CHAPTER-IV
CHAPTER IV

METHOD AND PROCEDURE

4.1 DESIGN

Present study was conducted in two phases. In the first phase various tools namely- Test of Creative Thinking in Mathematics, Group Test of General Mental Ability, Creative Activities Check List, Achievement Test in mathematics, Socio-economic status scale, Home Environment Inventory and Institutional Environment scale were administered to students. In the second phase, data was analysed with the help of coefficient of correlation and t-ratio technique.
4.2 METHOD

To see the association of intellective and non-intellective variables with the mathematical creativity of students, survey method was employed.

4.3 SAMPLE

Study was conducted on a random sample of 558 elementary school children studying in VII class in Public schools and traditional schools in the state of Himachal Pradesh. While selecting the sample care was taken to include both boys and girls children from Public schools, traditional schools situated in urban and rural areas. 18 children were deleted from study due to incomplete responses and thus making the final sample equal to 540. Detail of final sample has been given below in Table 4.1.
TABLE 4.1

Description of the Final Sample (N = 540)

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>NAME OF THE SCHOOL</th>
<th>PUBLIC SCHOOL</th>
<th>TRADITIONAL SCHOOL</th>
<th>URBAN</th>
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<th>BOYS</th>
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4.4 TOOLS USED

Following tools were used for data collection for the present study:

1. Test of Creative Thinking in Mathematics (Moghe, 1989).
2. Group Test of General Mental Ability (Tandon, 1971).
4. Achievement Test in Mathematics (Prakash, 2000).
5. Socio-Economic Status Scale (Kulshrestha, 1980).
7. Institutional Environment Scale. (Prepared by the investigator himself).

4.4.1 Test of Creative Thinking in Mathematics (Moghe, 1989)

This list is comprised by nine activities.
Description of these nine activities has been given below –

Activity 1 – Mathematical operations.
Activity 2 – Classification of numbers into different categories.
Activity 3 – Position and arrangement of students.
Activity 4 – Drawing of Different mathematical symbols with the help of three pins.
Activity 5 – Seeing the Position on graph.
Activity 6 – Drawing different figures to illustrate the concept of $\frac{1}{2}$ and $\frac{2}{3}$.
Activity 7 – Drawing/Writing examples from daily life where some mathematical pattern, property or shape is observed.
Activity 8 – Showing percent age with the help of pie chart.
Activity 9 – Writing of linear equation in as many ways as possible.

Time to complete the test is 45 minutes.
Scoring of the test was done on the pattern of Torrance Test of Creative Thinking. Total score on this test will be the total of fluency, flexibility and originality scores.

4.4.2 Group Test of General Mental Ability (Tandon, 1971)

As a measure of verbal intelligence, the Hindi version of the group test of general mental ability (Tandon, 1971) was used in the present study. This test was preferred to others as it is a well known test and is widely used in India e.g.,
Moreover being a group test it can be administered conveniently on a number of students at a time.

The present form of the test is a second revision of Test of "General Mental Ability – form A, which was prepared and first, used in 1950. Since then it has been used on a number of students studying at B.H.U. and other Indian colleges and universities.

The test contains 100 questions. Besides, it employs 10 items for practice in the beginning. Each item has been framed in such a way that it provides mostly five alternatives to each question. This has been done with a view to make scoring more rigid and objective. The test consists of sub-tests, namely, number series, mathematical instructions, follow-up instructions, vocabulary similars, vocabulary opposites, classification, analogies, best answers and reasoning. Some of these sub-tests have been found highly suitable for measuring general mental ability in Indian conditions.
The reliability coefficients of the test determined by three Methods are:
1) Split half method = 0.91
2) Kuder – Richardson formula = 0.91
3) Item reliability index and the item variance = 0.90

The present form (20/52) of test correlates with the Rev. Minnesota Paper Form Board Test Series AA. This shows that there is some presence of an ability of spatial relations in this test.

Further value of correlations (r = 0.35) with the academic examination marks and 0.67 with the “Samoohik Mansik Yogyata Pariksha” (A test of General Mental Ability in Hindi by Dr. S. Jalota) are reported by the author of the test. The test also correlates (r = 0.30) with the Samoohik Mansik Yogyata Pariksha (1/61), the Hindi adaptation of 20/52 scale. In addition to these, g-saturations worked out by Spearman’s technique, for all the sub-tests arrange from 0.30 to 0.87. The presence of some general factor has further been confirmed by the factorial analysis of the test using Thurstone’s centroid technique. A few subsidiary factors have also been found but identifications are yet to be confirmed by further investigations.
The test provides some simple directions in the beginning which are to be read carefully by the prospective investigator. To minimize the work of writing on the part of an examinee the answers have been framed in a manner to provide an answer to a question in a digit form of the figure only. This test proper is administered for 25 minutes only. Another 20-25 minutes are usually required for seating the candidates, distributing test booklets and answer sheets and later collection of the test materials. Hence, this test can be administered in a period of 45 to 50 minutes. The answer sheets are scored with the help of a scoring key provided for this purpose. Total of raw scores of candidate is total of right attempts.

4.4.3 Creative Activities Check List (Torrance, 1962).

Creative Activities check list was devised by Torrance (1962) which measures the level of creativity of the individual. The choice in favour of this tool was guided by considerations of its research orientedness, richness and variety of terms, case of administration and suitability of the test for the present study. This test has already seen used successfully by number of researchers e.g. Kaur (1993).
This check list contains 100 items which tests the creative level of individual in the field of language, science and home science. Each item of the checklist has two alternate answers in the form of yes or no. For every ‘yes’ response one mark is to be given and the marks obtained by the respondents are summed up. A high score on the check list indicates with degree of creativity of the individual.

4.4.4 Achievement Test in Mathematics (Prakash, 2000)

This test was professed due to suitability in the present study. This test is meant for VII class students.

Author of the test in beginning prepared 54 multiple choice of questions out of three topics i.e. rational numbers, simplification of rational numbers and percentage by selecting 18 items from each chapter. 26 items were dropped on the basis of judgement of judges. Remaining 28 items were given to 25 students for preliminary tryout. On the basis of preliminary tryout 13 items were further dropped. In this way Achievement test in its final form comprised of 15 multiple choice of items.
items on rational numbers, 7 items on simplification of rationale numbers and 3 items on percent age.

A score of one was to be assigned for each correct response and total score obtained by the student is the total number of his/her correct responses which are the achievement of the child on Achievement Test in Mathematics. Time to complete the test is 30 minutes.

4.4.5 Socio-Economic Status Scale (Kulshrestha, 1980)

To assess the socio-economic status of the subjects, a suitable scale was needed. Out of all the available SES scales, Socio-Economic Status Scale was Kulshresstha (1980) was preferred due to its wide applicability and good results.

This scale measures the status of the family, professional level, caste, total monthly income, etc. In other words the scale collects information regarding the following component variables.
1. Parents and sibling occupation: This item has been categorized into the following:
   a) Those who are not engaged in any occupation
   b) Agricultural labourer
   c) Traders and small businessman
   d) Those who are engaged into small family work e.g. animal husbandry
   e) Employees of Govt. and other organization
   f) Cultivators (own land)

2. Parental and sibling education
   a) Illiterate
   b) Can read only
   c) Can read and write
   d) Primary education
   e) Middle
   f) High school
   g) Graduate

3. Economics indicators. This includes the total income of the family from all sources.

4. Cultural indicators e.g. belief in caste, no. of children etc.
Time to complete the scale is 20 minutes.
Scoring of the scale was done on the basis of Trivedi and Pareek SES scale.

4.4.6 Home Environment Inventory (Misra, 1989)

The present home environment inventory (HEI) is an instrument designed to measure the psycho-social climate of home as perceived by children. It provides a measure of the quality and quantity of the cognitive, emotional and social support that has been available to the child within the home. HEI has 100 items belonging to ten dimensions of home environment.

The ten dimensions are –

a) Control
b) Protectiveness
c) Punishment
d) Conformity
e) Social isolation
f) Reward
g) Deprivation of Privileges
h) Nurturance
i) Rejection
j) Permissiveness, Each dimension has ten items belonging to it.

Home Environment Inventory can be administered in individual or group settings.

The responses are to be given on the booklet itself. There are five cells against every item of the inventory. Each cell indicates the frequency of occurrence of a particular behaviour. The five cells belong to five responses namely, ‘Mostly’, ‘Often’, ‘Sometimes’, ‘Least’, and ‘Never’. The dimension to which a particular item belongs has been indicated by alphabets near the serial number of the items. Assign 4 marks to ‘mostly’, 3 marks to ‘often’, 2 marks to ‘sometimes’, 1 mark to ‘least’, and 0 mark to ‘never’ responses. Count the marks assigned to A, B, C, D, E, F, G, H, I, and J dimension. Statements on every page and then add the dimension scores awarded to statements given on the five pages so as to get ten scores for the ten dimensions of HEI.

Split half reliability was worked out separately for all the 10 dimensions which were reported to be 0.87, 0.74, 0.94, 0.86, 0.87, 0.85, 0.90, 0.84 and 0.74 respectively.
4.4.7 INSTITUTIONAL ENVIRONMENT SCALE

(Prepared by the investigator himself)

Environment is a complex term to define. It stands for all the forces which assert their influence on the individual right from conception to death. The environment includes various factors related to home, physical environment, school and society.

For the present study; Institutional Environment Scale was prepared by the investigator himself as no scale was available for use in this study. Also for preparing this scale institutional or educational environment was considered. For this definition of Dave (1963) was taken into account which states, “Educational environment is the sum total of all the physical and psychological environment which surrounds the individual”.

Before preparing the statements for the Institutional Environment Scale, the works of various authors e.g. Kaur (1993), Lekha (1997) and Prakash (2000) were consulted and various journals and books related to school environment were read thoroughly.
To begin with 48 statements were prepared with the help of fellow research workers, teachers and the supervisor.

Copies of the Institutional Environment Scale were got photostat and were given to the fine experts in the field of research, measurement and evaluation in order to seek their opinion regarding the language and relevance of the statements. On the basis of their judgement 22 statements were dropped. In this way Institutional Environment Scale for the preliminary tryout of 26 statements.

These 26 statements were further got photostat and given to 20 students of VIIth class for preliminary tryout of the scale. These were further statements which were not answered by majority of the students, may be due to the difficulty level or language difficulty and therefore these eleven statements were also dropped. In this way final form of the Institutional Environment Scale comprised of 15 statements. For each statement there are three alternate responses for the child – these are Agreed, Uncertain, Not Agreed.
As all statements were negative statements therefore a score of 0, 1 and 2 were given for agreed, uncertain and not agreed responses respectively.

Time to give responses to all the items of the scale is 20 minutes. Institutional Environment Scale has been appended with the thesis (Appendix – I).

4.5 DATA COLLECTION

Collection of data for the final study was undertaken on a sample of 558 boys and girls students taken from Public and Traditional schools in urban and rural areas of Himachal Pradesh State.

Before the collection of data schools were selected randomly and permission of head of the schools as well as cooperation of teachers teaching to VII class were sought. Students were also made aware about the objectives of collecting the data and their doubts were removed. They were made comfortable by telling that the results of study will be kept confidential and will be used only for research purpose. All the tools namely – Test of Creative Thinking in Mathematics, Group
Test of General Mental Ability, Creative Activities Check List, Achievement Test in Mathematics, Socio-Economic Status Scale, Home Environment Inventory and Institutional Environment Scale were administered one after the other with some break. Data was completed in 2 sittings.

As 16 students did not respond to all the tests and 2 more students were deleted to make the sample size equal to 540. Thus final study and analysis of data was done on a sample of 540 children.

4.7 STATISTICAL TECHNIQUES USED.

1. The technique of coefficient of correlation was employed to study the degree of association of intellective and non-intellective variables with mathematical creativity.

2. To find the difference in the mathematical creativity due to sex – difference, rural, urban and tribal differences and also differences due to type of schools, the technique of mean, SD and t-ratio was employed.