A N A L Y S I S A N D F I N D I N G S

The univariate as well as the multivariate analyses of variance were performed to test the significance of obtained difference in the dependent variables under different social climates. The graphic analysis was also employed to high light the differential effect of climates on student behaviour variables which were found to be discriminating between climates.

THE UNIVARIATE ANALYSIS

The univariate analysis of variance was carried out, and F-test was applied to test the null hypotheses that the means of the criterion measures are the same for each treatment population. The six climate groups of schools, with three schools under each climate, formed the six treatment groups. The school mean scores on various aspects of students' personality, attitude, and school performance in the public examination at the end of school education, served as the criterion measures.

The assumptions of F-test were carefully considered before using this test to study the significance of obtained differences in the values of criterion variables between various treatment groups.

The assumption of random sampling was taken care of by drawing a random sample of schools from hypothetical

populations of school groups identified as having a given climate. It may be recalled that, earlier in the study, a group of 70 schools were selected randomly from among the population of schools consisting of non-governmental, co-educational high schools in Gujarat State serving mostly middle socio-economic strata of society. These schools were surveyed to know their social climate. An objective measure was used to identify the social climate of a school, and schools were classified under six climate groups on the basis of the climate measure. Each of these six climate groups of schools were then treated as forming hypothetical populations of schools with a specified school climate. From each of these hypothetical populations a random sample of three schools was selected and such groups were regarded as random samples from hypothetical treatment populations.

For the homogeneity of variance of criterion measures, it was not very meaningful to apply a test for homogeneity of variance due to small number of observations in each treatment group. However, the effect of these, if any, was not expected to be serious. This contention would appear to be plausible in view of Lindquist's observations that "the assumption of homogeneity of variance is practically never strictly satisfied in educational and psychological experiments, but that in most instances the

the heterogeneity is not marked. Fortunately, the form of the sampling distribution of the mean square ratios is not very markedly affected by moderate degrees of heterogeneity of variance, and hence, the F-test may still be satisfactorily used in many experimental sutuations" (Lindquist, 1956, p. 77-78). "In general, unless the heterogeneity of either form or variance is so extreme as to be readily apparent upon inspection of data, the effect upon the F-distribution will probably be negligible" (Lindquist, 1956, p. 86).

As the Groups-Within-Treatments Design with the group as the unit of analysis was adopted in the study, the analysis of variance was based on the mean scores of schools on the criterion measures.

Initially, it was decided to analyse the data for boys and girls separately as there was likelihood of sex differences in the scores on the criterion measures. Later on, however, it was discovered that in one of the schools there was not a single girl student, and in some other schools the number of girl students ranged from 3 to 7 only. In view of such a small number of girls in some of the schools, girls were dropped and the analysis was confined to boys only.

The school means of criterion variables for various climate groups are given in Table 1.

Table 1

School Mean Scores of Criterion Variables for Six Climate Groups

Criterion Variables	Climate Groups: Open	Autonomous	Controlled	Familiar	Paternal	Closed
	1	2	3	4	5	6
Personal-Social Adjustment Variables						
1. Activity	23.20	23.31	21.50	21.40	21.81	22.23
2. Hypomanic Temperament	18.27	18.73	18.37	18.70	18.60	18.67
3. Moral Values	24.77	25.24	23.53	23.96	23.48	24.36
4. Dominance	16.45	17.21	17.18	16.65	17.38	16.73
5. Paranoid Tendency	14.54	17.01	15.66	16.65	17.07	16.34
6. Depressive Tendency	12.14	15.05	14.47	13.95	14.78	13.60
7. Emotional Instability	08.30	11.42	10.54	10.45	10.32	09.18
8. Introversion	11.65	14.15	14.00	14.47	13.51	13.64
Value Related Variables						
9. Parents	24.56	25.84	26.84	25.43	24.37	24.80
10. Moral Values	25.06	24.20	26.45	24.90	24.57	24.86
11. Teachers	26.45	26.47	27.07	26.12	25.35	26.52
12. Social Values	23.05	23.06	23.62	22.67	22.30	22.35
13. Civic Values	24.76	24.87	25.05	24.36	23.35	24.08
14. Religion	23.25	24.80	24.31	23.74	23.33	24.66
15. Boy-Girl-Relationship	24.08	23.45	24.01	23.29	22.74	23.63
16. Education	25.02	24.78	26.02	25.64	23.93	24.12
Attitudinal Variables						
17. School	20.82	19.64	19.43	19.82	19.67	20.60
18. Educational Practices	14.11	13.87	13.74	13.14	13.13	13.21
19. How Teachers Teach	65.06	62.92	69.12	63.65	69.75	61.10
Scholastic Achievement variable						
20. Examination Results	1.86	1.82	1.99	1.86	1.63	2.06

Findings of Univariate Analysis:

The F-value for respective criterion variables are given in Tables 2 to 22.

Social Climate and personal-social adjustment: The obtained F-values in respect of personal-social adjustment variables are reported in Tables 2 to 9.

Table 2 gives the ratio of the observed variance of the treatment means to their expected chance variance with respect to the Activity characteristic of personality. The observed F-ratio of 1.20, with 5 and 12 degrees of freedom, is not significant at 5 percent level. The observed difference in the mean values of different climate groups may be attributed to chance.

Table 2

Analysis of Variance of Scores on Activity Characteristic of Personality for Six Climate Groups of Schools

Source of variation	Degrees of freedom	Sum of squares	Mean square	F	F.95
Between Groups	5	10.49	2.09	1.20	3.11
Within Groups	12	20.89	1.74		
Total	17	31.38			

The F-value of 0.06, with 5 and 12 degrees of freedom, reported in Table 3 shows too small a variance in the means of different climate groups for Hypomanic Temperament to be of any significance.

Table 3

Analysis of Variance of Scores on Hypomanic Temperament Characteristic of Personality for Six Climate Groups of Schools

Source of variation	Degrees of freedom	Sum of squares	Mean squares	F	F.95
Between groups	5	00.55	0.11	0.06	3.11
Within groups	12	23.82	1.98		
Total	17	24.37			

The Moral Value characteristic gets a relatively higher F-value than Activity or Hypomanic Temperament. But even the 2.16 F-value, with 5 and 12 degrees of freedom (see Table 4), fails to come up to 5 percent level of significance.

Table 4

Analysis of Variance of Scores on Moral Value Characteristic of Personality for Six Climate Groups of Schools

Source of variation	Degrees of freedom	Sum of squares	Mean squares	F	F.95
Between groups	5	7.39	1.47	2.16	3.11
Within groups	12	8.24	0.68		
Total	17	15.63			

Table 5 shows an F-value of 0.29, with 5 and 12 degrees of freedom, for the Dominance characteristic, which is far too low from the 5 percent level of 3.11.

Table 5

Analysis of Variance of Scores on Dominance Characteristic of Personality for Six - Climate Groups of Schools

Source of variation	Degrees of freedom	Sum of squares	Mean squares	F	F.95
Between groups	5	02.06	0.41	0.29	3.11
Within groups	12	16.39	1.37		
Total	17	18.45			

The Paranoid Tendency with 1.18 F-value (Table 6), the Depressive Tendency with 2.53 (Table 7), the Emotional Instability with 2.82 (Table 8), and the Introversion characteristic with 0.98 (Table 9), all with 5 and 12 degrees of freedom, do not come upto the level of 3.11, and are therefore not significant at 5 percent level.

Table 6

Analysis of Variance of Scores on Paranoid Tendency Characteristic of Personality for Six Climate - Groups of Schools

Source of variation	Degrees of freedom	Sum of squares	Mean squares	F	F.95
Between groups	5	14.05	2.81	1.18	3.11
Within groups	12	28.38	2.36		
Total	17	42.43			

Table 7

Analysis of Variance of Scores on Depressive Tendency Characteristic of Personality for Six Climate-Groups of Schools

Source of variation	Degrees of freedom	Sum of squares	Mean squares	F	F.95
Between groups	5	16.61	3.32	2.53	3.11
Within groups	12	15.72	1.31		
Total	17	32.33			

Table 8

Analysis of Variance of Scores on Emotional Instability Characteristic of Personality for Six Climate-Groups of Schools

Source of variation	Degrees of freedom	Sum of squares	Mean squares	F	F.95
Between groups	5	18.46	3.69	2.82	3.11
Within groups	12	15.68	1.31		
Total	17	34.14			

Table 9

Analysis of Variance of Scores on Introversion Characteristic of Personality for Six Climate Groups of Schools

&&

Source of variation	Degrees of freedom	Sum of squares	Mean squares	F	F.95
Between groups	5	15.04	3.01	0.98	3.11
Within groups	12	36.49	3.04		
Total	17	51.53			

To sum up the results on personality characteristics, it may be said that although all the eight characteristics fail to discriminate between climates at the 5 percent level of significance, some of the characteristics show larger variance between climates than others. As shown in Table 10, the Emotional Instability characteristic of

Table 10

F-values of Personality Characteristics for Various Climate Groups

Personality characteristic	Obtained F-value	Rank
Emotional Instability	2.82	1
Depressive Tendency	2.53	2
Moral Values	2.16	3
Activity	1.20	4
Paranoid Tendency	1.18	5
Introversion Tendency	0.98	6
Dominance	0.29	7
Hypomanic Temperament	0.06	8

personality adjustment shows the largest variance in the mean values between climates followed by the Depressive Tendency, the Moral Values, the Activity, the Paranoid Tendency, and the Introversion characteristics in that order. The Dominance and Hypomanic Temperament characteristics show the least and rather negligible variance between climates.

Social climate and value related variables: Table 11 to 18 report the obtained F-ratios for value-related characteristics. The calculated F-values range between 0.49 and 1.77, and with 5 and 12 degrees of freedom, none of these are significant at 5 percent level. The apparent differences between the mean values of these characteristics for different climates may be attributed to chance. Among the value-characteristics, however, attitude towards Parents (Table 11), Moral Values (Table 12), Teachers (Table 13), Religion (Table 14), and Education (Table 15) have relatively larger variance between climate groups than attitude towards Social Values (Table 16), Civic Values (Table 17), and Hetrosexual Relations (Table 18).

Table 11

Analysis of Variance of Scores on Attitude Towards Parents for Six Climate-Groups of Schools

Source of variation	Degrees of freedom	Sum of squares	Mean squares	F	F.95
Between groups	5	13.09	2.62	1.59	3.11
Within groups	12	19.67	1.64		
Total	17	32.76			

Table 12

Analysis of Variance of Scores on Attitude Towards Moral Values for Six Climate - Groups of Schools

Source of variation	Degrees of freedom	Sum of squares	Mean squares	F	F.95
Between groups	5	08.55	1.71	1.14	3.11
Within groups	12	17.95	1.50		
Total	17	26.50			

Table 13

Analysis of Variance of Scores on Attitude Towards Teachers for Six Climate-Groups of Schools

Source of variation	Degrees of freedom	Sum of squares	Mean squares	F	F.95
Between groups	5	4.63	0.93	1.05	3.11
Within groups	12	10.48	0.87		
Total	17	15.11			

Table 14

Analysis of Variance of Scores on Attitude Towards Religion for Six Climate - Groups of Schools

Source of Variation	Degrees of freedom	Sum of squares	Mean squares	F	F.95
Between groups	5	6.96	1.39	1.77	3.11
Within groups	12	9.43	0.79		
Total	17	16.39			

Table 15

Analysis of Variance of Scores on Attitude Towards Education for Six Climate - Groups of Schools

Source of variation	Degrees of freedom	Sum of squares	Mean squares	F	F.95
Between groups	5	10.14	2.03	1.43	3.11
Within groups	12	16.93	1.41		
Total	17	27.07			

Table 16

Analysis of Variance of Scores on Attitude Towards Social Values for Six Climate - Groups of Schools

Source of variation	Degrees of freedom	Sum of squares	Mean squares	F	F.95
Between groups	5	3.79	0.76	0.51	3.11
Within groups	12	17.58	1.47		
Total	17	21.37			

Table 17

Analysis of Variance of Scores on Attitude Towards Civic Values for Six Climate - Groups of Schools

Source of variation	Degrees of freedom	Sum of squares	Mean squares	F	F.95
Between groups	5	5.93	1.19	0.49	3.11
Within groups	12	28.59	2.38		
Total	17	34.52			

Table 18

Analysis of Variance of Scores on Attitude Towards Boy-Girl Relationship for Six Climate-Groups of Schools

Source of variation	Degrees of freedom	Sum of squares	Mean squares	F	F.95
Between groups	5	3.78	0.76	0.96	3.11
Within groups	12	9.43	0.79		
Total	17	13.21			

Social climate and attitude towards educational objects: For attitude towards school in general, and educational practices also there is no significant difference for the observed means between climates (see Table 19 and Table 20).

The F-value of 1.60, with 5 and 12 degrees of freedom (Table 21), for Pupils' Perception of How Teachers Teach is again not high enough to be significant at 5 percent level.

Table 19

Analysis of Variance of Scores on Attitude Towards School for Six Climate - Groups of Schools

Source of variation	Degrees of freedom	Sum of squares	Mean squares	F	F.95
Between groups	5	4.86	0.97	0.78	3.11
Within groups	12	14.81	1.23		
Total	17	19.67			

Table 20

Analysis of Variance of Scores on Attitude Towards Educational Practices for Six Climate-Groups of Schools

Source of variation	Degrees of freedom	Sum of squares	Mean squares	F	F.95
Between groups	5	2.75	0.55	0.44	3.11
Within Groups	12	14.82	1.24		
Total	17	17.57			

Table 21

Analysis of Variance of Scores on Pupils' Perception of How Teachers Teach for Six Climate-Groups of Schools

Source of variation	Degrees of freedom	Sum of squares	Mean squares	F	F.95
Between groups	5	181.34	36.27	1.60	3.11
Within groups	12	271.09	22.59		
Total	17	452.43			

Social climate and scholastic attainment: For school results at the Board's Examination, the analysis of variance was carried out after transforming the original scores in percentages into Radians as homogeneity of variance in case of proportions or percentages cannot be assumed because σp^2 varies with P and with N. For transformation of a Proportion to Radians, Table given in Walker and Lev (1953, p. 479) was used for conversions.

The obtained F-value of 0.04, with 5 and 12 degrees of freedom (Table 22), is almost near zero, and the obtained differences in the scholastic performance of students as reflected in Boards' Examination may be due to chance.

Table 22

Analysis of Variance of Scores on Boards' Examination for Six Climate-Groups of Schools

Source of variation	Degrees of freedom	Sum of squares	Mean squares	F	F.95
Between groups	5	0.21	0.04	.04	3.11
Within groups	12	11.57	0.96		
Total	17	11.78			

Note: The original scores were in percentage which were transformed to radians for the analysis of variance, as radian is more nearly normal than that of proportion or percentage.

As is clear from the above findings, none of the criterion variables showed F-value large enough to reject the null hypotheses. If we were to base our inference on univariate analysis, we would conclude that the different social climates in school do not tend to produce differences in either in scholastic performance or in personality variables. But, before accepting such a conclusion, it is necessary to subject the data to an alternative but a more powerful method of analysis.

THE MULTIVARIATE ANALYSIS

A multivariate analysis was then attempted to see whether a group of variables or characteristics studied 'simultaneously' show any difference between treatment groups. An assumption was made that although individually certain characteristics do not discriminate between various climate groups, a certain pattern of these very characteristics with different weightages may show discrimination between climate groups.

For the multivariate analysis, characteristics related to various aspects of personality were grouped together, and another group was formed of value-related characteristics. The group of personality characteristics included traits like Activity, Hypomanic Temperament, Moral Values, Dominance, Paranoid Tendency, Depressive

Tendency, Emotional Instability, and Introversion. The value group of characteristics included attitude towards Parents, Moral Values, Teachers, Social Values, Civic Values, Religion, Hetrosexual Relations, and Education.

An eight-variate multivariate analysis of variance was performed using as variables the mean scores of personality, and value related characteristics. Wilk's Λ -test with Rao's approximation (Whitla, 1968, p. 72) was applied to test the significance of difference between means of different variables for various climate groups.

Calculations for the multivariate analysis of variance consisted of forming the pxl vector mean for each subclass and the pxp matrix of within-subclasses sum of squares and cross products (briefly, "sum of products"). The Λ was computed as the ratio of the determinants of $|W|$ and $|T|$, where W is the matrix of within-groups sum of squares and T that of total sum of squares.

The significance of the attained Λ was evaluated by using the formula

$$F = \frac{1 - \Lambda^{1/s}}{\Lambda^{1/s}} \times \frac{ms - v}{t(k-1)} ,$$

where t and k are the number of test variables and the number of groups respectively, while

$$m = \frac{2N - t - k - 2}{2},$$

$$s = \sqrt{\frac{t^2(k-1)^2 - 4}{t^2 + (k-1)^2 - 5}}, \text{ and}$$

$$v = \frac{t(k-1) - 2}{2}.$$

The obtained value of F was referred to the F-table with t(k-1) and ms-v degrees of freedom.

Findings of the multivariate analysis:

For the personality related group of characteristics, the obtained F value of 2.815, with 24 and 40 degrees of freedom, is significant at 5 percent level. For the value group of characteristics, however, the obtained F value of 1.452, with 24 and 40 degrees of freedom, is not significant at 5 percent level. (For calculations see Appendix XII.)

To get an estimate of the relative effect of climate groups on variables related to personal-social adjustment aspect of pupils' personality characteristics found to be discriminating between climates (on the basis of multi-

variate analysis of variance), the F value of each personality characteristic calculated earlier under the univariate analysis of variance was used. A graph showing the relative F value of respective characteristics is given in Figure A. The broken line in the graph indicates the 5 percent level of significance. (The numerical F values are given in Table 10). It is clear from the graph that the Emotional Instability characteristic has the largest F value among personality characteristics, followed by Depressive Tendency, Moral Values, Activity, Paranoid Tendency, Introversion, Dominance, and Hypomanic Temperament, in that order. On the basis of these F values, it may be inferred that the Hypomanic Temperament and Dominance characteristics contribute least (among the characteristics) towards the difference between climate groups which is found to be significant when all the eight characteristics are treated 'simultaneously' for analysis of variance. If these two characteristics are ignored for their relative ineffectiveness, then a study of Table 23, showing the ranks of mean values of personality characteristics with relatively larger variance, and Figures B and C depicting mean values graphically, suggest that pupils of schools belonging to the Open Climate group show least Paranoid and Depressive tendencies, Emotional Instability, and Introversion

Figure 4

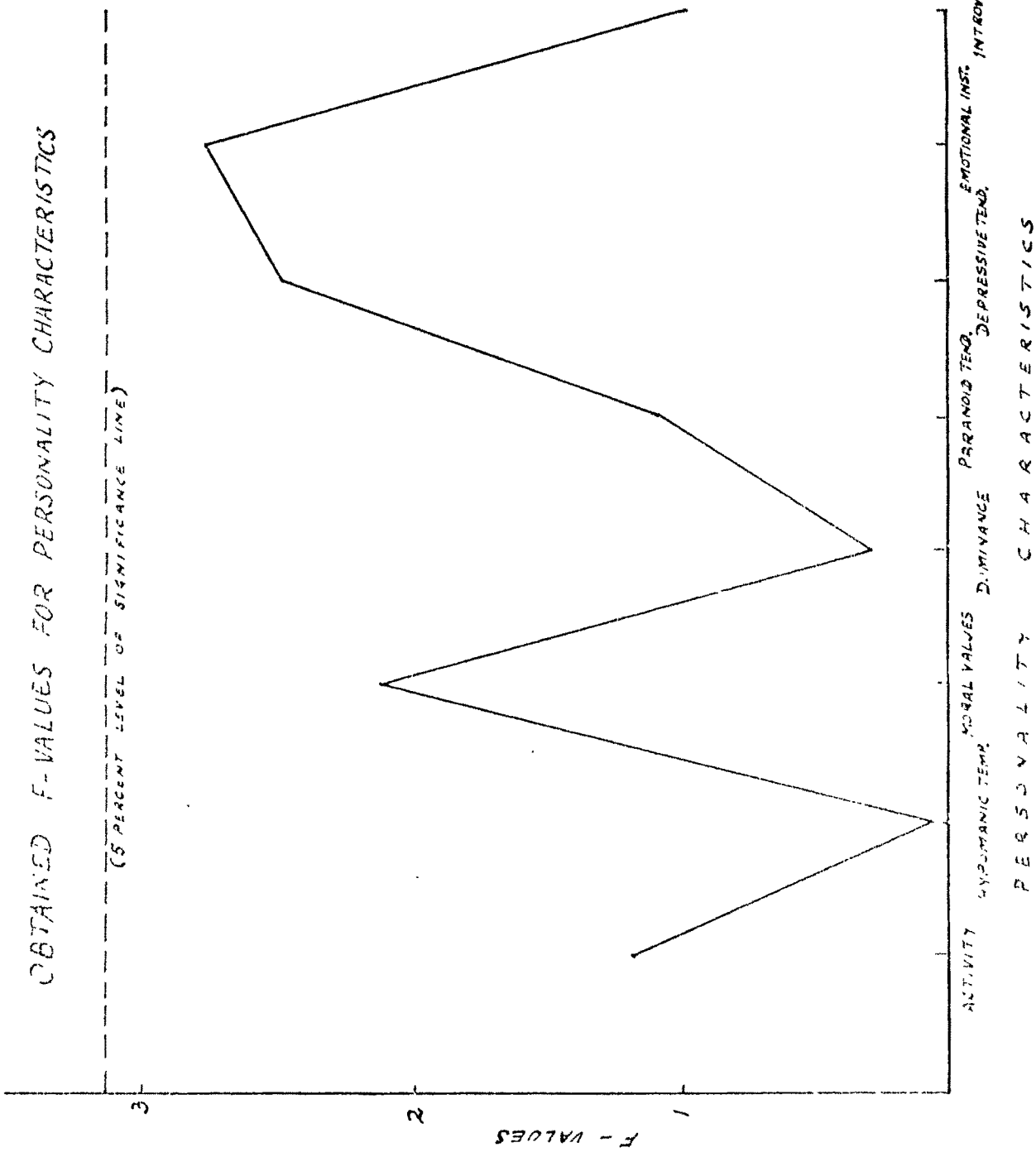

OBTAINED F-VALUES FOR PERSONALITY CHARACTERISTICS
(5 PERCENT LEVEL OF SIGNIFICANCE LINE)
F - VALUES
3
2
1
ANXIETY
HYPOMANIC TEND.
MORAL VALUES
DOMINANCE
PARANOID TEND.
DEPRESSIVE TEND.
EMOTIONAL INST.
INTROVERSION
PERSONALITY CHARACTERISTICS

Table 23

Ranks of Mean Values of Personality Characteristics with relatively larger Variance for Six Climate Groups*

Characteristic	Climate group					
	Open	Autono-mous	Contro-lled	Famil-iar	Pater-nal	Closed
1. Activity	2	1	5	6	4	3
2. Moral Values	2	1	5	4	6	3
3. Paranoid Tendency	1	6	2	5	4	3
4. Depressive Tendency	1	6	4	3	5	2
5. Emotional Instability	1	6	5	4	3	2
6. Introversion	1	5	4	6	2	3
Total Rank Score	8	25	25	28	24	16
Overall Rank	1	4.5	4.5	6	3	2

* For positive characteristics like Activity and Moral Values, first rank is assigned to a climate which has the highest mean score for a given characteristic. The ranking system is reversed for negative characteristics like Paranoid Tendency, Depressive Tendency, Emotional Instability and Introversion.

Figure B

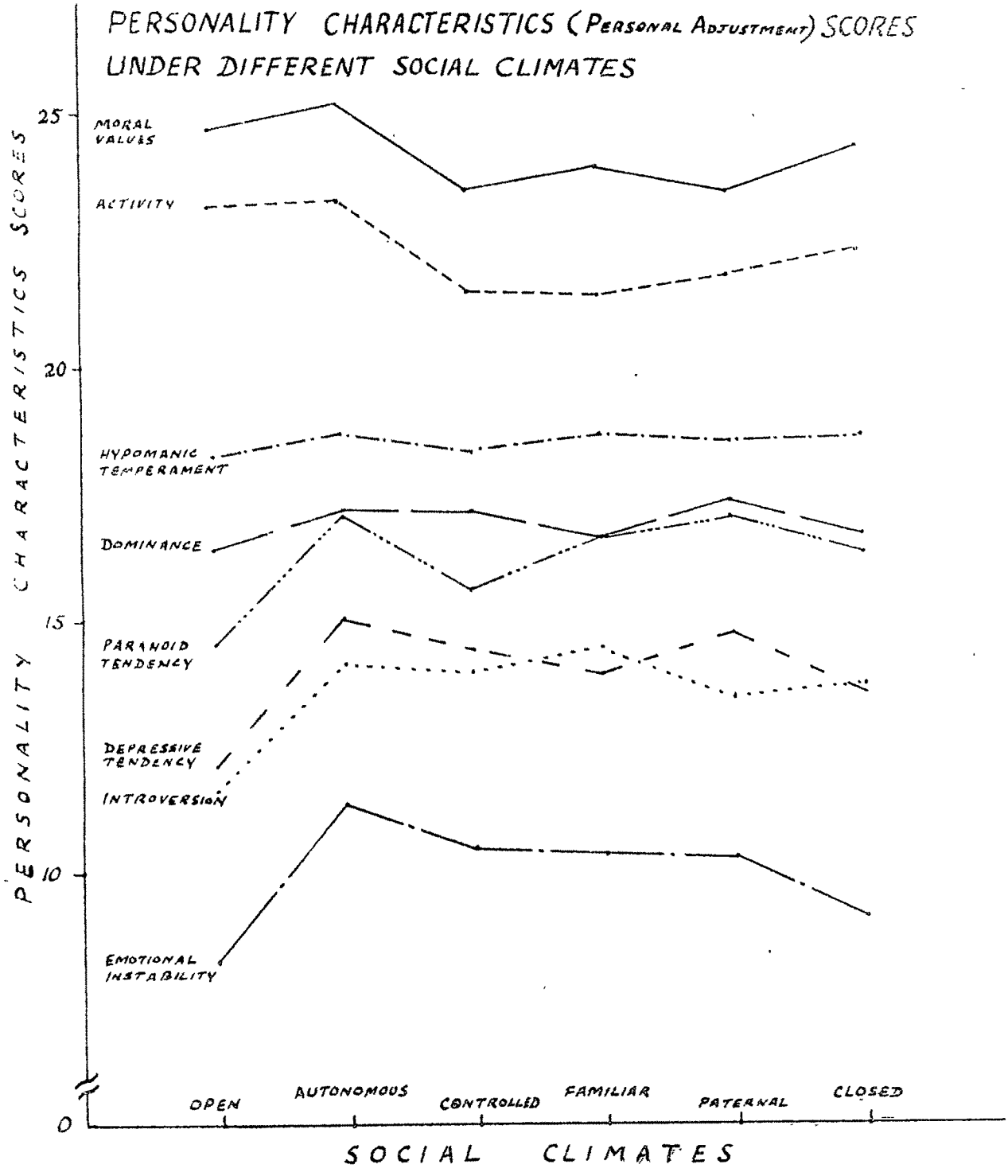
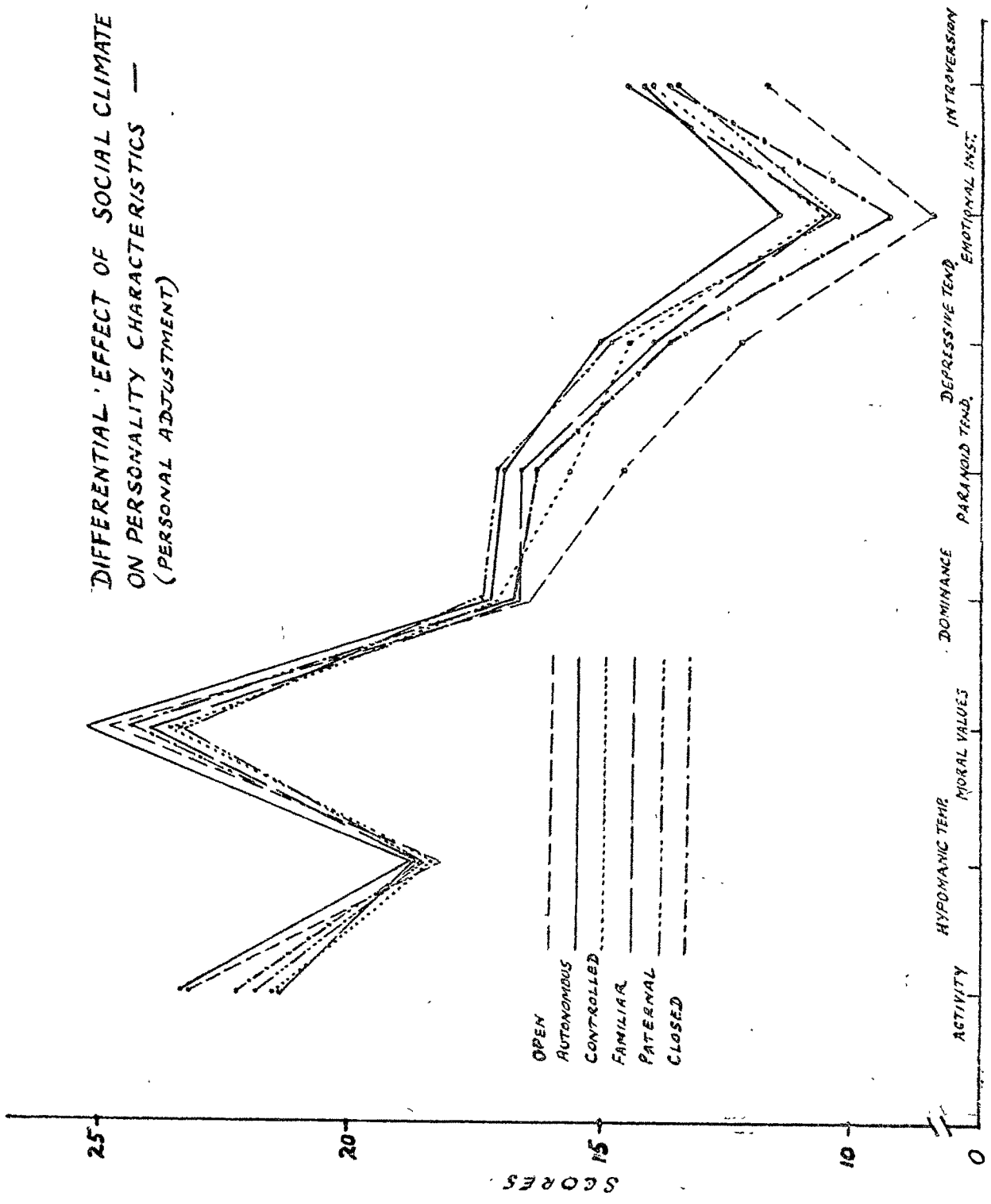

PERSONALITY CHARACTERISTICS (PERSONAL ADJUSTMENT) SCORES
UNDER DIFFERENT SOCIAL CLIMATES
PERSONALITY CHARACTERISTICS SCORES
25
20
15
10
0
MORAL VALUES
ACTIVITY
HYPOMANIC TEMPERAMENT
DOMINANCE
PARANOID TENDENCY
DEPRESSIVE TENDENCY
INTROVERSION
EMOTIONAL INSTABILITY
OPEN
AUTONOMOUS
CONTROLLED
FAMILIAR
PATERNAL
CLOSED
SOCIAL CLIMATES

Figure C


DIFFERENTIAL EFFECT OF SOCIAL CLIMATE
ON PERSONALITY CHARACTERISTICS —
(PERSONAL ADJUSTMENT)
SCORES
25
20
15
10
0
OPEN
AUTONOMOUS
CONTROLLED
FAMILIAR
PATERNAL
CLOSED
ACTIVITY
HYPOMANIC TEND.
MORAL VALUES
DOMINANCE
PARANOID TEND.
DEPRESSIVE TEND.
EMOTIONAL INST.
INTROVERSION
PERSONALITY CHARACTERISTICS

characteristics of personal social aspects of personality adjustment, and their score on Activity and Moral Values are higher than all other climate groups except the Autonomous group which gets highest score for these two characteristics, but lags far behind other climate groups on other characteristics.

Schools with Closed Climate come next in their influence on pupils' personal-social adjustment, getting consistently second or third rank for the differentiating characteristics.

The Paternal Climate group of schools becomes number three in terms of over all rank by one point in its contribution towards positive personal-social adjustment of pupils, otherwise its general effect on student variables related to personal adjustment is almost equal to that of the Autonomous and Controlled groups. Between adjustment variables, the Autonomous Climate group of schools contribute highest towards Activity and Moral Values, whereas the Controlled group gets a second position for Paranoid behaviour, and the Paternal group scores a second rank for Introversion and a third rank for Emotional Instability. Otherwise, the effect of the Autonomous, the Controlled, and the Paternal Group is more or less similar in case of other adjustment variables.

The last among the climate groups comes the Familiar Climate group of schools. Here, except for the Depressive Tendency for which this group gets a third rank, other characteristics' ranks vary from 4 to 6.

To sum up, the only null hypothesis that could be rejected on the basis of obtained results is related to personal-social adjustment of pupils. The univariate analysis of variance could not show significant differences between climate groups for the eight personality adjustment characteristics, but the powerful multivariate analysis of variance did show that significant differences exist between climate groups when all the eight variables are treated 'simultaneously'. Among personality characteristics, the Emotional Instability characteristic showed the maximum variance between climates followed by Depressive Tendency, Moral Values, Activity, Paranoid Tendency, Introversion, Dominance, and Hypomanic Temperament, in that order. Between climate groups, the Open Climate comes out to be the most effective from the positive personal-social adjustment of pupils' point of view, followed by the Closed, the Paternal, the Autonomous and the Controlled with a tie, and the Familiar, in that order.