Chapter III

METHOD AND PROCEDURE

The present chapter deals with the operational aspects of the study, the methodological and procedural design of the research work, the tools and statistical treatment of the data suited to the purpose and objectives of the work.

Since the method and procedure are subservient to aims and objectives of a research work, it may be profitably recalled that the present study is an attempt to explore the personal concomitants of over and under achievement in different school subjects with the following specific objectives:

(1) To identify the differential personality factors going with over and under achievement in each of the four subjects selected for study, Hindi, English, Mathematics and Science, among the male and female subjects separately.

(2) To investigate sex differences within the groups of over achievers and under achievers in individual subject areas along different personality dimensions.

(3) To determine whether over under achievement is a general phenomenon or a specific one with reference to different school subjects.
Tools of the Study

The meaningfulness of results of any research work depends very much on the appropriateness of the tools and measures employed in the study. They should be reasonably valid and reliable as well as suited to the age and ability levels of the sample involved in the research work.

For its purpose, the present investigation required the following tools and measures:

i) a reliable test for measuring intelligence,
ii) a comprehensive standard test of personality, and
iii) dependable achievement scores of the subject areas involved in the study.

Measure of Intelligence

For measuring intelligence of the subjects, the 'Culture Fair' test of general ability constructed by Cattell and Cattell (Test of 'g': Culture Fair, Scale 2, Form A) was employed. This test was chosen in preference to some other possible choices primarily because it is a culture free test. The authors claim that the test measures "individual intelligence in a manner designed to reduce, as much as possible, the influence of verbal fluency, cultural climate, and educational level" (Measuring Intelligence with the Culture Fair Tests, Manual for Scale 2 and 3, 1973, p.5). Scale 2 of the test could profitably be employed for the
present study as it covers age range 8 years upwards and the subjects for the study were school pupils of classes VIII and IX, with a mean age of 15 years.

The ease of administration of the test was also a consideration. The test is so designed that it can be conveniently administered in groups. In the words of the author, it is "wholly group administrable".

As already mentioned, in order to avoid the influence of language the tasks in the test are so structured that the subjects are required 'only to perceive relationships in shapes and figures'.

So far as the design of the test is concerned, Cattell's Test of 'g': Culture Fair, Scale 2, Form A, consists of four subtests. The first subtest has 12 series items and the time allotted for it is 3 minutes. The second subtest contains 14 classification items and the time allotted for it is 4 minutes. The third subtest is constituted of 12 matrices and the allotted time is 3 minutes. The fourth subtest has 8 topology items and the time allotted for it is $2^{1/2}$ minutes. Thus in all there are 46 items in four subtests. It appears important to mention that both in the arrangement of the four subtests and the order of items within the subtests the psychological principle of moving from easy to difficult operations is adhered to.
Examples are given before each subtest so that the task requirements are understood well by the subjects involved.

Reliability of the Intelligence Measure

In order to determine the reliability of the Culture Fair, Scale 2, Form A, the test-retest agreement method and the split-half method were employed by the authors for obtaining dependability coefficient and consistency coefficient respectively. The test-retest 'dependability' coefficients, corrected to full length on Spearman Brown Formula, ranged from .82 to .85 while the odd-even split half 'consistency' coefficients ranged from .95 to .97 (Technical Supplement for the Culture Fair Intelligence Tests, Scales 2 and 3, 1973, p.2).

Validity of the Intelligence Measure

Concept validities by the internal consistency method, which they term as the 'direct concept validities' for Scale 2 have been calculated for each of the four subtests in Scale 2, and reported in the Technical Supplement. For the 12 series items of the first sub-test, the direct concept validity coefficient is .76, for the 14 classification items of the second subtest the coefficient is .54, for the 12 'matrices' of the third subtest it is .76, and for 8 'topology' items of the fourth subtest .51. For the total test consistency of 46 items, the direct concept validity coefficient has been reported to be

For determining concrete validity of Scale 2, performance on the scale was correlated with that on other intelligence tests. It is reported in the Manual that the concrete validity coefficients for the Scale 2, Form A, against four tests of intelligence, namely, 'Wechsler Adult, Revised Beta, Otis Group Test, and Coloured Progressive Matrices', were found to be .74, .76, .71 and .68 respectively (Technical Supplement, 1973, p.18). The average coefficient of concrete validity as determined against these tests was found to be .70 (Manual, 1973, p.11).

The Measure of Achievement

For the achievement measure, the investigator had to depend upon the school records of test and examination marks. Much as the lack of reliability of school examination marks is proverbial, there was no other way to get the measure of academic achievement. It would have been, no doubt, far better, if standardised achievement tests could have been employed for this purpose but no such tests were available for the school subjects chosen for the study and suited to the grades on which the study was made. Next best alternative was to construct an achievement test of one's own and to standardise it to the extent that was possible. In such a case the reliability and validity of the achievement
measure could have been ensured. However, neither standardised tests of achievement were available nor the time and resources at the disposal of the investigator allowed for the construction of tests in the four subjects, chosen for study. Hence school records and results of examinations had to be relied upon.

In order to ensure better reliability of achievement scores, results of four tests taken at even intervals and two examinations, one half yearly and one annual, were taken into account in all the four subjects—Hindi, English, Mathematics and Science—for each of the two grades—VIII and IX. The marks for these tests and examinations when added separately for each of the four school subjects, yielded the raw scores for every individual.

Measure of Personality

For studying the personality characteristics of the over and under achievers in the present work, the investigator employed an Indian adaptation of Cattell and Beloff's H.S.P.Q. (Kapoor and Mehrotra, Form A, 1973), covering fourteen personality dimensions. The H.S.P.Q. is a comprehensive test of personality consisting of 114 items, which, the authors claim, measures "distinct dimensions or traits of personality" (Cattell and Beloff, Manual for the H.S.P.Q., 1973). The dimensions, or traits, according to the authors come near to covering the total personality comprising both the structural
and dynamic aspects.

On careful scrutiny by the present investigator, the test was found to be amply suited to the purpose of this study. It was, in the first place, suitable for the age group taken for study, secondly, being in an Indian language, namely Hindi, was easy to administer. The test is also conveniently administrable to groups of students and can be completed within a class period.

The fourteen dimensions of personality or factors on the H.S.P.Q. are identified with alphabets, ten of the fourteen factors ranging from A to J and the last four being designated as O, Q₂, Q₃, Q₄. Each of the traits or factors is bi-polar, the low score representing one pole and the high score the opposite of it. The poles are qualitatively described in terms of characteristics opposed to each other and further explained with the help of synonymous adjectives. However, none of the ends has a necessary connotation of "good" or "bad". A list of the fourteen personality dimensions is given below, with the left pole showing low score and the right pole high score.

A. **RESERVED** - - - - - - - - - - WARM HEARTED
   (Critical, aloof, stiff) (Outgoing, participating, easy going)

B. **LESS INTELLIGENT** - - - - - - - - MORE INTELLIGENT
   (Concrete thinking, low scholastic mental capacity) (abstract thinking, of higher mental capacity)
C. **AFFECTED BY FEELINGS**  
(emotionally less stable,  
easily upset, of low ego strength)  
**EMOTIONALLY STABLE**  
(mature, calm, of high ego strength)

D. **UNDEMONSTRATIVE**  
(deliberate, inactive, stodgy)  
**EXCITABLE**  
(impatient, overactive unrestrained).

E. **OBEIDENT**  
(mild, docile, accommodating)  
**ASSERTIVE**  
(aggressive, competitive, stubborn).

F. **SOBER**  
(taciturn, serious)  
**ENTHUSIASTIC**  
(heedless, happy go lucky)

G. **DISREGARDS RULES**  
(expedient, weaker super ego-strength)  
**CONSCIENTIOUS**  
(persistent, stronger super ego-strength)

H. **SHY**  
(timid, restrained, threat sensitive)  
**ADVENTUROUS**  
(thick skinned, socially bold, does not see danger)

I. **TOUGH MINDED**  
(rejects illusion, self-restraint, responsible)  
**TENDER MINDED**  
(sensitive, dependent, over protected)

J. **ZESTFUL**  
(likes group action)  
**CIRCUMSPECT INDIVIDUALISM**  
(reflective, internally restrained)

O. **SELF ASSURED**  
(placid, secure, untroubled)  
**APPREHENSIVE**  
(self reproaching, insecure)

Q2. **SOCIABLY GROUP DEPENDENT**  
(joiner, sound follower)  
**SELF SUFFICIENT**  
(resourceful, prefers own decisions)
Q₃. **UNCONTROLLED** -------------------------------- **CONTROLLED**  
(lax, follows own urges, careless of social rules)  
(exacting will power, socially precise, follows self image)

Q₄. **RELAXED** -------------------------------- **TENSE**  
(tranquil, unfrustrated composed)  
(driven, frustrated, fretful)

**Reliability of Personality Measure (HSPQ)**

To determine the reliability of HSPQ, Form A, group performances on the test have been compared over time, at different intervals. The authors have reported the test-retest agreement, or reliability coefficient, for each of the fourteen factors on the basis of immediate retest, ranging from .74 to .91, and after six months, ranging from .53 to .69, and after one year .38 to .69. The range of coefficients over time clearly indicates that the test enjoys a high level of reliability both on 'dependability' and 'stability' criteria (Manual for HSPQ, 1973, p.4).

**Validity of Personality Measure (HSPQ)**

As for validity, the authors have attached much importance to the construct validity of the test. "What matters crucially is good, intensive measurement of the personality factors, in the first place, and therefore the HSPQ scales are meant to stand or fall by their construct validity" (Manual for HSPQ, 1973, p.5).
The construct validity coefficients reported for each of the fourteen personality factors on the basis of multiple correlation "between the items" in the scale and the corresponding pure factor are highly significant. The coefficients range from .57 to .74 (Manual for HSPQ, 1973, p.5).

Population

To start with, a sample of 650 students was taken from VIII and IX classes of Aligarh Muslim University boys' and girls' high schools. The number of cases, however, shrank to 437 due to the occasional absence of the students on the days of administration of the tests as well as due to the non-availability of achievement records of some of the subjects who had missed some short term tests or examinations. The ages of the subjects ranged from 14 to 16 years with a mean of 15 years. Since the subjects hailed from the middle classes, and were getting education under similar circumstances, the sample was taken to be reasonably homogeneous from the socio-economic point of view.

Administration of the Tests and Collection of Data

The administration of the two tests, Cattell's Culture Fair Intelligence Test and the High School Personality Questionnaire (HSPQ) took two days in each of the three
schools where data for the study were collected. Both the tests were administered to the same sections of VIII and IX classes and strict adherence to the instructions given by the authors of the tests was maintained.

The school children were highly involved and interested while they were being tested on Cattells' Culture Fair Intelligence Test and the HSPQ. It was a novel experience for them and they took the task quite seriously. Scoring on both the tests was done with the help of keys provided and thus for each case, involved in the study, scores on intelligence and fourteen personality factors were obtained. For achievement, test and examination marks in Hindi, English, Mathematics and Science were taken from the school registers and the total marks in each school subject were converted in Z-scores respectively, for each subject. To facilitate comparisons between intelligence and achievement scores, the intelligence scores were also converted in Z-scores (Best, 1977, p.238).

**Identification of Over and Underachievement**

After obtaining the data, the first task before the investigator was to identify the cases of over and under achievement in Hindi, English, Mathematics and Science separately. The problem essentially involved the prediction of 'the expected achievement' against which the positive and negative discrepancies were to be worked out -- the cases
of positive discrepancy being the over achievers and those of negative discrepancy, the under achievers.

For this purpose of statistically recognising over and under achievement in each of the four knowledge areas 'regression equation' or the 'prediction equation' between intelligence and achievement scores was worked out for each individual. The formula for working out regression equations was as follows:

\[ \overline{Y} = r \frac{\sigma_Y}{\sigma_x} (x - M_x) + M_y \] (Garrett, 1981, p.158).

in which:

- \( \overline{Y} \) = the predicted value of criterion (achievement)
- \( r \) = the coefficient of correlation between the predictor (intelligence) and the criterion (achievement) variables.
- \( \sigma_Y \) = standard deviation of the criterion scores.
- \( \sigma_x \) = standard deviation of the predictor scores.
- \( x \) = individual predictor score.
- \( y \) = individual criterion scores
- \( M_x \) = mean of the predictor scores.
- \( M_y \) = mean of the criterion scores.
- \( r \frac{\sigma_Y}{\sigma_x} \) = regression coefficient.

Since the prediction equation required means and standard deviations of the predictor and criterion variables as well as correlation coefficient between intelligence and achievement
scores these were also worked out for boys and girls separately and utilised in working out the regression equation. The value thus obtained represented the expected achievement score for the individual concerned as predicted on the basis of intelligence.

After obtaining the predicted scores, the discrepancies between the actual achievement scores and the predicted values were worked out for each individual in each of the four knowledge areas—Hindi, English, Mathematics and Science.

For identifying the overachievers and underachievers, more precisely, i.e., unaffected by the statistical errors of estimate, cases one SD_e above their predicted achievement scores were designated as overachievers and those one SD_e below as underachievers. The formula for standard error of estimate is given below:

\[ SD_e = SD \sqrt{1-(r)^2} \]  


Working along the above mentioned procedure, the male and female overachievers and underachievers were identified in the four knowledge areas separately. These fell into the following 16 groups -- 8 for boys and 8 for girls:
1. Male overachievers in Hindi.  
3. Male overachievers in English.  
4. Male underachievers in English.  
5. Male overachievers in Mathematics.  
10. Female underachievers in Hindi.  
11. Female overachievers in English.  
12. Female underachievers in English.  
13. Female overachievers in Mathematics.  
14. Female underachievers in Mathematics.  
15. Female overachievers in Science.  
16. Female underachievers in Science.  

**Procedure for Assessing Generality/Specificity of Over and Under Achievement**

An important problem before the investigator was to ascertain whether over and under achievement is a general phenomenon or a specific one with reference to different school subject areas; whether the proportion of over and under achievers in one knowledge area varies with variation in other areas of scholastic achievement significantly or not.

For treating the above problem, the study employed the Normal Deviate Test-$z$- which would verify whether and to what extent the common proportion of over and under achievers,
observed along different areas of knowledge, differed significantly from the statistically hypothetical common proportion which is 0.5. The formula employed for calculating the Normal Deviate Test was as given below:

\[ z = \frac{P_H - P_0}{\sigma_P} \]  

(McNemar, 1962, p.50)

in which

- \( P_0 \) = proportion observed common to two areas,
- \( P_H \) = hypothetical common proportion, i.e., .5 or 50 %
- \( \sigma_P \) = standard error of proportion which is calculated as under

\[ \sigma_P = \sqrt{\frac{PQ}{N}} \]

in which

- \( Q = 1-P \)
- \( P \) = percentage in decimal points
- \( N \) = number of cases

Following the above procedure, if the value of common proportion obtained on Normal Deviate Test differs significantly in the negative direction from the hypothetical proportion .5 or 50 %, it would mean that the overlap or the common proportion between the two subject areas is very low and insignificant; and if it is significantly higher than .5, it would mean that the overlap is significant.
Procedure for Determining Group Differences on Personality Factors

In order to determine the differences between groups of over and under achievers, in each of the four school subjects, on the fourteen personality dimensions the 't' test of significance of difference between means was employed. For this, means and standard deviations were worked out for each of the groups of over and under achievers in the four subject areas on each of the fourteen dimensions of personality. Sex differences within the groups of over achievers and under achievers on the fourteen personality factors in each of the four subject areas were also determined by the application of 't' test. The 't' values were computed with the help of the following formula:

\[ t = \frac{M_1 - M_2}{\sqrt{\frac{\sigma_1^2 + \sigma_2^2}{N_1 + N_2}}} \]  

(McNemar, 1962, p.102)

The analysis is presented in the following chapter.