analysis was made by Spearman (1904). Spearman on the basis of his study of relationship in various constituents of general intelligence reached the conclusion that intelligence is constituted of two factors ‘g’ and ‘s’ and he proved his theory by analyzing the correlation matrix. His conclusion that the common element is identical in all tests involving the process of cognition. Every test, then, he thought to be composed of the g factor, which is universal, plus a specific factor that is found in each test alone. [3, 4, 5]

Objective of the problem:

To find out the common factors in contents of course of B.Ed. from marks obtained by students in their theory papers.

1.1 Analysis and Interpretation

A closure examination of the statement of the problem makes it obvious that the data for the present study constitute of the marks obtained by B.Ed. students in theory papers.

The objectives of the study as already stated make it clear that, It is an examination which all the students from all the affiliated colleges of education have to appear in.
The examination of three consecutive sessions was considered for the study. Since students belong to three major streams the data for the present study could be precisely defined as under.

The data were categorized as under:
I) Science Stream:
A) Marks obtained by B.Ed students of science stream in theory papers in the year 2016-17
B) Marks obtained by B.Ed students of science stream in theory papers in the year 2017-18
C) Marks obtained by B.Ed students of science stream in theory papers in the year 2018-19

II) Arts Stream:
A) Marks obtained by B.Ed students of Arts stream in theory papers in the year 2016-17
B) Marks obtained by B.Ed students of Arts stream in theory papers in the year 2017-18
C) Marks obtained by B.Ed students of Arts stream in theory papers in the year 2018-19

III) Commerce Stream:
A) Marks obtained by B.Ed students of Commerce in theory papers in the year 2016-17
B) Marks obtained by B.Ed students of Commerce in theory papers in the year 2017-18
C) Marks obtained by B.Ed students of Commerce in theory papers in the year 2018-19

In order to maintain the brevity of the details the data as categorized above will be mentioned as: IA, IB, IC, IIA, IIB, IIC, and IIIA, IIIB, IIIIC, respectively.

2. Procedure of factor analysis

Stage I: Extraction of the first centroid factor:

Step I: First, enter a value which is maximum of row as well as column in the diagonal cell, then sum the columns without having diagonal cell entering the sums in the row headed by $S_1$.

Step II: Write down the diagonal cells in the row headed by $D$ and add the consecutive pairs of $(S_1+D)$ and put these values in the row headed by $E$.

Step III: Sum the sums in row $E$. This gives the sum of all elements in the matrix, symbolized by $T$ (for grand total).

The first factor loading are given by the equation

$$a_1 = E_j / T = m E_j$$

$a_1$ is first centroid factor loading

$E_j$ is sum of correlations with test $T$ (where $T$ is each test in turn)

$T$ is sum of all coefficients in the correlation matrix.

Step IV: Compute the first factor loadings. Check the last step. The sum of the factor loadings should equal to $T$.

Stage II: Computation of the first factor residuals

Step I: Prepare a worktable which contains the residuals. In the first column, list in order first factor loading $a_1$ corresponding to the test numbers in column 2. In the top row, list the first factor loading with reversed sign. (call them $K_1$, where $K_1 = - a_1$ )

Step II: Add to each element in Matrix R. (Correlation matrix table 3.1) the product $(a_iK_i)$ from the corresponding row and column in table 3.2. This operation applies equation,

$$\rho_{ij} = r_{ij} + (a_i)(-a_j)$$

Where $r_{ij}$ is correlation between $i$th and $j$th test.

$\rho_{ij}$ is second factor residuals
$a_i$ is first factor loading corresponding to $i$th test.

Step III: Having recorded the first factor loading $a_i$ in column 1, sum them to find $v_1$ sum the $k_1$ values and see whether $\sum k_1 = -\sum a_1$ as a check. And $\sum k_1 = -v_1$

Step IV: Compute the sum of residuals taking into consideration of their signs. (-ve + +ve) and record them in the row headed $S_2$. Note that nothing is done with the diagonal residuals at this stage.

Step V: Carry over from the preceding table the $S_1$ values, recording them in the row headed $S_1$

Step VI: Find the product $K_1 V_1$ for tests and record them in the row provided for them.

Step VII: Find $K_1^2$ for all the tests, and record them in the appropriate cells.

Step VIII: Find the sum of $S_1 + K_1 V_1 + K_1^2$, and record just below the previous row.

Check to see that the $S_2$ already recorded agrees with this sum.

Step IX: For each test find a value $A$, which equals $-\frac{S_2}{2}$. In row A find the largest +ve value. In our problem it is 0.06925.

Step X: Write +5 at the head of the next row to indicate that test 5 is being reflected. The values of this row are found by adding algebraically the $A$ values for all tests to the corresponding residuals in the row for test 5. For example First element of row +5 is calculated as,

$$0.0096 + (-0.0630) = -0.0534$$

Step XI: Continue this procedure until all values in the row are either negative outside parentheses or positive inside parentheses. The last row, at the completion of this process, is also called row B.

Step XII: Multiply the values in row B by (-2) to find $C$ for each test. All tests that had parentheses will have negative $C$ values.

Step XIII: Enter diagonal values in row D, each with a sign consistent with that of $C$ in the same column. Each D value equals the largest residuals value in its column. No matter what the sign of that residual is its new sign should be like that of the corresponding $C$ value.

Step X V: Find $E$ for each test, where $E = C + D$, Sum the $E$ values discarding signs $\sum|E| = T$

Compute $\sqrt{T}$ and $\frac{1}{\sqrt{T}}$ which equals to ‘m’

Step XV: Compute the factor loadings $a_2$ by the product m $E$. The absolute sum of the loading should equal to $\sqrt{T}$.

Step XVI: The computation of subsequent residuals and the extraction of factors follow the same steps as those just given.(Repeat the step II for further calculations).

In the present investigation, the procedure of factor analysis is limited up to three factors only. [1,2,3]
3. Calculations

**Table 1** Correlation matrix of the data belonging to category IA

|     | 1       | 2       | 3       | 4       | 5       | 6       | Check sum |
|-----|---------|---------|---------|---------|---------|---------|-----------|
| 1   | 0.4545  | 0.4545  | 0.3961  | 0.4069  | 0.2431  | 0.2283  | 1.7289    |
| 2   | 0.4545  | 0.3618  | 0.4008  | 0.3540  | 0.1900  |         | 1.7611    |
| 3   | 0.3961  | 0.3618  | 0.2522  | 0.2887  | 0.2667  |         | 1.5655    |
| 4   | 0.4069  | 0.2522  | 0.4069  | 0.1317  | 0.1702  |         | 1.3618    |
| 5   | 0.2431  | 0.3540  | 0.1317  | 0.3540  | 0.1641  |         | 1.1816    |
| 6   | 0.2283  | 0.1900  | 0.1702  | 0.1641  | 0.2667  |         | 1.0193    |
| $S_1$ | 1.7289  | 1.7611  | 1.5655  | 1.3618  | 1.1816  |         | 1.0193    |
| D   | 0.4545  | 0.4545  | 0.3961  | 0.4069  | 0.2667  |         | 1.0193    |
| E   | 2.1834  | 2.2156  | 1.9616  | 1.7687  | 1.5356  | 1.286   | 2.1834    |

\[ E = S_1 + D \]

\[ m = \frac{E}{2} \]

Where 1: Philosophical and Sociological Foundations of Education.

2: Psychological Foundation of Education.

3: Methods of Instruction and Evaluation.

4: School Administration and Current Trends in Indian Education.

5: Special Method 1 for example Physics, Chemistry, Mathematics.

6: Special Method 2 for example Biology.

Description of table 1: 1 Entries from row 1 to row 6 are the correlation between 1 and 1,2,3,4,5,6.

2. $S_1$ sum the columns without having diagonal cell entering the sums in the row.

3. D diagonal cell

4. E is addition of the consecutive pairs

5. T is sum of all coefficients in the correlation matrix

Likewise all entries filled as given in sec 2.

**Table 2** Computation of the first factor residuals and the second factor loadings.

| $K_1$ | -0.6598 | -0.6695 | -0.5928 | -0.5345 | -0.4640 | -0.3886 |
|-------|---------|---------|---------|---------|---------|---------|
| $\alpha_1$ | Test | 1 | 2 | 3 | 4 | 5 | 6 |
| 0.6598 | 1 | 0.0128 | 0.0049 | 0.0542 | -0.0630 | -0.0281 |
| 0.6695 | 2 | 0.0128 | -0.0351 | 0.0429 | 0.0434 | -0.0702 |
| 0.5928 | 3 | 0.0049 | -0.0351 | -0.0647 | 0.0136 | 0.0363 |
| 0.5345 | 4 | 0.0542 | 0.0429 | -0.0647 | -0.1163 | -0.0375 |
| 0.4640 | 5 | -0.0630 | 0.0434 | 0.0136 | -0.1163 | -0.0162 |
| 0.3886 | 6 | -0.0281 | -0.0702 | 0.0363 | -0.0375 | -0.0162 |

\[ S_1 = 1.7289 \]

\[ V_1 = 3.3092 \]
\[
K^2 V_1 = -2.1834 \quad -2.2155 \quad -1.9617 \quad -1.7688 \quad -1.5355 \quad -1.2859
\]
\[
K^2 V_2 = 0.4353 \quad 0.4482 \quad 0.3514 \quad 0.2857 \quad 0.2153 \quad 0.1510
\]
\[
S_1 + K_1 V_1 + K_2 V_2 = -0.0192 \quad -0.0062 \quad -0.0448 \quad -0.1213 \quad -0.1386 \quad -0.1156
\]
\[
S_2 = -0.0192 \quad -0.0062 \quad -0.0448 \quad -0.1213 \quad -0.1386 \quad -0.1156
\]
\[
\frac{S_2}{2} A = A + 5 = -0.0534 \quad -0.0465 \quad 0.036 \quad -0.0557 \quad 0.06925 \quad 0.04165
\]
\[
+2 = -0.0406 \quad 0.0465 \quad 0.0009 \quad -0.0128 \quad 0.1126 \quad -0.02855
\]
\[
+3 = -0.0357 \quad 0.0114 \quad 0.0009 \quad -0.0775 \quad 0.1262 \quad 0.00775
\]
\[
+6 = B = 0.0639 \quad -0.0588 \quad -0.0372 \quad -0.115 \quad 0.11 \quad 0.00775
\]
\[
-2 B = C = 0.1276 \quad +0.1176 \quad -0.0744 \quad +0.23 \quad -0.22 \quad -0.0155
\]
\[
D = 0.0630 \quad 0.0702 \quad -0.0647 \quad 0.1163 \quad -0.1163 \quad -0.0702
\]
\[
C + D = E = -0.1906 \quad 0.1878 \quad -0.1391 \quad 0.3463 \quad -0.3363 \quad -0.0857 \quad 1.2858
\]
\[
mE = A_2 = 0.1681 \quad 0.1656 \quad -0.1227 \quad 0.3054 \quad -0.2966 \quad -0.0756 \quad 1.134
\]

Here \( T = 1.2858 \), \( \sqrt{T} = 1.1339312 \), \( \frac{1}{\sqrt{T}} = 0.8818877 = m \), \( m T = 1.1339312 \)

**Table 3** Factor residuals and extraction of the third centroid factor.

| \( a_2 \) | Test | 1 | 2 | 3 | 4 | 5 | 6 |
|---------|------|---|---|---|---|---|---|
| 0.1681  | 1    | -0.0150 | 0.0255 | 0.0029 | -0.0131 | -0.0154 |
| 0.1656  | 2    | -0.0150 | -0.0148 | -0.0077 | 0.0925 | -0.0577 |
| -0.1227 | 3    | 0.0255 | -0.0148 | -0.0272 | -0.0228 | 0.0270 |
| 0.3054  | 4    | 0.0255 | -0.0077 | -0.0272 | -0.0257 | -0.0144 |
| -0.2966 | 5    | -0.0131 | 0.0925 | -0.0228 | -0.0257 | -0.0386 |
| -0.0756 | 6    | -0.0154 | -0.0577 | 0.0270 | -0.0144 | -0.0386 |

\( V_2 = 0.1442 \)

\[
K^2 V_2 = 0.0283 \quad 0.0274 \quad 0.0151 \quad 0.0933 \quad 0.0879 \quad 0.0057
\]
\[
S_2 + K_1 V_1 + K_2 V_2 = -0.0151 \quad -0.0027 \quad -0.012 \quad -0.072 \quad -0.0078 \quad -0.0991
\]
\[
S_3 = -0.0151 \quad -0.0027 \quad -0.0123 \quad -0.071 \quad -0.0077 \quad -0.0991
\]
\[
\frac{S_2}{2} A = A + 6 = -0.00785 \quad -0.05635 \quad 0.03315 \quad 0.02165 \quad -0.03475 \quad 0.04955
\]
\[
+3 = 0.01765 \quad -0.07115 \quad 0.03315 \quad -0.00555 \quad -0.05755 \quad 0.07655
\]
\[
+1B = 0.01765 \quad -0.08615 \quad 0.05865 \quad -0.00265 \quad -0.07065 \quad 0.06115
\]
\[
-2 B = C = -0.0353 \quad 0.1723 \quad -0.1173 \quad 0.0053 \quad 0.1413 \quad -0.1223
\]
\[
D = -0.0255 \quad -0.0295 \quad -0.0272 \quad -0.0272 \quad 0.0925 \quad -0.0577
\]
\[
C + D = E = -0.0608 \quad 0.2648 \quad -0.1445 \quad 0.0325 \quad 0.2338 \quad -0.18 \quad 0.9164 = T
\]

Here \( T = 0.9164 \), \( \sqrt{T} = 0.9572878 \), \( \frac{1}{\sqrt{T}} = 1.04461 = m \), \( m T = 0.9572878 \)
Table 4 Computation of third Factor residuals

| 𝐾₃  | 0.0635 | -0.2766 | 0.1509 | -0.0339 | -0.2442 | 0.1880 |
|-----|--------|---------|--------|----------|---------|--------|
| 𝑎₃  | Test   | 1       | 2      | 3        | 4       | 5      | 6     |
| 0.0635 | 1 | 0.0025  | 0.0159 | 0.0051  | 0.0024  | -0.0273 |
| -0.2766 | 2 | 0.0025  | 0.0269 | -0.0171 | 0.0249  | -0.0057 |
| 0.1509 | 3 | 0.0159  | 0.0269 | -0.0221 | 0.0140  | -0.0014 |
| -0.0339 | 4 | 0.0051  | -0.0171 | -0.0221 | -0.0339 | -0.0080 |
| -0.2442 | 5 | 0.0024  | 0.0249 | 0.0140  | -0.0339 | 0.0073  |
| 0.1880 | 6 | -0.0273 | -0.0057 | -0.0014 | -0.0080 | 0.0073  |

\[ V_3 = 0.1523 \]

\[ S_3 = -0.0151, -0.0027, -0.0123, -0.0721, -0.0077, -0.0991 \]

\[ K_3V_3 = 0.0097, -0.0421, 0.0229, -0.0052, -0.0372, 0.0286 \]

\[ K_3^2 = 0.0040, 0.0765, 0.0228, 0.0011, 0.0596, 0.0353 \]

\[ S_3 + K_3V_3 + K_3^2 = -0.0014, 0.0317, 0.0334, -0.0762, 0.0147, -0.0352 \]

\[ S_4 = -0.0014, 0.0315, 0.0333, -0.076, 0.0147, -0.0351 \]

Table 5 Centroid Factor Matrix for category IA

| TEST | 𝑎₁    | 𝑎₂    | 𝑎₃    |
|------|-------|-------|-------|
| 1    | 0.6598 | 0.1681 | -0.0635 |
| 2    | 0.6695 | 0.1656 | 0.2766 |
| 3    | 0.5928 | 0.1227 | -0.1509 |
| 4    | 0.5345 | 0.3054 | 0.0339 |
| 5    | 0.4640 | 0.2966 | 0.2442 |
| 6    | 0.3886 | 0.0756 | -0.1880 |

Table 6 Correlation matrix of the data belonging to category IB

|   | 1     | 2     | 3     | 4     | 5     | 6     |
|---|-------|-------|-------|-------|-------|-------|
| 1 | 0.3880 | 0.3880 | 0.3099 | 0.2103 | 0.2694 | 0.2129 |
| 2 | 0.3880 | 0.2294 | 0.1619 | 0.2466 | 0.2698 |
| 3 | 0.3099 | 0.0657 | 0.1843 | 0.1501 |
| 4 | 0.2404 | 0.1427 | 0.2404 |
| 5 | 0.2694 | 0.2085 |
| 6 | 0.2698 |

Procedure of factor analysis is applied to this correlation matrix as stated before.

Table 7 Centroid Factor Matrix for category IB

| TEST | 𝑎₁    | 𝑎₂    | 𝑎₃    |
|------|-------|-------|-------|
| 1    | 0.6671 | -0.2519 | 0.0812 |
| 2    | 0.6342 | -0.1420 | -0.2587 |
| 3    | 0.4686 | -0.2352 | 0.1858 |
| 4    | 0.4008 | 0.2802 | -0.1212 |
| 5    | 0.4954 | 0.1110 | 0.2360 |
| 6    | 0.5069 | 0.2926 | -0.1588 |
Table 8 Correlation matrix of the data belonging to category IC

|    | 1   | 2   | 3   | 4   | 5   | 6   |
|----|-----|-----|-----|-----|-----|-----|
| 1  | 0.4273 | 0.2332 | 0.4273 | 0.0362 | 0.2753 | 0.2520 |
| 2  | 0.3288 | 0.2853 | 0.3288 | 0.1868 | 0.3199 |       |
| 3  | 0.4273 | 0.2753 | 0.1251 | 0.2609 | 0.2666 |       |
| 4  | 0.3288 | 0.1264 | 0.2753 | 0.2108 |       |       |
| 5  | 0.2753 | 0.2108 |       |       |       |       |
| 6  | 0.3199 |       |       |       |       |       |

Procedure of factor analysis is applied to this correlation matrix as stated before.

The resultant factor –Matrix

Table 9 Centroid Factor Matrix for category IC

| TEST | \(a_1\) | \(a_2\) | \(a_3\) |
|------|--------|--------|--------|
| 1    | 0.5444 | 0.3763 | 0.1674 |
| 2    | 0.5547 | -0.2788| 0.1456 |
| 3    | 0.5909 | 0.2550 | 0.1181 |
| 4    | 0.3817 | -0.3963| -0.1154|
| 5    | 0.4402 | 0.1336 | -0.1493|
| 6    | 0.5215 | -0.1144| 0.0824 |

Table 10 Correlation matrix of the data belonging to category II A

|    | 1    | 2    | 3    | 4    | 5    | 6    |
|----|------|------|------|------|------|------|
| 1  | 0.3926 | 0.3607 | 0.3070 | 0.3926 | 0.2831 | 0.3323 |
| 2  | 0.3667 | 0.3667 | 0.3049 | 0.3600 | 0.3051 | 0.2974 |
| 3  | 0.3667 | 0.3667 | 0.3051 | 0.3600 | 0.3051 | 0.2974 |
| 4  | 0.3996 | 0.3996 | 0.3051 | 0.3600 | 0.3051 | 0.2974 |
| 5  | 0.3996 | 0.3996 | 0.3051 | 0.3600 | 0.3051 | 0.2974 |
| 6  |       |       |       |       |       | 0.3323 |

Procedure of factor analysis is applied to this correlation matrix as stated before.

The resultant factor –Matrix

Table 11 Centroid Factor Matrix for category IIA

| TEST | \(a_1\) | \(a_2\) | \(a_3\) |
|------|--------|--------|--------|
| 1    | 0.6162 | 0.1454 | 0.2004 |
| 2    | 0.5860 | 0.1254 | -0.0749|
| 3    | 0.5967 | -0.0561| -0.2217|
| 4    | 0.6155 | -0.2194| -0.1319|
| 5    | 0.4976 | -0.3438| 0.1874 |
| 6    | 0.4446 | -0.4138| -0.1656|
Table 12 Correlation matrix of the data belonging to category II B

|   | 1    | 2    | 3    | 4    | 5    | 6    |
|---|------|------|------|------|------|------|
| 1 | 0.5603 | 0.5603 | 0.5556 | 0.1752 | 0.0614 | 0.1782 |
| 2 | 0.5603 | 0.5283 | 0.0629 | 0.0648 | 0.2483 |
| 3 | 0.5556 | 0.1067 | 0.1057 | 0.1274 |
| 4 |      | 0.3226 | 0.3226 | 0.1877 |
| 5 |      |      | 0.3226 | 0.0139 |
| 6 |      |      |      | 0.2483 |

Procedure of factor analysis is applied to this correlation matrix as stated before.

The resultant factor –Matrix

Table 13 Centroid Factor Matrix for category II B

| TEST | $a_1$  | $a_2$  | $a_3$  |
|------|--------|--------|--------|
| 1    | 0.6906 | 0.3249 | 0.1065 |
| 2    | 0.6688 | 0.3549 | -0.1736|
| 3    | 0.6537 | 0.3431 | 0.1627 |
| 4    | 0.3889 | -0.4702| 0.1617 |
| 5    | 0.2943 | -0.3569| 0.2486 |
| 6    | 0.3315 | -0.0916| -0.3062|

Table 14 Correlation matrix of the data belonging to category II C

|   | 1    | 2    | 3    | 4    | 5    | 6    |
|---|------|------|------|------|------|------|
| 1 | 0.3055 | 0.1117 | 0.2849 | 0.2025 | 0.2754 | 0.3055 |
| 2 | 0.2414 | 0.2377 | 0.1686 | 0.2414 | 0.2068 |
| 3 | 0.2849 | 0.1652 | 0.1725 | 0.0428 |
| 4 | 0.2025 | 0.1437 | 0.0465 |
| 5 |      | 0.2754 | 0.0440 |
| 6 |      |      | 0.3055 |

Procedure of factor analysis is applied to this correlation matrix as stated before.

The resultant factor –Matrix

Table 15 Centroid Factor Matrix for category II C

| TEST | $a_1$  | $a_2$  | $a_3$  |
|------|--------|--------|--------|
| 1    | 0.5649 | -0.2544| -0.2755|
| 2    | 0.4593 | 0.2508 | 0.3178 |
| 3    | 0.4518 | 0.1678 | 0.1223 |
| 4    | 0.3533 | 0.1214 | -0.0703|
| 5    | 0.4383 | 0.1548 | -0.0894|
| 6    | 0.3617 | -0.3719| 0.3394 |
Table 16 Correlation matrix of the data belonging to category III A

|    | 1    | 2    | 3    | 4    | 5    | 6    |
|----|------|------|------|------|------|------|
| 1  | 0.4099 | 0.2481 | 0.3574 | 0.3521 | 0.3639 | 0.4099 |
| 2  | 0.4778 | 0.4778 | 0.2418 | 0.0483 | 0.1353 | 0.3077 |
| 3  | 0.4778 | 0.4746 | 0.3294 |        | 0.1782 |        |
| 4  |        | 0.6617 | 0.6617 |        |        |        |
| 5  |        | 0.6612 | 0.3445 |        |        |        |
| 6  |        |        |        | 0.4099 |        |        |

Procedure of factor analysis is applied to this correlation matrix as stated before.

The resultant factor - Matrix

Table 17 Centroid Factor Matrix for category III A

| TEST | a1   | a2   | a3   |
|------|------|------|------|
| 1    | 0.5948 | 0.1154 | -0.2839 |
| 2    | 0.4525 | -0.4881 | -0.0579 |
| 3    | 0.6735 | -0.3347 | 0.0574 |
| 4    | 0.7139 | 0.1274  | 0.4432 |
| 5    | 0.6693 | 0.4449  | 0.3014 |
| 6    | 0.4958 | 0.1121  | 0.3231 |

Table 18 Correlation matrix of the data belonging to category III B

|    | 1    | 2    | 3    | 4    | 5    | 6    |
|----|------|------|------|------|------|------|
| 1  | 0.7428 | 0.7428 | 0.6724 | 0.0372 | 0.2204 | 0.4173 |
| 2  | 0.7428 | 0.4711 | 0.1562 | 0.3738 | 0.4254 |        |
| 3  | 0.6724 | 0.0297 | 0.3533 | 0.2884 |        |        |
| 4  | 0.3139 | 0.1404 |        | 0.3139 |        |        |
| 5  | 0.3738 | 0.2215 |        | 0.2624 |        |        |
| 6  | 0.5944 | -0.4553 |        | -0.0992 | 0.2664 |        |

Procedure of factor analysis is applied to this correlation matrix as stated before.

The resultant factor - Matrix

Table 19 Centroid Factor Matrix for category III B

| TEST | a1   | a2   | a3   |
|------|------|------|------|
| 1    | 0.7895 | 0.4388 | 0.2693 |
| 2    | 0.8116 | 0.1452 | 0.1952 |
| 3    | 0.6874 | 0.3076 | -0.2772 |
| 4    | 0.2739 | -0.4553 | 0.2215 |
| 5    | 0.4805 | -0.0992 | 0.2664 |
| 6    | 0.5944 | -0.3008 | -0.1736 |
Table 20 Correlation matrix of the data belonging to category III C

|    | 1   | 2    | 3    | 4    | 5    | 6    |
|----|-----|------|------|------|------|------|
| 1  | 0.4101 | 0.2793 | 0.3441 | 0.2655 | 0.3114 | 0.4101 |
| 2  | 0.3608 | 0.2214 | 0.3608 | 0.2884 | 0.2436 |       |
| 3  | 0.3513 | 0.3068 | 0.2658 | 0.2855 |       |       |
| 4  |      |      | 0.3513 | 0.2855 |       |       |
| 5  |      |      |      | 0.3513 | 0.2636 |       |
| 6  |      |      |      |      | 0.4101 |       |

Procedure of factor analysis is applied to this correlation matrix as stated before.

The resultant factor –Matrix

Table 21 Centroid Factor Matrix for category III C

| TEST | a₁       | a₂       | a₃       |
|------|----------|----------|----------|
| 1    | 0.6088   | -0.2251  | -0.0444  |
| 2    | 0.5285   | 0.1917   | 0.2042   |
| 3    | 0.5616   | 0.0712   | -0.2106  |
| 4    | 0.5187   | 0.1976   | 0.2146   |
| 5    | 0.5358   | 0.0905   | 0.2118   |
| 6    | 0.5654   | -0.2737  | -0.0728  |

4. Interpretation of Results

The results of the factor analysis for science stream are summed up in the three factor matrices, table numbers 5, 7 and 9. Looking at the three tables simultaneously we find there is a considerable similarity so far as factor a₁ is concerned, paper I, II, and III contain the highest loadings of the factor. Looking at the contents of the three papers, paper I, contains the theoretical (Philosophical and sociological elements) whereas paper II represents the understanding of the psychological principles which have further application in measurement and evaluation. [5, 6]

Looking at the 1st factor loading represented in all the three tables under discussion the factor under consideration seems to be most common factor underlying the achievements of B.Ed. examinees in all the six theory papers. The relationship between various papers and the 1st factor range from 0.3817 (table 9) to 0.6695 (table 5). Thus we can conclude on the basis of study of the three tables that there is one basic factor common to all the six papers, which emerge out to be sizeable in all the three sessions. This factor could be named as “conceptual clarity of the theoretical principles.”[7, 8]

Considering the loadings of the factor II, even though there is some similarity in the magnitudes of loadings of factor II in various tests there is a difference in the direction. However, factor II continuously to dominate in paper I (refer table 9) otherwise the relationship between the factor II and paper II tend to be consistently high in all the three tables ignoring the negative sign of the factor loading represented in 9. It is very difficult to identify the factor even though the loadings are significant. However, very high relationship between factor II and test 4 suggests the operation of certain personality characteristics in the performance of the B.Ed. examinees in paper IV which is Educational Administration.[9,10,11]

Referring to the contents of the papers it can be very well understood that educational administration and institutional organization involves the understanding of the interpersonal relationships. School is a social institution in which programs have to be implemented for children.
through the teachers. A successful administrator is one who knows how to motivate the functionaries of educational institutions and the learner’s so that the realization of the educational outcomes is optimum. The whole procedure involves understanding the dynamics of human relationship and inspiring the individuals to appropriate action. So a person who has understood this principle is supposed to perform better as an administrator. This is a possible explanation of the high relationship between the factor II and paper IV represented in the entire three factors matrix tables.

The name of the factor II could be ‘General administrative ability’. Referring to table numbers 5, 10 and 15 for factor III, it can be said that factor III as the highest loading in paper V (table 5 and table 7) which is the methodology of teaching. This could be considered as the “grasp of the contents and the logical presentation in the process of teaching.” The results of the factor analysis for arts stream are summed up in the three factor matrix.

Referring to table numbers (11, 13, 15) it is found that loadings of the factor I vary from 0.2943 (table 13) to 0.6906 (table 13). Another observation that is suggested by the tables is that papers I and II tend to have the highest loading of the factor I. Besides, the factor seems to be highly operative in all the papers referring to the tables presented in IA, IB, and IC. In comparison to the results summed up in table IIA, IIB, and IIC. We find there is considerable similarity in the results. Hence the factor I gets confirmed to be identified as “Conceptual clarity of the theoretical principles”

The 1st factor loadings in the six tests vary between 0.2739 to 0.8116 in table 19. Most of the factor loadings are around 0.5. The operation of factor I seems to be universal and hence may be given the same name as suggested while interpreting the data pertaining to IA, IB, IC and IIA, IIB, IIC. The third factor loadings represented in tables 19, 21 vary between 0.0444 to 0.4432. Out of which are negative the highest loading of the factor III is in test number 4.

In the commerce stream it seems that “General administrative ability” is the IIIrd factor.

5. Conclusion

Thus we can conclude on the basis of study of the above tables that there is one basic factor common to all the six papers, which emerge out to be sizeable in all the three sessions. This factor could be named as “conceptual clarity of the theoretical principles”.

The name of the factor II could be ‘General administrative ability’.

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