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This monograph contains the third section, operations at the factor level, of a report of studies done in Helsinki, Finland, describing school achievement in terms of ability, trait, situational, and background variables. The report (1) investigates the structure of school achievement, (2) describes school achievement in terms of selected personality variables, and (3) applies multidimensional statistical operations in situations where it is considered desirable to reduce the number of dimensions and to describe a set of dependent variables in terms of a set of independent variables in a single operation. Part III presents the mathematical and statistical operations transforming groups of variables into factors, and describes the analysis models employed. To bring the description to a more general level, to simplify the research design, and to make possible a more concise interpretation of the results, the dependent or school achievement variables and the independent or personality variables are transformed into factor level variables by means of factor scores. Information provided by correlation coefficients, factor analyses, congruence coefficients, and canonical analyses are employed to describe school achievement in terms of the personality variables of the study. (BP)

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SCHOOL ACHIEVEMENT AND PERSONALITY
Description of School Achievement in Terms of Ability, Trait, Situational and Background Variables

III: Operations at the Factor Level

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Description of School Achievement in Terms of Ability, Trait, Situational and Background Variables

III: Operations at the Factor Level

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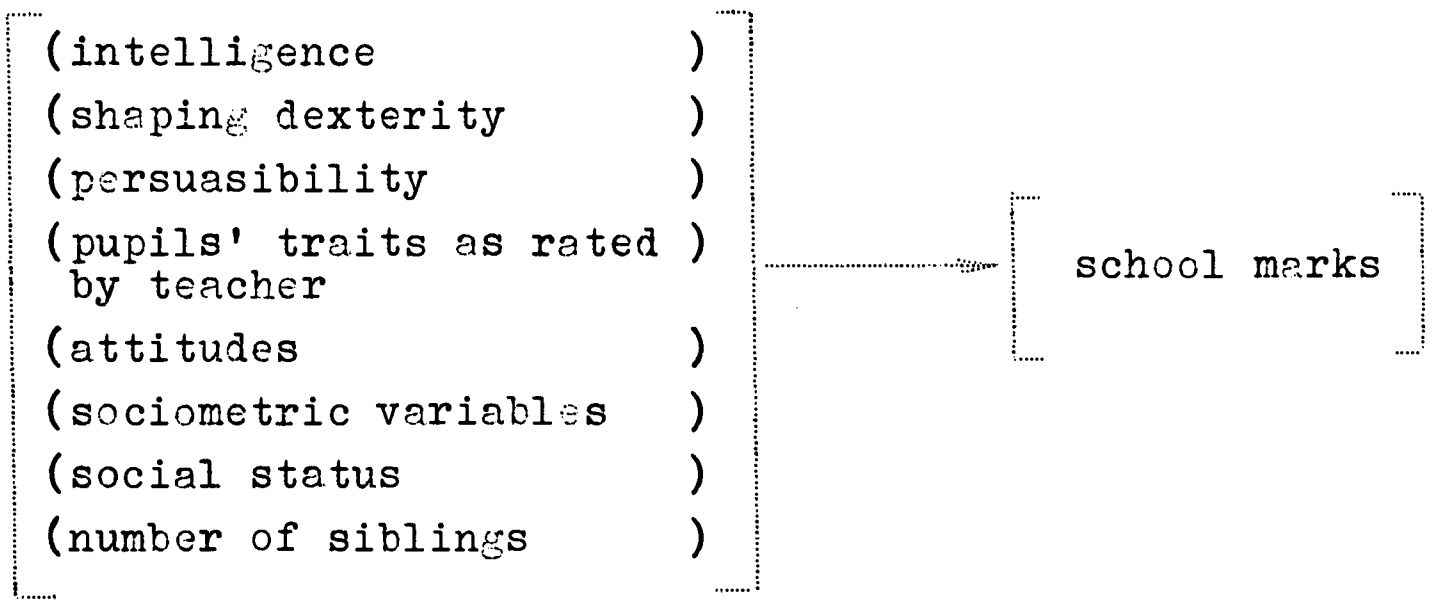
Contents

Plan of This Study

The following four parts of my studies on school achievement will be published in succession:
SCHOOL ACHIEVEMENT AND PERSONALITY
Description of School Achievement in Terms of Ability, Trait, Situational and Background Variables
I: Design and Hypotheses
IV: Results and Discussion
These parts are published as No. 21, Research Bulletin, Institute of Education, University of Helsinki.
II: Operations at the Variable Level
This part is published as No. 22, Research Bulletin, Institute of Education, University of Helsinki.
III: Operations at the Factor Level
This part is included in this monograph.

Part III, Operations at the Factor Level, presents the mathematical and statistical operations at the factor level. This part presents the transformation of groups of variables into factors and describes the analysis models employed. The information obtained is only recorded in this part, and its discussion on the basis of the hypotheses is postponed to Part IV.
The approach followed in the study is such that an attempt is made to describe school achievement in terms of the other variables chosen for the study; or, in other words, the other variables will be made to account for the variance of school achievement. This approach can be illustrated, in terms of matrices, by the following schematic representation. This matrix scheme also provides an opportunity for an analysis in terms of the matrix elements or vectors.



1. Summary

The series of studies on school achievement reported here is concerned with the following three problem areas:
1. investigation of the structure of school achievement
2. description of school achievement in terms of selected personality variables
3. application of multidimensional statistical operations in situations where it is considered desirable to reduce the number of dimensions and to describe a set of dependent variables in terms of a set of independent variables in a single operation.
The present Part III, entitled Operations at the Factor Level, is method-centred.
Citizenship school pupils (compulsory school, years 7 and 8) served as subjects in the study; the sample of subjects included 97-87 girls and 80-70 boys.
To bring the description to a more general level, to simplify the research design and to make possible a more concise interpretation of the results, the dependent or school achievement variables and the independent or personality variables were transformed into factor-level variables by means of factor scores.
The information provided by correlation coefficients, factor analyses, congruence coefficients and canonical analyses can be employed to describe school achievement in terms of the personality variables included in the study. The content of this information is presented in Part IV of the study.

2. On the Principles Underlying the Operations at the Factor Level

In the preceding operations, which took place at the variable level, the elements of the matrices from which analysis was started, were variables which had not been combined by employing multi-variate techniques. The number of dimensions proved to be so large, however, that the general interpretation of the results was difficult. Therefore, in the following operations an attempt will be made to use the vectors corresponding to the element matrices as the elements of new matrices. This amounts to a reduction in the number of dimensions. The canonical analyses carried out also revealed that the interrelations between the variables disturbed the operations. From the standpoint of the description technique it is also an advantage to be able to control the interrelationships between the phenomena concerned. From the viewpoint of the theory of the behavioural sciences, again, it is an advantage if the phenomena can be described in terms of more general dimensions.

All operations have been performed for the girl group, boy group and the combined group. The operations at the variable level show that it is reasonable to keep girls and boys separate. The group of subjects being small the operations have also been performed for the combined group. The results obtained for this group can be used for controlling the operations and the reliability of results.

3. The Estimation of Factor Scores

When dimensions were combined, use was made of factor scores based on multi-variate techniques. Since the set of variables was heterogeneous, separate factor analyses were made of the school achievement variables and of the intelli-

gence variable battery. The rating-trait variables were excluded, because they did not span any dimensions even nearly invariant under changes of the subject group. The persuasibility, attitude, dexterity and sociometric variables were not factored. Their factorization would not have been entirely unreasonable, but the battery would have become heterogeneous: it would have consisted of sets of variables differing in nature. Since the number of variables in each of the groups mentioned was small, the writer found it possible to consider them exclusively at the variable level; being aware, however, that the interdependences of the variables within each group would manifest itself at least in the canonical analysis.

The requirement was imposed on the method to be used in the estimation of factor scores that it should meet the orthogonality condition to a sufficient extent. Heerman's method (Heerman 1963) would have satisfied this requirement. For the sake of simplicity, however, Lederman's shorter method was used here (Lederman 1939, Harman 1960). When this method is employed, information about the degree of orthogonality can be obtained by computing the intercorrelations of the factor scores.

4. The Operations Performed

The variables contained in the matrix obtained are the following: the factor scores of the school achievement variables, the factor scores of the intelligence variables (the relevant factorial operations were presented in the section II where these variables were described) and the persuasibility, attitudinal, dexterity and sociometric variables per se. For this battery, the correlations were computed, a principal factorfactorization and a varimax rotation were carried out, and a canonical analysis was performed separately for each subject group through the Canon programme.

The results obtained by employing this battery still proved difficult to interpret, owing to the interdependences within the various sets of variables. This was particularly the case with the canonical analysis. Therefore, the results obtained will not be reported at this point. Instead, when the results of the further operations resorted to are described, those of the results of the above operations that were supplementary to the ones yielded by the further operations will be taken into account, this being advisable because the new operations involved further combinations of dimensions.

One of the objectives of the study was the discovery and employment of mathematical and statistical operations which would permit shaping the pre-existing information in such a way that interpretations relevant to the material aims of the study would be rendered possible. The canonical analysis did not prove, in the form applied here, fit for the study. The multicollinearity due to the interdependencies between the variables within various sets was difficult to allow for appropriately. When this method was used in operations at the variable level, where the interdependences were strong and the number of variables was large, it seemed to the writer that multicollinearity would result only in changes in the signs of the a and b coefficients of the vectors corresponding to each other. The operations at the factor level seemed to suggest, however, that changes in the magnitude of the coefficients were also likely to emerge, and thus it would have been very difficult to use these coefficients for purposes of interpretation. The Canon programme applied was also unsatisfactory, in that the variables are not identifiable. This, in turn, makes it difficult to check whether there have been errors in the computations. Because of these shortcomings in the programme, the writer asked the Computer Centre of the University of Helsinki Mathematical Institute for a revised programme, more suitable for the present operations.

A new programme was, in fact, prepared (Canon, Nummi), and it is, in principle, in harmony with the mathematical foundations of canonical analysis as presented here. In the former programme, the vectors a_i and b_i were normalized in such a way that $a_i^2 = b_i^2 = 1$. In the normalization, the intercorrelations of the variables were not employed as a criterion. In the new programme, the variables are standardized, and a new canonical variate is formed by employing the weights obtained, and this variate is normalized in such a way that it will equal unity. Or, if the correlation matrix is denoted by R, then $R = ZZ'$. The combined canonical variate is $\alpha'Z$. The normalization is carried out as follows: $\alpha' ZZ' \alpha = 1$. The weights computed in this way furnish information about multicollinearity. For, if the weights greatly exceed unity in absolute value, multicollinearity can be assumed to be present. This programme also provides additional information from which inferences can be made concerning the behaviour of individual variables. Moreover, variables can be identified when use is made of this programme.

The writer found it advisable to replace the approach described above by another, in which the variables not subjected to factor analysis in the former version should be factor analyzed, and factor scores should be computed for them just as for the school achievement and intelligence variables. This approach made it possible to reduce the interdependences within the various sets of variables, to diminish the number of variables and to bring the description entirely on to the factor level.

The initial matrix for the factor analysis involved the attitude-dependent and attitude-independent persuasibility variables, the attitudinal and dexterity variables and the sociometric variables. This battery was factor analyzed by employing the principal factor and varimax methods. Five factors were expected to emerge. It proved necessary to extract six factors, however, in order for the variance

of attitude-dependent persuasibility to be included. For this factor analysis, the reader is referred to Tables 62 - 67.

Table 62. Unrotated factor matrix, Girls, N = 87

		h^2	1	2	3	4	5	6
Sibelius, change score	1	.16	-.13	-.16	-.03	-.00	.22	.25
gipsies, change score	2	.36	-.39	-.03	.02	.15	.08	.37
shift work, change score	3	.17	-.10	-.14	.04	.21	.26	-.17
total picture, difference	4	.58	-.40	-.54	-.19	-.04	.05	-.17
total object, difference	5	.59	-.48	-.58	-.09	.01	.05	.10
attitudes towards peers	6	.53	-.48	.32	-.05	-.00	-.00	.28
attitudes towards teachers	7	.65	-.68	-.23	-.02	.11	-.31	-.05
attitudes towards parents	8	.61	-.67	.10	-.09	-.06	-.36	-.03
attitudes towards mother	9	.77	-.70	.43	-.06	-.09	.17	-.20
attitudes towards father	10	.74	-.70	.33	-.12	-.07	.24	-.07
ornaments	11	.54	.20	-.09	-.64	-.20	.15	.00
wire bending	12	.54	.24	.06	-.58	-.34	-.13	.06
leadership	13	.46	.25	.21	-.34	.46	-.12	.03
companion-ship	14	.46	-.01	.03	-.38	.55	.04	-.07
Eigenvalues		7.2533	2.917	1.222	1.100	.789	.518	.420
Eigenvalues as a percentage of the number of variables		51.81	20.84	8.74	7.86	5.64	3.70	3.01

Table 63. Rotated factor matrix, Girls, N = 87

		h^2	1	2	3	4	5	6
Sibelius, change score	1	.16	-.01	-.06	-.04	-.05	.08	.38
gipsies, change score	2	.32	-.21	-.15	.16	.07	-.06	.47
shift work, change score	3	.17	-.01	-.08	.10	.07	.39	.05
total picture, difference	4	.54	-.03	-.65	-.13	-.09	.26	.10
total object, difference	5	.59	-.01	-.65	-.00	-.09	.15	.36
attitudes towards peers	6	.42	-.53	-.01	.08	.04	-.22	.27
attitudes towards teachers	7	.64	-.32	-.68	.22	.05	-.10	.05
attitudes towards parents	8	.61	-.53	-.47	.11	.00	-.29	-.05
attitudes towards mother	9	.76	-.86	-.08	.05	.05	.11	-.02
attitudes towards father	10	.69	-.80	-.11	-.00	-.03	.13	.13
ornaments	11	.53	.06	-.00	-.71	.11	.05	.04
wire bending	12	.54	.04	.04	-.67	.05	-.27	-.09
leadership	13	.46	.08	.16	-.09	.64	-.08	-.07
companion-ship	14	.46	-.04	-.07	-.06	.64	.18	.02
variances of factors		6.9686	2.127	1.649	1.105	.887	.563	.635
Eigenvalues as a percentage of the number of variables		49.78	15.19	11.79	7.90	6.34	4.03	4.54

Table 64. Unrotated factor matrix, Boys , N = 70

		h^2	1	2	3	4	5	6
Sibelius, change score	1	.24	-.05	.04	.23	-.12	-.36	.17
gipsies, change score	2	.23	-.11	.06	.13	-.03	-.27	-.34
shift work, change score	3	.27	.16	.10	.27	-.34	-.00	.20
total picture, difference	4	.51	-.06	-.15	-.48	-.47	-.14	.03
total object, difference	5	.52	-.16	.08	-.65	-.27	-.05	.04
attitudes towards peers	6	.35	-.24	-.37	.20	-.10	-.29	-.11
attitudes towards teachers	7	.33	-.34	-.11	-.32	.21	.04	-.24
attidudes towards parents	8	.68	-.80	.02	.04	.04	.02	.15
attitudes towards mother	9	.60	-.77	-.06	.00	-.05	.04	.01
attitudes towards father	10	.63	-.78	.04	.08	.04	-.00	.08
ornaments	11	.48	.07	-.44	-.25	.41	.03	.20
wire bending	12	.44	.15	-.49	-.07	.23	-.31	.12
leadership	13	.58	.09	-.74	.08	-.12	.04	-.06
companionship	14	.58	-.07	-.55	.21	-.33	.34	-.04
Eigenvalues		6.508	2.137	1.517	1.094	.849	.550	.359
Eigenvalues as a percentage of the number of variables		46.49	15.27	10.84	7.82	6.07	3.93	2.57

Table 65. Rotated factor matrix, Boys, N = 70

		h^2	1	2	3	4	5	6
Sibelius, change score	1	.24	-.10	.08	.01	.10	-.20	.40
gipsies, change score	2	.23	-.03	.04	.04	-.07	-.46	-.02
shift work, change score	3	.27	.10	-.09	.00	-.18	.05	.46
total picture, difference	4	.51	-.01	-.13	-.70	.03	-.02	.02
total object, difference	5	.52	-.00	.14	-.68	-.04	.10	-.15
attitudes towards peers	6	.35	-.22	-.29	.00	.24	-.38	.10

(Table 65 continues)

		h^2	1	2	3	4	5	6
attitudes towards teachers	7	.33	-.25	.01	-.12	.08	-.08	-.49
attitudes towards parents	8	.68	-.82	.02	.00	-.03	-.00	-.04
attitudes towards mother	9	.60	-.75	-.10	-.07	-.07	-.08	-.11
attitudes towards father	10	.63	-.78	.03	.03	-.06	-.08	-.05
ornaments	11	.48	.02	-.07	.03	.57	.26	-.26
wire bending	12	.44	.11	-.11	-.01	.64	-.07	-.00
leadership	13	.58	.09	-.66	-.02	.36	-.05	-.03
companionship	14	.58	-.07	-.75	.01	-.02	.07	.03
variances of factors		6.506	2.027	1.193	.984	1.010	.539	.752
Eigenvalues as a percentage of the number of variables		46.48	14.48	8.52	7.03	7.22	3.85	5.38

Table 66. Unrotated factor matrix, Girls + Boys, N = 157

		h^2	1	2	3	4	5	6
Sibelius, change score	1	.16	-.07	.03	.01	-.06	.38	.05
gipsies, change score	2	.30	-.33	.06	.03	-.14	.19	-.27
shift work, change score	3	.16	-.01	.10	.05	-.29	.09	.23
total picture, difference	4	.56	-.33	.00	.63	-.02	.05	.16
total object, difference	5	.57	-.41	.17	.60	.02	.03	-.01
attitudes towards peers	6	.40	-.40	-.26	-.07	-.17	.25	-.21
attitudes towards teachers	7	.46	-.50	-.06	.19	.19	-.28	-.22
attitudes towards parents	8	.53	-.69	-.08	-.11	.11	-.07	-.04
attitudes towards mother	9	.70	-.74	-.16	-.27	.03	-.01	.18
attitudes towards father	10	.70	-.72	-.11	-.27	.09	.05	.16
ornaments	11	.51	.21	-.47	.16	.42	.03	.10
wire bending	12	.50	.26	-.47	.05	.37	.22	-.00
leadership	13	.52	.14	-.62	.08	-.30	-.05	-.13
companionship	14	.52	-.03	-.51	.09	-.44	-.17	.12
Eigenvalues		6.660	2.520	1.273	1.033	.814	.440	.374
Eigenvalues as a percentage of the number of variables		47.58	18.01	9.09	7.38	5.82	3.14	2.67

Table 67. Rotated factor matrix, Girls + Boys, N = 157

		h^2	1	2	3	4	5	6
Sibelius, change score	1	.16	-.02	.08	.04	.04	.32	-.21
gipsies, change score	2	.25	-.13	.03	.12	-.15	-.00	-.44
shift work, change score	3	.16	.01	-.09	.08	-.20	.32	.05
total picture, difference	4	.55	-.07	-.07	.72	.02	.09	-.02
total object, difference	5	.56	-.07	.09	.72	-.09	-.03	-.13
attitudes towards peers	6	.37	-.30	-.19	.02	.02	.05	-.49
attitude towards teachers	7	.46	-.34	.01	.34	-.02	-.46	-.12
attitudes towards parents	8	.52	-.65	.03	.15	-.06	-.19	-.19
attitudes towards mother	9	.68	-.81	-.04	.04	-.07	.01	-.09
attitudes towards father	10	.66	-.79	.04	.03	-.04	.03	-.13
ornaments	11	.48	.03	-.10	.04	.66	-.08	.17
wire bending	12	.49	.09	-.07	-.08	.68	.00	-.01
leadership	13	.52	.11	-.66	-.07	.21	-.05	-.12
companionship	14	.51	-.07	-.71	.04	-.00	.05	.04
variances of factors		6.4548	2.000	1.039	1.242	1.047	.484	.640
Eigenvalues as a percentage of the number of variables		46.11	14.29	7.42	8.88	7.48	3.46	4.57

The factors obtained for the girl group are the following:

I. An attitude factor

II. A factor of attitude-independent persuasibility (and the attitudes towards teachers and parents).

III. A dexterity factor

IV. A sociometric factor

V. A general persuasibility factor

VI. A factor of attitude-dependent persuasibility

The factors for the boy group are the following:

I. An attitude factor
II. A sociometric factor
III. A factor of attitude-independent persuasibility
IV. A dexterity factor
V. A factor of attitude-dependent persuasibility
VI. A factor of attitude-dependent persuasibility (the attitudes towards teachers variable obtained a negative loading).

The factors for the combined group are the following:

I. An attitude factor
II. A sociometric factor
III. A factor of attitude-independent persuasibility
IV. A dexterity factor
V. A factor of attitude-dependent persuasibility (the attitudes towards teachers variable obtained a negative loading).
VI: A general persuasibility factor

The factor configurations for the various groups can be compared in terms of the congruence coefficients computed. The coefficients show that the attitude factors, sociometric factors and dexterity factors for the boy and the girl groups correspond to each other to a high degree (the coefficients were .94, .92 and .84 respectively). The correspondence between the persuasibility factors is not as close (.76, .61 and .40). The factors of attitude-independent persuasibility for the two groups correspond ., however, very closely to each other. The above results are in the same direction as those yielded by transformation analysis. Congruence coefficients are presented in Tables 68 - 73.

Table 68. Congruence coefficients,

Girls + Boys x Girls + Boys

(1 = Girls + Boys,
2 = Girls
3 = Boys)

	1/1	1/2	1/3	1/4	1/5	1/6
1/1	1.00	-.00	-.27	.18	.21	.50
1/2	-.00	1.00	.03	-.24	-.04	.09
1/3	-.27	.03	1.00	-.13	-.12	-.28
1/4	.18	-.24	-.13	1.00	-.12	.18
1/5	.21	-.04	-.12	-.12	.99	.02
1/6	.50	.09	-.28	.18	.02	.99

Table 69. Congruence coefficients, Girls x Girls + Boys

	1/1	1/2	1/3	2/4	1/5	1/6
2/1	.97	.03	-.21	.17	.16	.59
2/2	.47	-.07	-.92	.15	.33	.35
2/3	-.21	.20	.04	-.94	-.08	-.30
2/4	.06	-.95	-.12	.24	-.06	-.07
2/5	.03	-.08	.35	-.32	.54	.32
2/6	-.25	.06	.51	-.18	.24	-.74

Table 70. Congruence coefficients, Girls x Girls

	2/1	2/2	2/3	2/4	2/5	2/6
2/1	1.00	.39	-.22	.04	.07	-.30
2/2	.39	1.00	-.13	.11	-.16	-.45
2/3	-.22	-.13	1.00	-.17	.07	.14
3/4	.04	.11	-.17	.99	.00	-.06
2/5	.07	-.16	.07	.00	.99	.17
2/6	-.30	-.45	.14	-.06	.17	.99

Table 71. Congruence coefficients, Boys x Girls + Boys

	1/1	/2	1/3	1/4	1/5	1/6
3/1	.98	-.01	-.20	.16	.21	.44
3/2	.05	.99	.02	-.24	-.06	.13
3/3	.11	-.00	-.93	.05	.02	.14
3/4	.10	-.35	-.05	.94	-.15	-.07
3/5	.33	.01	-.03	.21	-.09	.89
3/6	.24	-.03	-.23	-.24	.91	-.04

Table 72. Congruence coefficients, Boys x Girls

	2/1	2/2	2/3	2/4	2/5	2/6
3/1	.93	.42	-.19	.05	.09	-.17
3/2	.09	-.06	.20	-.92	-.06	.06
3/3	.06	.76	.06	.13	-.36	-.36
3/4	.46	.10	-.33	.00	.31	-.61
3/5	.46	.10	-.33	.00	.31	-.61
3/6	.19	.35	.10	-.02	.33	.15

Table 73. Congruence coefficients, Boys x Boys

	3/1	3/2	3/3	3/4	3/5	3/6
3/1	1.00	.03	.04	.10	.26	.21
3/2	.03	1.00	.00	-.35	.07	-.05
3/3	.04	.00	.99	-.00	-.06	.18
3/4	.10	-.35	-.00	1.00	-.23	.23
3/5	.26	.07	-.06	-.00	.99	-.17
3/6	.21	-.05	.18	-.23	-.17	.99

Next, the factor scores were computed by Lederman's shorter method.

Following this, a matrix was formed which included the factor scores of school achievement and intelligence and the factor scores obtained from the analysis just described for the attitudinal, persuasibility, dexterity and sociometric variables. Then, the correlations were computed for this battery, and factor analyses and canonical analyses were performed. The purposes which each of these operations were intended to serve and the information yielded by the operations will be presented below.

5. The Intercorrelations of Factor Scores

These correlations were computed with the objective of discovering how far the orthogonality condition was satisfied and of obtaining information about the connections between the school achievement variables and the variables employed to account for school achievement. The interdependences revealed by the factor analyses provide information concerning the first point. Correlations, factor matrices and congruence coefficients are presented in Tables 74 - 85

Table 74. Correlation matrix, factor scores, Girls, N = 87

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1 home economics factor	270															
2 partial factor of skill subjects	-113	344														
3 theoretical subjects factor		204	-074	459												
4 specific factor of theoretical citizenship-school subjects		181	082	102	138											
5 mathematical factor	-131	012	-056	-045	267											
6 verbal factor		114	-040	459	-049	-085	459									
7 numerical factor		-160	-002	-252	-031	267	001	267								
8 visualization and reasoning factor		016	-052	209	188	-262	159	-017	442							
9 comprehension of verbal relationship and numerical factor		064	-250	277	-040	-228	129	-199	006	277						
10 intelligence as rated by teachers	-270	137	-452	-076	070	-245	-074	-021	-053	452						
11 attitude factor		-048	-235	125	-022	-122	055	-009	028	224	009	235				
12 attitude-independent persuasibility factor		008	-185	056	148	-066	026	-035	095	046	-143	065	185			
13 dexterity factor		087	-344	145	043	-178	178	107	442	108	-086	-033	-022	442		
14 sociometric factor	-059	020	-266	067	-061	-174	-047	-223	030	359	007	021	-052	359		
15 general persuasibility factor		-178	-077	-062	021	107	-175	184	076	-062	-147	002	-012	019	-007	184
16 attitude-dependent persuasibility factor		027	-067	-159	-041	-117	-086	214	031	-042	120	-018	-164	019	-018	122	21

Table 75. Unrotated factor matrix, factor scores, Girls, N = 87

	h^2	1	2	3	4	5	6	7	8	9
1	.33	.32	.15	-.01	-.08	-.22	.37	-.07	-.02	-.03
2	.44	-.32	.21	-.19	-.46	.08	-.06	.12	-.08	.05
3	.56	.67	.20	-.18	-.02	.06	-.07	.05	-.01	.15
4	.24	.12	-.00	.03	-.22	-.37	-.05	-.00	-.16	.07
5	.32	-.28	-.06	-.40	.14	.01	-.12	-.19	.04	.07
6	.49	.51	.08	-.15	-.09	.33	-.03	-.17	-.20	-.02
7	.36	-.18	-.46	-.22	.11	.06	.00	-.09	-.19	-.02
8	.53	.40	-.37	.20	-.36	-.01	-.18	.10	.02	-.03
9	.33	.33	.19	.29	.25	.10	.00	.07	.01	.10
10	.54	-.53	.05	.40	-.18	.21	-.10	-.05	-.00	-.00
11	.25	.16	.05	.20	.31	.08	-.15	.16	-.15	-.06
12	.23	.16	.04	.05	.10	-.30	-.24	-.07	-.06	-.17
13	.52	.40	-.44	.26	-.08	.06	.04	-.24	.10	.06
14	.40	-.33	.15	.38	.06	-.11	-.00	-.22	-.15	.16
15	.25	-.08	-.33	-.10	.16	-.13	-.09	.18	-.00	.18
16	.27	-.12	-.29	.09	.01	.09	.31	.19	-.14	-.01

Eigenvalues	6.147	1.982	.945	.897	.700	.525	.409	.332	.20	.15
Eigenvalues as a percentage of the number of variables	38.42	12.39	5.91	5.61	4.38	4.38	3.29	2.56	2.08	1.25 .96

Table 76. Rotated factor matrix, factor scores, Girls, N = 87

1. home economics factor	.32	.04	.19	-.14	-.00	-.02	.51
2. partial factor of skill subjects	.41	-.14	.20	.04	-.56	.01	-.19
3. theoretical subjects factor	.53	.09	.23	-.62	.17	-.20	.12
4. specific factor of theoretical citizenship-school subjects	.21	.17	.03	.05	-.16	-.33	.20
5. mathematical factor	.28	-.34	-.33	-.06	-.16	.00	-.16
6. verbal factor	.42	.13	.21	-.58	.09	.07	-.05
7. numerical factor	.31	.02	-.51	-.01	-.08	.19	-.08
8. visualization and reasoning factor	.51	.68	-.00	-.16	-.04	-.13	-.04
9. comprehension of verbal relationship and numerical factor	-.31	.05	.26	-.08	.48	-.02	.04
10. intelligence as rated by teachers	.54	.03	.20	.54	-.12	.19	-.38
11. attitude factor	.20	.00	.04	-.01	.42	-.06	-.11
12. attitude-independent persuasibility factor	-.19	.04	-.04	-.00	.15	-.40	.04
13. dexterity factor	.45	.60	-.10	-.12	.19	.09	.08
14. sociometric factor	.30	-.07	.15	.51	.08	-.03	-.05
15. general persuasibility factor	.18	.04	-.42	.04	.03	-.06	-.02
16. attitude-dependent persuasibility factor	.22	.13	-.16	.15	-.00	.36	.12
variances of factors	5.459	1.069	.918	1.386	.918	.569	.597
Eigenvalues as a percentage of the number of variables	34.12	6.69	5.74	8.67	5.74	3.56	3.73

Table 77. Correlation matrix, factor scores,
Boys, N = 70

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1 general factor of theoretical subjects	424															
2 partial factor of skill subjects	073	432														
3 handcrafts factor	127	034	447													
4 home economics factor	-115	-023	-127	356												
5 reading factor	-076	-086	068	060	338											
6 numerical factor	287	120	014	257	-084	287										
7 verbal fluency factor	-174	-100	129	-199	338	-007	338									
8 visualization and numerical reasoning	155	-140	225	-177	043	062	011	383								
9 comprehension of verbal relationship	-285	432	-026	356	-010	014	-138	-024	432							
10 non-verbal reasoning	-405	-266	-284	027	041	-064	064	-149	-034	405						
11 verbal and non-verbal reasoning	-145	-052	-059	328	-048	101	-100	020	154	-095	328					
12 attitude factor	211	-196	-004	-049	-102	108	083	222	-008	-058	-039	222				
13 sociometric factor	424	199	087	-002	-179	155	-294	101	-107	-294	191	014	424			
14 attitude-independent persuasibility factor	174	040	-059	152	167	140	-194	-048	041	036	-143	003	006	194		
15 dexterity factor	-012	-195	-447	111	-067	028	108	-383	-095	192	242	049	-125	011	447	
16 attitude-dependent persuasibility factor	-101	-191	010	-143	179	-079	100	059	-102	142	141	089	014	-023	-008	191
17 attitude dependent persuasibility factor	-042	-025	299	-014	027	-122	103	132	018	-115	-168	088	-049	077	-144	-136

Table 78. Unrotated factor matrix, factor scores, Boys, N = 70

	h^2	1	2	3	4	5	6	7	8	9
1	.57	-.57	.07	-.42	-.10	-.20	-.08	-.00	-.03	-.04
2	.53	-.28	.36	.39	-.27	.05	-.22	-.00	-.19	-.03
3	.48	-.46	-.33	.26	.15	.01	-.08	-.06	.17	.14
4	.47	.14	.49	.14	.31	-.24	.06	-.01	.15	.06
5	.41	.14	-.27	.16	.18	-.29	-.32	.22	.03	-.11
6	.36	-.20	.28	-.16	.16	-.28	-.06	-.03	-.17	.26
7	.45	.20	-.45	.06	.08	-.10	-.32	-.23	-.14	.05
8	.42	-.38	-.29	.00	.32	.04	.21	.07	-.17	-.02
9	.54	.04	.39	.55	.13	-.01	.08	-.04	-.18	.11
10	.45	.57	-.09	-.03	-.04	-.03	.21	.19	-.06	.14
11	,44	.10	.35	-.07	.47	.23	-.12	-.05	.10	-.02
12	.29	-.12	-.12	-.23	.19	-.12	.20	-.19	-.23	-.13
13	.47	-.50	.28	-.25	.04	.18	-.09	.12	.09	-.03
14	.28	-.05	.12	-.01	-.07	-.43	.07	.23	.06	-.09
15	.54	.48	.23	-.39	-.03	-.07	-.12	-.26	.04	-.10
16	.24	.13	-.20	-.13	.24	.14	-.10	.24	-.07	-.09
17	.33	-.18	-.25	.24	.00	-.17	.17	-.23	.22	-.09
Eigen-values		7.3687	1.807	1.500	1.147	.734	.646	.511	.457	.355 .208
Eigen-values as a percentage of the number of variables		43.35	10.63	8.83	6.75	4.32	3.80	3.01	2.69	2.09 1.23

Table 79. Rotated factor matrix, factor scores, Boys, N = 70

	h^2	1	2	3	4	5	6
1. general factor of theoretical subjects	.57	-.66	-.03	-.15	-.19	-.24	.10
2. partial factor of skill subjects	.49	-.20	-.12	.63	.09	-.10	.13
3. handcrafts	.43	-.18	-.59	.02	-.07	.07	-.17
4. home economics factor	.45	.01	.14	.02	.63	-.17	.02
5. reading factor	.35	.07	-.06	-.00	.05	-.06	-.57

(Table 79 continues)

	h^2	1	2	3	4	5	6
6. numerical factor	.25	-.36	.07	-.09	.25	-.21	-.00
7. verbal fluency factor	.37	.14	-.03	-.04	-.17	.10	-.55
8. visualization and numerical reasoning	.38	-.13	-.49	-.34	.00	.11	.03
9. comprehension of verbal relationship	.49	.18	-.16	.36	.52	-.06	.11
10. non-verbal reasoning	.39	.52	.29	-.16	-.01	-.02	-.02
11. verbal and non-verbal reasoning	.43	-.13	.18	-.05	.47	.38	.03
12. attitude factor	.18	-.09	-.09	-.39	.00	-.06	.04
13. sociometric factor	.44	-.59	-.04	.02	.02	.12	.28
14. attitude-independent persuasibility factor	.22	-.07	.03	-.04	.10	-.44	-.03
15. dexterity factor	.46	.06	.66	-.11	.05	-.00	-.06
16. attitude-dependent persuasibility factor	.17	.03	.04	-.20	-.01	.29	-.19
17. attitude-dependent persuasibility factor	.22	.10	-.40	-.04	-.05	-.19	-.06
variances of factors	6.345	1.399	1.408	.937	1.076	.681	.841
Eigenvalues as a percentage of the number of variables	51.81	20.84	8.74	7.86	5.64	3.70	3.01

Table 80. Correlation matrix, factor scores, Girls + Boys

N = 157

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1 general factor of theoretical subjects	394																
2 skill subjects factor	080	307															
3 hone economics factor	-162	-009	210														
4 book-keeping factor	118	-039	-102	267													
5 handcrafts factor	134	100	-158	099	306												
6 verbal factor	288	307	210	-101	094	307											
7 special numerical factor	-308	117	040	085	-066	000	308										
8 visualization and reasoning factor	108	-158	-008	136	175	033	-055	354									
9 numerical factor	217	030	132	218	142	052	-089	110	237								
10 perceptual speed factor	-134	-204	-067	-087	-144	-046	063	012	-237	237							
11 non-verbal reasoning factor	-394	-103	085	-158	-257	-162	-022	-301	-014	-077	394						
12 attitude factor	159	-011	-026	001	104	018	-010	022	159	006	-080	164					
13 sociometric factor	307	183	-037	072	112	216	-165	159	011	-041	-341	001	341				
14 attitude-independent persuasibility factor	-118	-084	-012	-119	-008	-167	104	043	-017	145	054	-040	011	167			
15 dexterity factor	-007	-133	135	-267	-306	-050	-104	-354	-022	-146	284	038	-094	-025	354		
16 attitude-dependent persuasibility factor	-066	002	-002	055	177	-108	153	047	-115	034	-161	054	-028	-043	-071	177	
17 general persuasibility factor	016	076	-000	-149	030	040	-007	029	-078	-190	045	164	063	-084	065	001	190

Table 81. Unrotated factor matrix, factor scores.

Girls + Boys, N = 157

	h^2	1	2	3	4	5	6	7	8	9	10
1	.50	-.56	-.29	-.21	.13	.03	-.11	-.12	.05	.00	.02
2	.38	-.22	-.24	.46	-.11	.00	-.16	.10	.07	.02	.01
3	.29	.13	-.19	.11	-.08	-.31	.29	-.11	-.05	-.00	-.10
4	.34	-.28	.23	-.15	-.29	-.13	-.21	-.08	-.11	.09	.05
5	.37	-.44	.13	.03	-.18	.20	.04	.12	.11	-.16	-.14
6	.40	-.31	-.35	.30	.09	-.20	.08	-.05	.01	-.13	.05
7	.36	.15	.27	.40	-.19	-.05	.01	-.15	.06	.14	.07
8	.41	-.39	.29	-.14	.02	-.10	.32	.11	-.11	.02	.04
9	.34	-.23	-.16	-.25	-.36	-.20	.05	-.02	.15	.02	-.01
10	.33	.13	.34	.02	.37	-.08	-.00	-.13	.10	-.09	.08
11	.48	.61	-.16	-.08	-.17	-.02	-.00	.18	.01	-.05	.05
12	.21	-.14	-.09	-.09	-.09	.21	.16	-.20	.19	.01	.13
13	.37	-.47	-.14	.06	.26	-.03	-.02	.09	-.04	.21	-.07
14	.22	.13	.20	-.02	.12	-.06	.08	.14	.28	.15	-.09
15	.45	.40	-.44	-.15	.07	.09	.00	-.16	-.00	.09	-.11
16	.24	-.06	.24	.15	-.08	.23	.05	-.20	-.08	-.01	-.19
17	.26	-.02	-.21	.09	-.04	.31	.23	.09	-.08	.09	.14
Eigen-values		6.025	1.830	1.102	.727	.628	.480	.391	.302	.223	
									.179	.159	
Eigen-values as a percentage of the number of variables		35.44	10.77	6.49	4.28	3.70	2.83	2.30	1.78	1.31	
									1.06	.94	

Table 82. Rotated factor matrix, factor scores,

Girls + Boys, N = 157

	h^2	1	2	3	4	5	6
1. general factor of theoretical subjects	.48	-.21	-.23	-.57	-.18	.08	-.11
2. skill subjects factor	.36	-.01	-.59	.09	-.06	.03	-.01
3. home economics factor	.26	.09	-.04	.07	-.05	.00	.49
4. book-keeping factor	.31	-.27	.03	.04	-.38	-.22	-.18
5. handcrafts factor	.29	-.40	-.11	.02	-.18	.21	-.19
6. verbal factor	.38	-.11	-.49	-.18	.00	.02	.29
7. special numerical factor	.30	-.06	-.10	.52	.07	-.09	.03
8. visualization and reasoning factor	.38	-.56	.18	-.09	-.04	.05	.12
9. numerical factor	.31	-.09	.02	-.13	-.51	.00	.15
10. perceptual speed factor	.28	-.11	.19	.03	.41	-.24	-.03
11. non-verbal reasoning factor	.44	.57	.21	.20	-.05	-.00	.12
12. attitude factor	.12	-.07	.03	-.07	-.10	.31	-.03
13. sociometric factor	.31	-.29	-.30	-.36	.08	.01	-.01
14. attitude-independent persuasibility factor	.08	-.45	.19	.07	.17	-.09	.04
15. dexterity factor	.40	.57	.06	-.16	.03	.15	.11
16. attitude-dependent persuasibility factor	.15	-.19	.00	.24	.06	.15	-.17
17. general persuasibility factor	.21	.05	-.09	.00	.03	.44	.03
variances of factors	5.159	1.460	.948	.964	.735	.527	.522
Eigenvalues as a percentage of the number of variables	30.35	8.59	5.58	5.68	4.33	3.10	3.07

Table 83. Congruence coefficients
Girls + Boys x Girls + Boys

	1/1	1/2	1/3	1/4	1/5	1/6
1/1	1.00	.22	.20	.18	.01	.29
1/2	.22	.99	.26	.16	-.23	-.08
1/3	.20	.26	.99	.22	-.19	-.00
1/4	.18	.16	.22	.99	-.16	.02
1/5	.01	-.23	-.19	-.16	.99	.00
1/6	.29	-.08	-.00	.02	.00	.99

Table 84. Congruence coefficients Girls x Girls

	1/1	1/2	1/3	1/4	1/5	1/6
1/1	1.00	.04	-.26	.24	-.09	.22
1/2	.04	.99	-.11	.14	-.19	.11
1/3	-.26	-.11	1.00	-.24	.25	-.36
1/4	.24	.14	-.24	.99	-.14	.22
1/5	-.09	-.19	.25	-.14	.99	-.26
1/6	.22	.11	-.36	.22	-.26	.99

Table 85. Congruence coefficients Boys x Boys

	1/1	1/2	1/3	1/4	1/5	1/6
1/1	1.00	.22	.03	.01	.12	-.34
1/2	.22	.99	-.06	.17	.02	.06
1/3	.03	-.06	.99	.25	-.12	.18
1/4	.01	.17	.25	1.00	-.05	.17
1/5	.12	.02	-.12	-.05	.99	-.08
1/6	-.34	.06	.18	.17	-.08	.99

The intercorrelations of the factor scores of the school achievement variables are negligible for each of the three groups. Thus, the orthogonality condition is satisfied almost perfectly.

The intercorrelations of the factor scores of the intelligence variables are negligible in the boy group. By contrast, interdependencies emerge both in the girl group and in the combined group. These interdependences must be taken into account in the interpretation of the results of the canonical analysis.

The interrelations in the third group of variables can be estimated on the basis of the intercorrelations of the factor scores and the congruence coefficients computed.

The correlations between the factor scores are negligible. The congruence coefficients furnish information about the interrelations between the attitudinal and persuasibility variables.

The intercorrelations of factor scores can also be employed to obtain information on the interrelations between the school achievement factors and the factors used to account for the variance of the school achievement factors.

In the interpretation of the interrelations, the signs of the correlations need particular attention. The factors, as they emerged from the various factorial operations, had either a positive or a negative sign or were bipolar; the sign of a factor can be reversed by turning the factor axis through an angle of 180^{o}. The computer programmes employed did not lead to factor reflections. The appropriate sign can be determined by making use of the original rotated factor matrices as well. It would be an advantage, however, if the programmes could be formulated in such a way that factor reflection would be possible during the operation itself.

The interrelations found for the girl group are as follows (not including those that did not reach the .05 level of significance):

The factor of home economics is interrelated with the factor of intelligence as rated by teachers.

The partial factor of skill subjects is interrelated with the dexterity factor, the verbal comprehension factor, the numerical factor, the attitude factor and the factor of intelligence as rated by teachers.

The theoretical subjects factor is interrelated with the verbal factor, the factor of intelligence as rated by teachers, the sociometric factor, the factor of verbal and numerical comprehension, the numerical factor and the visualization and reasoning factor.

The specific factor of theoretical citizenship school subjects is interrelated with the visualization and reasoning factor.

The mathematical school achievement factor is interrelated with the numerical factor, the visualization and reasoning factor and the verbal comprehension and numerical factor.

The following interrelations are found for the boy group:

The general factor of theoretical subjects is interrelated with the sociometric factor, the non-verbal reasoning factor, the verbal comprehension factor, the numerical factor and the attitude factor.

The partial factor of skill subjects is interrelated with the verbal comprehension factor, the non-verbal reasoning factor, the dexterity factor, the sociometric factor, the attitude factor and the factor of attitude-dependent persuasibility.

The handcrafts factor is interrelated with the dexterity factor, the factor of attitude-dependent persuasibility, the non-verbal reasoning factor and the visualization and reasoning factor.

The home economics factor is interrelated with the verbal comprehension factor, the factor of verbal and non-verbal reasoning, the numerical factor and the verbal fluency factor.

The reading factor is interrelated with the verbal fluency factor.

The interrelations for the combined group are as follows:

The general theoretical subjects factor is interrelated with the non-verbal reasoning factor, the numerical special factor, the sociometric factor, the verbal factor and the numerical factor.

The skill subjects factor is interrelated with the verbal factor, the perceptual speed factor and the sociometric factor.

The home economics factor is interrelated with the verbal factor.

The book-keeping factor is interrelated with the dexterity factor and the numerical factor.

The handcrafts factor is interrelated with the dexterity factor and the non-verbal reasoning factor.

The factor score intercorrelation matrices also furnished information on the interrelationships between the variables chosen as those in terms of which school achievement was to be described. The content of these interrelations would be of some interest. Nevertheless, this aspect will not be discussed at this point. For purposes of interpretation and the canonical analysis, it should only be pointed out here that there were correlational relationships between these variables. The emergence of these correlations was made possible by the fact that the factor scores for the descriptive variables were based on two separate factor analyses. The factor score correlation matrix will be utilized as an aid in the interpretation of the canonical analysis.

6. The Interrelations between Factor Scores, as Suggested by the Factorial Models

The writer found it desirable to have the information on the interrelationships between the factor scores for school achievement and the descriptive variables, contained in the correlation matrices; to this end, the battery was factorized by the principal factor method and a varimax rotation was carried out. This factor analysis can also be utilized in the interpretation of the canonical analysis. The results are presented in Tables 75, 76, 78, 79, 81 and 82.

The following interrelations, based on a six-factor rotation, emerge for the girl group.

The mathematical school achievement factor forms a dimension in combination with the visualization and reasoning factor and the dexterity factor.

The mathematical school achievement factor is interrelated with the numerical factor and the general persuasibility factor.

The theoretical subjects factor is interrelated with the verbal factor, the factor of intelligence as rated by teachers and the sociometric factor.

The partial factor of skill subjects is interrelated with the comprehension of verbal relationship and numerical factor and the attitude factor.

The specific citizenship school theoretical subjects factor is interrelated with the factor of attitude-independent persuasibility.

The home economics factor is interrelated with the factor of intelligence as rated by teachers.

The six-factor rotation reveals the following interrelations for the boy group:

The general theoretical subjects factor is interrelated with the non-verbal reasoning factor and the sociometric factor.

The handcrafts factor is interrelated with the dexterity factor and the visualization and reasoning factor.

The partial skill subjects factor is interrelated with the attitude factor.

The home economics factor is interrelated with the verbal comprehension factor and the verbal and non-verbal reasoning factor.

The reading factor is interrelated with the verbal fluency factor.

The following interrelations emerge for the combined group:

The general theoretical subjects factor is interrelated with the perceptual speed factor and the sociometric factor.

The home economics factor is interrelated with the dexterity factor and the visualization and reasoning factor.

The skill subjects factor is interrelated with the attitude factor.

The book-keeping factor is interrelated with the numerical factor.

The handcrafts factor is interrelated with the special numerical factor.

The above approach to the determination of the interrelations between the various groups of variables is superior to the determination of these interrelationships undertaken at the separate variable level, in that here an attempt was made to eliminate the interrelationships of the variables within each particular group through the factor score estimation technique. As was seen, however, this attempt was not perfectly successful: interrelationships of variables belonging to one and the same group were also involved in the rotated matrices. Inspection

of the variances of the factors and the communalities of the school achievement variables reveals that the proportion of the variance for the boy group that was accounted for by the battery was larger than the corresponding proportion for the girl group. This difference will be discussed in greater detail in Part IV. The information provided by the factor analyses on the interrelationships between the intelligence variables and the other test variables can be utilized in the interpretation of the canonical analysis. The value of the above approach to the determination of interrelationships, based on factor analysis, is limited by the fact that the statistical significance of the findings cannot be evaluated. On the other hand, the interrelationships to be revealed by the following canonical analysis can be tested for their statistical significance.

7. The Results Based on Canonical Analysis

It should be pointed out, initially, that the reductio in the number of dimensions, effected by means of factor scores, renders the situation interpretationally manageable. However, when the weights obtained for the canonical vectors are interpreted, results yielded by previous operations must be resorted to. None of the weights exceeded unity. This suggests that multicollinearity did not play a very noticeable part, if any. The above analysis of the factor score correlations revealed intercorrelations between the descriptive variables. This suggests the presence of multicollinearity in the weights of the descriptive variables. Yet, the correlation matrices and the factor analyses carried out can be used as an aid in interpretation in such a way that the weights can be evaluated correctly as regards their order of magnitude, and as regards their signs, in particular. The informat concerning the canonical analyses is presented in Tables 86 - 88.

Table 86. Canonical correlation at the factor level, Girls, N = 87

	Rc	Wilks lambda	Chi^2	Degrees of freedom	p <
1.	.708	.197	125.906	55	.001
2.	.512	.542	47.488	40	ns
3.	.383	.733	24.061	27	ns
4.	.304	.859	11.800	16	ns
5.	.232	.946	4.290	7	ns

M_1 vectors

Var/vec	1	2	3	4	5
6	-.22	.53	.19	-.25	.27
7	.41	-.10	.35	-.16	-.25
8	-.18	.07	-.80	-.61	-.23
9	-.27	-.08	.10	-.13	.36
10	.58	-.05	.08	-.42	.67
11	-.21	-.28	.22	-.18	.23
12	-.06	-.40	.07	-.16	-.30
13	-.26	-.57	.42	.33	.07
14	-.05	-.28	-.48	.01	-.22
15	.09	-.07	.38	-.57	.08
16	-.16	-.30	-.28	.43	.32

(Table 87 continues)

	M_2 vectors				
var/vec	1	2	3	4	5
1	-.12	.19	-.17	.96	-.30
2	.41	.76	-.52	-.04	.08
3	-.69	.60	.24	-.37	-.03
4	-.02	-.32	-.36	-.44	-.78
5	.43	.29	.67	.08	-.52

Table 87. Canonical correlation at the factor level,

Boys, N = 70

	Rc	Wilks lambda	Chi^2	Degrees of freedom	p<
1.	.754	.086	147.314	60	.001
2.	.732	.199	96.793	44	.001
3.	.631	.430	50.703	30	.01
4.	.425	.713	20.292	18	ns
5.	.360	.871	8.312	8	ns

	M_1 vectors				
var/vec	1	2	3	4	5
6	-.21	.36	.04	-.20	-.31
7	-.03	-.34	-.48	.44	-.31
8	.37	.00	-.07	.03	-.06
9	-.73	-.08	.04	.36	.19
10	.03	-.42	.42	-.15	.05
11	-.23	-.27	.20	-.58	-.58
12	.22	.19	.16	-.29	-.04
13	-.04	.41	-.16	.26	.24
14	-.01	.06	-.09	.39	-.75
15	.30	.24	.54	.44	.02
16	.14	-.17	-.15	.14	-.09
17	-.10	-.11	-.15	-.58	-.10

(Table 87 continues)

M_2 vectors

var/vec	1	2	3	4	5
1	.33	.88	-.13	.15	-.30
2	-.73	.20	-.27	.48	.35
3	-.19	-.08	-.71	-.68	-.07
4	-.60	.23	.35	-.33	-.61
5	.04	-.31	-.38	.62	-.62

Table 88. Canonical analysis of the factor level, Girls + Boys, N = 157

Rc	Wilks lambda	Chi^2	Degree of freedom	p <
1.	.698	.263	194.67	60	.001
2.	.511	.514	97.156	44	.001
3.	.435	.695	53.125	30	.01
4.	.280	.857	22.546	18	ns
5.	.266	.929	10.690	8	ns

M_1 vectors

var/vec	1	2	3	4	5
6	.44	.35	-.56	-.13	-.45
7	-.24	-.42	-.42	-.37	.18
8	-.13	.11	.48	-.36	-.38
9	.29	-.13	.15	-.66	-.08
10	-.32	.28	.20	-.11	.08
11	-.47	-.13	-.31	-.24	-.29
12	.12	.05	.16	.22	-.02
13	.17	-.09	-.14	.02	.47
14	-.01	.17	-.06	.30	-.46
15	-.18	.77	.06	-.45	.07
16	.08	-.17	.01	.03	-.82
17	-.01	.15	-.16	.33	-.22

M_2 vectors					
var/vec	1	2	3	4	5
1	.74	.57	.28	-.05	.30
2	.35	-.29	-.84	.17	.25
3	.30	.18	-.24	-.77	-.51
4	.13	-.72	.24	-.53	.37
5	.39	-.36	.24	.32	-.77

In the case of the girl group, only the first canonical correlation is statistically significant ($p < .001$). Here, the variance of the theoretical subjects factor, the mathematical school achievement factor and the partial skill subjects factor is accounted for to a statistically significant extent by the factor of intelligence as rated by teachers and the numerical factor.

Three statistically significant canonical correlations are obtained for the boy group.

The first pair of axes ($p < .001$): the variance of the partial skill subjects factor and the home economics factor is accounted for by a statistically significant extent by the verbal comprehension factor, the visualization and numerical reasoning factor and the dexterity factor.

The second pair of axes ($p < .001$): the variance of the general theoretical subjects factor and the reading factor is accounted for by the non-verbal reasoning factor, the numerical factor, the verbal fluency factor and the sociometric factor.

The third pair of axes ($p < .01$): the variance of the handcrafts factor (the home economics factor and the reading factor) is accounted for by the dexterity factor

(the verbal fluency factor and the non-verbal reasoning factor).

Three of the canonical correlations obtained for the combined group are statistically significant.

The first pair of axes ($p < .001$): the theoretical subjects general factor - and the factors of skill subjects, home economics and handcrafts, combined with it - is accounted for by the verbal factor, the non-verbal reasoning factor and the perceptual speed factor.

The second pair of axes ($p < .001$): the variance of the book-keeping factor, the theoretical subjects factor and the handcrafts factor is accounted for by the dexterity factor, the numerical special factor and the verbal factor.

The third pair of axes ($p < .01$): the variance of all the school achievement factors, considered as a whole, is accounted for by all the intelligence factors.

The canonical correlations which were not sufficiently large to be statistically significant might also be employed as guidelines. They will not, however, be discussed here.

When the information furnished by canonical analysis about a situation where the interrelations between the various school achievement variables are eliminated is interpreted, it should be taken into account that the results appear in the form of linear combinations; and, thus, the information itself is combined in character. More specific information could be obtained by subjecting each of the school achievement variables then to multiple-regression analysis. Such an analysis will not, however, be undertaken here.

The factual information included in this part will be discussed in Part IV.

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