Statement of the Problem, Methodology and Procedure
STATEMENT OF THE PROBLEM, METHODOLOGY AND PROCEDURE

1. Statement of the Problem:

With the adoption of the national policy on education (1986), it is mandatory for the government to promote education of the disabled to fulfill long-cherished objectives of "universalization of primary education". The policy recognizes that non-enrolment and drop-out of special groups of children is one of the major difficulties in the realization of this goal. One of the special groups, which has received inadequate attention so far, is that of disabled children.

1.1 National Policy on Education:

Outlining the steps for ensuring equal educational opportunities for the disabled, the national policy on education (1986) states that the objective should be to integrate disabled children with the general community as equal partners, to prepare them for normal growth and to enable them to face life with courage and confidence. Similarly, it also envisages promotion of special education for children with multiple disabilities wherever integrated education in not possible. In other words, the national policy envisages promotion of residential as well as integrated education (NCERT).

1.2 Draft Legislation:

The draft legislation for the handicapped (1988) also proposes that the policy of the government should be to promote integration through "integrated education programmes". At the same time, it also proposes setting up of special schools through government and voluntary sector for those in need of special education, in such manner that handicapped children living in any part of the country should have access to such schools. The draft legislation thus emphasizes integrated education and proposes that special education should also be continued (Barul Islam Committee on Legislation, 1989).

1.3 Prevalence of Different Modes of Education:

At present, three modes of education viz. itinerant mode of integrated education, semi-integrated education and residential schools are prevalent in Gujarat.

1.3.1 Integrated Education (Itinerant Mode): It aims at educating blind children along with the sighted in a nearby regular school with the only difference that for every eight integrated students, services of an itinerant teacher who travels from home to home and from school to school to extend support services to blind children are provided.

1.3.2 Semi-integrated Education: It refers to the mode of education under which a blind child stays in a special hostel for the blind and attends a regular school nearby where services of a resource teacher and facilities of a resource room are available.

1.3.3 Residential Schools: The term "residential schools" refers to provision of special education exclusively to blind children with free boarding and lodging facilities. The schools are run in complete isolation and as a charitable activity.

The first residential school in Gujarat was established during the year 1900 at Ahmedabad; semi-
integrated education was introduced at Palanpur during 1964; and itinerant mode of integrated education was adopted recently at Visnagar during 1981.

1.4 Performance of Different Modes:

The three modes of education, with all the merits and demerits, as explained below, have not delivered the desired results in terms of qualitative as well as quantitative coverage of visually impaired children.

1.4.1 Integrated Education: While the central scheme of integrated education (Annexure 10) is completely sponsored by the central government, very few state governments have adopted and implemented the same so far. As compared to other categories of disability, coverage of visually impaired children under this mode of education is minimal, as the major coverage, due to the convenience factor, is that of locomotor handicapped children. As a very few regular educational institutions in the country have adopted semi-integrated education, the coverage of visually impaired children under this mode of education is also very meagre.

1.4.1.1 Coverage of Single Category: Integrated education has emerged as a single category programme, in other words, a particular implementing agency in a designated project area covers only single category and not all categories of disabled children. Whereas the Ministry of Human Resource Development and the National Council for Educational Research and Training desire coverage of all categories of disability. The lack of availability of adequate training facilities for the special teachers is limiting factor in this respect.

1.4.1.2 Salamanca Declaration: Because of these impediments, the National Council for Educational Research and Training has already started advocating the concept of "Inclusive School". The challenge confronting the inclusive school is that of developing a child-centred pedagogy capable of successfully educating all children, including those who have serious disadvantages. This concept has already been evolved and adopted recently at international level as "Salamanca Declaration - 1994". The declaration highlights that merit of such schools is not only that they are capable of providing quality education to all children; their establishment is a crucial step in helping to change discriminatory attitudes, in creating welcoming communities and in developing an inclusive society.

1.4.1.3 Lack of Systematic Evaluation: Thus integrated education which is still at the stage of infancy is facing the rough weather. It is pertinent to mention that these statements regarding 'failure of integrated education' as well as need for promoting 'inclusive school' are based more on academic considerations and emotional outbursts rather than systematic performance evaluation of any particular mode of education.

1.4.2 Semi-integrated Education: This mode of education is most prevalent in the states where the system of regular boarding schools is popular. In Gujarat, semi-integrated education has very limited acceptance as such centres tend to be as expansive as residential education. In fact, this is the least popular mode of education in Gujarat.

1.4.2.1 Tend to be Residential Schools: According to Stein (1993), as the demand for semi-integrated education programmes increases, these tend to be residential schools. The objective of integration is defeated in the long run as visually impaired children tend to cluster around in their own little isolated groups.

1.4.2.2 Higher Cost: Moreover, the advantage of low initial investment, cost effectiveness, active community involvement and complete integration which are the principal objectives of integrated education are not fulfilled in this mode of education. Stein (1993) feels that for a country like India...
which has a resource constraint and a large number of visually impaired children, this mode of education is not practicable.

1.4.3 Residential Education: The education facilities of the residential schools which are meagre at present are not being utilized to the fullest extent. The capacity utilization at present in Gujarat is less than 60 per cent (Thaker, 1984). Most schools are facing consistent decline in admissions and a number of schools have already curtailed number of seats as well as number of classes due to this reason. The government of Gujarat has recently decided not to provide grant-in-aid to any new special school for the disabled.

1.5 Summary:

All the modes of education are collectively covering only 8 per cent (6 % under residential education and 2 % under integrated education) (Advani, 1992) visually impaired children of school-age. Remaining 92 per cent of them have no hope of receiving any form of education. As most of educated visually impaired persons are not able to pursue suitable professional careers, and generally end up carrying out traditional activities, it is desirable to evaluate quality of education imparted under different modes of education.

The objective of the research study is to investigate and to conduct a systematic comparative and evaluative study on establishing extent of effectiveness of different modes of education of the visually impaired and to establish as to which mode is more desirable for Gujarat in particular and country in general.

2. Objectives of Evaluation:

The study attempts to evaluate the existing three modes of education in terms of their cost effectiveness, socio-psychological implications, concept development, effectiveness in respect of individual performance, speed and accuracy of braille, extent of social maturity and their social relevance.

The focus of the research study is to establish the need for promoting education of the visually impaired, its contribution to economic growth, its economic gains, its effect on the quality of life, the rate of return from investment in special education. It also examines the concepts of cost effectiveness, human resource development, human capital, incremental earnings, equity & social justice and alternative approaches of measuring economic gains in general and their relevance and applicability to education of the visually impaired in particular. These indicators would help to establish the need and significance of promoting various modes of their education.

The study also attempts to investigate in-built merits and limitations of each mode of education. It also attempts to establish comparative effectiveness of different modes in respect of level of social integration, extent of social maturity, and nature of concept development of the beneficiaries. Based on the findings, it attempts to propose the appropriate modifications in the existing approach to education of visually impaired children.

3. Chapter Scheme:

3.1 The introductory chapter is devoted to explanation of the procedure and methodology of the research study. It enlist various statistical tools, procedure of compilation of statistical information, various performance evaluation tests and methods of analysis of data.
3.2 The first chapter is devoted to review of literature on residential as well as Integrated education. It explains different modes of education and combinations thereof. It highlights merits as well as demerits of different modes as advocated by researchers across the world. It also enlists salient features of each mode of education.

3.3 The second chapter analyses integrated education in Gujarat through a structured questionnaire administered to the organizers of such education. It focuses on growth pattern, effectiveness, quality of staff, availability of infrastructure facilities, cost effectiveness and administrative pattern etc.

3.4 The third chapter is devoted to residential education in Gujarat. It covers growth pattern, general effectiveness, cost of education, quality of services, administrative support, and grant-in-aid pattern of residential schools.

3.5 The fourth chapter presents views of leading educators of the visually impaired across the country in respect of relevance, effectiveness, desirability, performance and growth pattern of different modes of education. It also evaluates historical statements of world leaders in the field pertaining to merits and demerits of different modes of education.

3.6 The fifth chapter is devoted to review of the literature on management perspective of the education of the visually impaired. It analyses contribution of such education to economic growth, its economic gains, its effect on the quality of life, the rate of return from investment in special education. It also examines the concepts of cost effectiveness, human resource development, human capital, incremental earnings, equity & social justice.

3.7 The sixth chapter is devoted to primary research on comparative evaluation of the effectiveness of various modes of education of visually impaired children. The focus of the chapter is comparing the extent of social integration, level of participation in activities, speed and accuracy of braille, social maturity and extent of concept development of the target group enrolled under different modes of education.

3.8 The concluding chapter is devoted to presentation of summary of analysis of research and findings of the study. It also enlists contributions of the study and points out limitations, proposes areas for further investigation and research pertaining to effectiveness of different modes of education.

4. Methodology and Procedure

As all the three modes of special education viz. integrated education, semi-integrated education and residential education are prevalent in Gujarat, it was possible to compile the required statistical information by confining the research study to Gujarat itself.

4.1 Secondary Source: Review of Literature:

The review of literature on education of the visually impaired (Chapter I) as well as management perspective of such education (Chapter V) has been carried out using published material on the subject. As it was merely a review of literature, no primary research in this respect has been carried out. However, a most exhaustive list of publications on the subject has been compiled.

4.1.1 Education: The almost all the relevant publications available around the world have been acquired. Similarly, copies of relevant articles, thesis, brochures, research papers and seminar papers
published after 1950 have also been compiled. In-depth analysis and review of the available literature has been carried out to present a summary of the views, findings, thoughts and observations of the educators as well as researchers in the field of education of the visually impaired in chapter I.

4.1.2 Management Perspective: Similarly, an extensive review of literature pertaining to management aspects of education of the visually impaired, particularly in respect of contribution of such education to economic growth, its economic gains, its effect on the quality of life, the rate of return from investment in special education has been carried out. It also examines the concepts of cost effectiveness, human resource development, human capital, incremental earnings, equity and social justice.

Based on views of researchers, educators and management experts, a summary of review of literature on management perspective of special education has been presented in chapter V.

4.2 Questionnaire Based Research:

The principal objective of the research study is to conduct comparative evaluation of the effectiveness of various modes of education of visually impaired children. For doing that, it is, however, essential to understand the existing pattern of such education in Gujarat. Similarly, it is also desirable to seek responses of the leading educators to identify merits, demerits and salient features of different modes of special education.

The questionnaire based research has been carried in respect of following three areas:

a. Review and evaluation of integrated education in Gujarat (Chapter II)

b. Review and evaluation of residential education in Gujarat (Chapter III), and

c. Views of leading educators of the visually impaired in terms of relevance, effectiveness, desirability, performance and growth pattern of different modes of education (Chapter IV).

4.2.1 Integrated Education in Gujarat: The research study focuses at growth pattern, effectiveness, quality of staff, availability of infrastructure facilities, cost effectiveness and administrative pattern of integrated education in Gujarat. The questionnaire II entitled "study of integrated education projects for the blind in Gujarat" was mailed to 13 organizers of integrated education in Gujarat (Annexure 2). All of them responded and returned the completed questionnaire.

4.2.1.1 Questionnaire: The questionnaire II included 25 questions, mostly multiple choice type. It sought information about general details of the project (questions 1 to 4), nature of coverage (questions 5 & 6), sources and structure of grant (questions 9 & 10), expenditure pattern (question 11), extent of availability of facilities and equipment (question 12 to 20), number and qualification of staff (questions 21 to 25).

4.2.1.2 Compilation of Information: Information regarding extent of grant-in-aid released to the organizers of integrated education (Annexure 2) has been collected from the state department of education (Table 2.6). Similarly, details regarding the number of visually impaired students enrolled under integrated education in Gujarat (Annexure 4) have been collected from the secondary sources of information like progress reports of the projects and other such publications.
4.2.2 Residential Education in Gujarat: The research study focuses at growth pattern, general effectiveness, cost of education, extent of availability of infrastructure facilities, cost effectiveness and administrative pattern of residential education in Gujarat. The questionnaire entitled ‘study of special schools for the blind in Gujarat’ was mailed to 21 residential schools for the visually impaired in Gujarat. However, 17 persons responded (Annexure 1) and returned the completed questionnaire.

4.2.2.1 Questionnaire: The questionnaire included 25 questions, mostly multiple choice type. It desired information about general details of residential schools (questions 1 to 4), target group (questions 5-8), strength of staff (question 9), sources and structure of grant (questions 9 & 10), extent of availability of facilities and equipment (question 11 to 19), number and education level of staff (questions 21 to 25).

4.2.2.2 Compilation of Information: Information regarding extent of grant-in-aid sanctioned and released (Annexure 5) has been collected from the state department of social defense and the financial statements of the respective schools.

4.2.2.3 Analysis of Data: The data compiled through questionnaires I and II and secondary sources of information has been analyzed using a specially developed computer software. The statistical tools of frequency tables, arithmetic mean, standard deviation and percentage analysis have been used.

For analyzing the data systematically, 17 tables and 2 graphs in case of integrated education; and 19 tables and 6 graphs in case of residential education have been prepared. The tables mostly pertain to demographic details, level of integration, grant pattern, expenditure pattern, extent of availability of facilities and equipment, types and sources of braille and recorded books and level of qualification of teachers. The graphs mostly illustrate pattern of growth in respect of enrolment of students, extent of grant-in-aid and number of teachers etc.

As it is a descriptive study aimed at subjective evaluation of a particular mode of education, no hypotheses has been evolved and tested. Similarly, no test of significance or analysis of variance has been carried out in respect of integrated as well as residential education.

4.2.3 Views of Leading Educators: Inter Mode Comparison: While reviewing the published material on education of the visually impaired (Chapter I), it was realized that plenty of relevant research studies conducted and published abroad, particularly in the U.S.A. and U.K. are available. However, only a few studies on education of the visually impaired in India have been conducted and published so far.

4.2.3.1 Need for Such Evaluation: There are a number of educators of the visually impaired in the country (Annexure 3) who have devoted their life-time in initiation, promotion, implementation and administration of a variety of modes of education of the visually impaired. Most of these experienced voluntary workers as well as professional educators do not have any publications to their credit. Hence it is not possible to compile their views from the secondary sources of information. It is desirable to seek their responses to evaluate effectiveness of various modes of special education.

4.2.3.2 Explanation of the Questionnaire: The Questionnaire No. III entitled ‘inter-model comparison of in-built merits and demerits of various modes of education of the visually impaired’ was circulated among 28 leading educators of the visually impaired in the country (Annexure 3). The principal objective was seeking responses of the educators pertaining to various aspects of education of the visually impaired.

1. General Information: The first 9 questions sought general information from the respondents regarding the extent of prevalence as well as incidence of visual impairment, knowledge about existence and salient features of different modes of education. Information was also sought about the number of
residential schools, extent of enrolment under different modes of education, and the estimated population of the visually impaired in the country.

ii. Specific Evaluation: The question No. 10 which is the subject matter of this study, desired the respondents to evaluate 64 statements pertaining to merits as well as demerits of various modes of education. These statements have been selected from the published literature on special education. Last ten statements advocated middle path approach to the promotion of such education.

4.2.3.3 Focus of Statements: These statements generally pertain to the following major areas:

1. Cost of programme
2. Level of social integration
3. Level of acceptance
4. Quality of education
5. Extent of availability of facilities
6. Extent of coverage of the target group
7. Level of employment orientation
8. Performance of children

The odd number statements generally favour the residential system whereas the even number statements favour integrated education. Thus the statements are listed in a pattern of one statement supporting residential education followed by the one supporting integrated education.

The last 12 statements support a middle path approach or complementary roles of both modes of education. These statements focus on the child and his needs irrespective of the system of education.

4.2.3.4 Selection of Respondents: Based on the published material, participation in the national as well international conferences on education of the visually impaired, publication of papers, professional training, experience and extent of involvement in promotion of such education, 25 leading educators of the visually impaired have been identified. The Questionnaire III was mailed to them with a request to duly complete and return the same within one month.

Within 6 months of the first mailing of the questionnaire, 21 persons returned the duly completed questionnaire. The list of these respondents is given in Annexure No. 2. The responses of two of them have not been considered for the purpose of evaluation of statements. Thus the statistical analysis in this respect is based on responses of 19 leading educators of the visually impaired.

4.2.3.5 Barometer Statements: To test the sincerity and seriousness of the respondents, three ‘barometer’ statements which are in complete contrast to earlier similar statements had been included in the questionnaire. Based on responses to these ‘barometer’ statements and general pattern of responses, seriousness of the respondents has been established. Based on this test, responses of 2 respondents have been rejected from this analysis. It has been established that these respondents have evaluated the statements either without paying adequate attention or without understanding the same.

4.2.3.6 Evaluation Scale: For the purpose of uniform evaluation, Likert 5 Point Evaluation Scale has been selected. The respondents were required to rate every statement using the following 5 point scale.

5 stands for 'strongly agree'
4 stands for 'agree'
3 stands for 'indifferent'
2 stands for 'disagree'
1 stands for 'strongly disagree'

The respondents were desired to tick mark only one of the five options provided for each statement.

4.2.3.7 Statistical Tools: As five point scale has been used for rating various statements, the statistical tools of arithmetic mean, standard deviation, mode and chi-square test have been used for the identification of the most preferred variables and the order of preference of such variables.

For convenience, 'SYSTAT' programme of computerized statistical analysis has been used. The mean, standard deviation tables (Annexure 9B), frequency tables (Annexure 9C), Pearson correlation matrix (Annexure 9D) and factor loading plots have been drawn for 64 variables and 19 cases.

i. Normative Analysis: For establishing the level of preference, merits as well as demerits of different modes of education, normative analysis has been done. The analysis of responses to first 9 questions, which pertains to general information, has been done on the basis of aggregate score, mean score and frequency of responses.

ii. Null Hypotheses: For testing divergence of observed results from those expected on hypotheses of equal probability, analysis of variance has been done. For this purpose, evaluation score of every statement has been subjected to testing of null hypotheses: 'there is no evidence of either strongly favourable or unfavourable attitude toward the proposition'. The chi-square value for each statement based on the standard formula of summation of square of differences between the observed and expected values divided by the expected value has been carried out.

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\text{Chi-square} = \frac{(O - E)^2}{E}
\]

The test of significance has been carried out at 0.05 level of significance and at 2 to 5 degree of freedom depending upon number of levels evaluated in case of each variable.

iii. Pearson Coefficient of Correlation: For establishing extent of correlation between different variables, the coefficient of correlation has been extensively used. It has been used for establishing the extent of correlation between compartmentalization of education on the basis of extent of residual vision or the level at which integration should be initiated; correlation between individual needs of a child or administrative convenience; correlation between integrated education as a "matter of compulsion" or a "matter of necessity" and "only hope for blind children in developing countries"; and correlation between the variables "special education is costly" and "integrated education costs lower".

Using Systat software, the Pearson coefficient of correlation matrix for all the variables has been listed (Annexure 9D). For the purpose of this research study, the coefficient of correlation has been used only for one or few selected variables. The Matrix could be further analyzed for deriving further results in respect of correlation between different variables.

4.2.3.8 Exclusion of Statements: Based of testing the divergence of observed results from those expected on hypotheses of equal probability (null hypotheses), all those statements in which the null hypotheses has been retained have been listed in Table 4.13. In this case the null hypothesis is that there is no evidence of either strongly favourable or a strongly unfavourable attitude toward the proposition. The retention of the null hypotheses signifies that the statement is neither
such statements do not reflect any definite sentiments of the respondents. Thus 14 statements have been excluded from the further analysis.

4.2.3.9 Statistical Analysis of Variables: The remaining 50 variables for which the null hypotheses has not been retained, signifying either a strongly favourable or a strongly unfavourable attitude toward the proposition, have been selected for further statistical analysis.

1. Most Preferred Variables: Based on the statistical output of frequency tables, mean and standard deviation, the remaining 50 variables (statements) have been arranged in the declining order of the arithmetical mean (Table 4.14). All the 14 statements which have mean between 4 to 5 (agree to strongly agree categories) with standard deviation of less than 1.000 and mode of 4 to 5 have been considered as the most preferred variables.

ii. Least Preferred Variables: Similarly all the statements which have been assigned arithmetic mean of less than 2.50 and mode of 1 or 2, have been considered the least preferred variables. In other words, the leading educators have rejected these statements outrightly.

The findings of the research study in respect of views of leading educators pertaining to performance of different modes of education of the visually impaired are based upon statistical analysis of the rating of the remaining 50 variables by 19 leading educators.

5. Procedure: Primary Research Study:

The analytical, descriptive and non-experimental primary research on effectiveness of various modes of education has been carried out by administering a pre-designed and pre-tested questionnaire personally to 130 blind children.

5.1 Need for Evaluation:

The responses of organizers, administrators and educators are generally based on their individual perceptions, personal experiences and official compulsions. As the principal objective of any educational programme is preparing children for life, the evaluation of comparative performance of the children themselves would provide valuable evidence regarding effectiveness and limitations of various modes of education.

5.2 Parameters for Evaluation:

Based on review of literature, primary research on different modes of education and responses of leading educators, the following five parameters have been identified:

1. Coverage of special groups
2. Level of social integration
3. Achievement in braille reading
4. Level of social maturity
5. Level of concept development
5.2.1 Exclusion of Academic Performance: As evaluation of academic performance in various subjects upto 5th standard is generally subjective and based on oral examination, such performance in the internal as well as terminal examinations has been completely excluded from the purview of the study. The other factors which support exclusion of academic performance of this research study are listed below:

a. It is difficult to avail performance records of each child as most of schools follow the system of oral evaluation and mass promotion of all the children at the primary level.

b. As Mani's Test of Concept Development already covers a variety of knowledge based concepts viz. body awareness, time and distance awareness and skill development concepts, the study covers academic performance indirectly.

c. The BMA Adapted Tooze Braille Speed Test establishes effectiveness of different modes of education as regard performance of children which in turn reflects the quality of education.

5.2.2 Coverage of Special Categories: The study intends to compare effectiveness of different modes in respect of coverage of special groups viz. (a) blind girls, (b) younger blind children, (c) congenital blind, and (d) children from the lower castes. The performance of a particular mode in this respect would reflect upon its overall effectiveness.

5.2.3 Tools for Establishing the Extent of Social Integration: It has been observed from the review of literature that the following parameters of sociometric analysis would be appropriate for establishing the level of social integration:

5.2.3.1 Friends:

a. Total number of friends
b. Location of friends
c. Type of friends

A comparative study of total number of friends and number of the blind and the sighted friends is an effective sociometric device that establishes the role of a mode of education in fostering friendship which in turn measures extent of social integration. To avoid this diverse situation, all the friends irrespective of location have been considered as a subject of the research study.

5.2.3.2 Activities

a. Nature of activities
   i. Active activities
   ii. Passive activities

b. Level of activities

Thus a comparative study in respect of the extent of active as well as passive activities which a child performs would be an appropriate and effective sociometric device for the measurement of the extent of social integration which in turn would establish comparative effectiveness of different modes of education in this respect.

To remove the anomaly between the restrictive environment of a residential school and the wide open...
environment of an integrated programme, all the passive as well as active activities which a child performs in the school, hostel and home have been included in the study. The child is given the option to list at least five passive as well active activities he generally performs regularly in any situation.

5.2.3.3 **Summary:** The extent of social integration would be established from the number as well as type of friends - blind or sighted; and the number of activities as well as nature of activities - active or passive. A comparison of the number as well as type of friends and the number as well as nature of activities would indicate effectiveness of the respective mode of education in respect of promoting social integration of the pupils.

5.2.4 **Achievement in Braille Reading:** Braille reading is still the most widely used means of reading and writing for severely visually impaired and functionally blind individuals (Heinze, 1986). Braille represents to a blind child what print represents to a seeing child (Lowenfeld). It is thus essential for a blind child to acquire good reading and writing abilities in braille during the initial years at school. It has been established that by the time a child reaches the 4th standard, he should develop fairly effective reading and writing abilities in braille.

5.2.4.1 **Components of Braille Reading:** According to Lowenfeld, comprehension and rate of reading are the two components which make up what could be termed reading efficiency. An effective reader is, therefore, one who reads with good comprehension and at a good speed.

5.2.4.2 **Braille Reading Tests:** After referring to all the leading libraries on the subject and the available published material, the instructional manuals and test batteries on various tests, the following braille comprehension and reading tests could be compiled:

a. Stanford Achievement Tests - Reading Comprehension
b. Sequential Tests of Educational Progress - Reading
c. The Lorimer Braille Recognition Test
d. Tooze Braille Speed Test

The review of literature, in-depth analysis of various braille tests establishes that the Tooze Braille speed test (Annexure 11) is the most relevant and appropriate test for carrying out a comparative study of the performance of blind children in respect of the speed of braille reading as well as basic perceptual activities.

5.2.4.3 **Adaptation of the Tooze Braille Test:** As mentioned earlier, the target group knows Gujarati braille only. As Tooze test (Annexure 11) is a word-test based on reading of a number of words in one minute, it was essential to identify appropriate three-character Gujarati words.

The research committee constituted by the researcher for this purpose devoted about six months in adapting the test. The following guiding principles were considered while selecting the words.

*The words should be:*

i. three-letter words only;
ii. prevalent and popular in the target area;
iii. from the text books of 1st to 5th standard;
iv. without the use of braille contractions;
v. as far as possible, Gujarati translation of the words used in the original test provided these four criteria are fulfilled;
vii. based on Gujarati system of braille which is most prevalent in the area;
5.2.4.4 Pre-Testing: The research committee selected 6 students who fulfilled all the criteria of selection as envisaged under the research study. The adapted test was administered in the manner explained in the original Tooze test. The speed of braille was evaluated by recording the number of words read correctly per minute and the time taken for reading 120 words. Responses of these students were also sought regarding popularity of these words and ease in reading the same.

The members of the research committee actively participated in conducting the preliminary trials and provided inputs for improving the adapted test. The committee also decided that the adapted test should be referred to as BMA adapted Tooze braille speed test (Gujarati Version) (Questionnaire IV).

5.2.4.5 Administration of the Braille Test:

a. Explanation of the Test: Each child is administered the test individually using a stop watch. The child is provided the braille sheet and explained the purpose of carrying out the test. He is explained that he should read the three-letter braille words loud and correctly from left to right at the highest possible speed.

b. Marking of Sheet: The person administering the test tick marks the words read correctly and deletes any words read incorrectly or omitted by the child. The number of words read per minute are recorded on a standard scoring sheet (Questionnaire IV). Similarly, time taken to read all the 120 words in braille sheet is also recorded.

The child is encouraged to repeat the test in the same manner at least three times. The words read correctly per minute as well as the time taken to read the complete sheet are recorded on the scoring sheet using different colour pencils. Every child is given a new braille sheet to maintain uniformity in the quality of braille dots. Similarly a new scoring sheet is used for each child.

5.2.4.6 Categorization of Performance:

I. Four General Categories:

a. No Braille: If a child does not even know as how to hold the braille sheet; can not identify even the first character which is 'dot 1 in braille and which stands for A'; and can not complete identification of three characters of the first word 'Achal', he is designated as "not knowing braille or no braille".

b. Poor Braille: In case a child can identify the letter but can not read the words properly, he is given three minutes, the optimum time for reading the whole sheet of 120 words, to read the first ten words. All those children who read the letters correctly but read, on an average, less than 10 words in the allocated time have been designated as children with "poor braille".

c. Moderate Braille: All those children who read between 10 to 40 words correctly in the allocated time have been designated in the "Moderate braille" category.

d. Excellent Braille: All those children who read more than 40 words correctly in the allocated time have been designated in the "Excellent braille" category.

II. Two Broad Categories: All other children who read first 10 words properly, the number of words read in three minutes and the time taken to read the whole test sheet are recorded. The performance of these children is evaluated on the basis of number of words read in three minutes. The statistical
information regarding time taken to read the whole test sheet is used for cross-checking the speed of braille reading i.e. number of words read in three minutes. This group of children have been included under two categories:

a. Deficient in Braille: Number of words read per minute less than 10.
b. Proficient in Braille: Number of words read per minute more than 10.

5.2.5 Test of Social Maturity: The *Vineland social maturity scale* (Indian adaptation) has been identified as the most appropriate instrument for comparing the extent of social maturity of blind children enrolled under different modes of education.

5.2.5.1 *Vineland Social Maturity Scale*: It measures the differential social capacities. It provides an estimate of social age and social quotient and shows high correlation (0.80) with Intelligence (A. J. Malin). The scale can be used for the age group of 0 - 15 years.

5.2.5.2 *The Indian Adaptation*: The Indian adaptation by Dr. A. J. Malin (Annexure 12) is very popular in the country and is being used extensively for measuring extent of social maturity of the target group.

5.2.5.3 *Gujarati Version*: As mentioned earlier, the target group of the research study knows Gujarati language only. It was essential to translate the test items verbatim into Gujarati. The underlying principle, however, was that the Gujarati translation should convey exactly the same meaning as the original statements.

5.2.5.4 Adaptation of the Scale: The original scale and its Indian adaptations are meant for evaluating social maturity of the sighted children. The scale is said to provide a "means of evaluating the influence and effects of such handicaps as ... blindness" (Doll, 1947). Thus certain test items which are based on visual perceptions or are vision based activities i.e. "uses pencil or chalk", "enjoys reading newspaper" were required to be modified accordingly.

The range of age of the target group of the research study is 10 - 13 years. It was considered appropriate to administer the test items bearing serial numbers 51 to 84 which indicate maturity levels from 4-5 years to 11-12 years (Questionnaire IV).

5.2.5.5 Administration: The respondents were asked to answer questions based on test items. Responses of itinerant teachers as well as class teachers were also sought to establish the extent of independence of the child in respect of a particular activity. Whenever it was difficult to establish the level of performance of a particular activity, certain relevant probing questions were asked to establish the extent of performance. The explanations of various items as provided in the VSMS manual (Annexure 12) have also been considered while explaining the same to the children.

5.2.5.6 Recording: The same system of recording as recommended in the manual (Annexure 12) has been followed. A separate recording sheet was used for each child (Questionnaire IV). If a child was able to perform the item correctly, he was accorded 1 credit; if failed completely, 0 credit; and if it could be presumed that the child could have passed the item if the opportunity was present, 1/2 credit was given. The half credits were converted into full credits if they lay between two passed credits.

5.2.6 Level of Concept Development: The *Mani's test of concept development* is the most appropriate assessment tool for assessment of conceptual understanding and concept development. It has been recently developed specially for blind children in the age groups of 6-8 years and 13-13 years. The test battery has been translated into Gujarati following the underlying principle that the translation must not alter the meaning conveyed by the original concepts.
5.2.6.1 **Reliability:** As Mani (1991) has already provided the test items and manual in Tamil language, it was easier to translate the test items into Gujarati. Mani (1991) has used the terms which are commonly used all over the country. Hence all the test items could be easily translated into any regional language without any adaptation or modification of the terms. Hence the level of reliability and validity would not be altered as the test items and the procedure of administration of the test remain the same.

5.2.6.2 **Gujarati Adaptation:** The services of the research committee constituted for adaptation of braille test have also been availed for evolving the Gujarati version of the test. As majority of the test items were merely listing of body parts, simple skills, activities and words pertaining to environment, it was quite convenient to translate the same verbatim into Gujarati. Difficulty was, however, encountered in case of component 2 on awareness of objects; component 3 on time and distance awareness; and component 4 on spatial awareness, as these test items were narrative and in the interrogative form. Efforts have been made by the expert team to translate the test items in such a way that the basic meaning of the concept was not altered (Questionnaire IV).

5.2.6.3 **Pre-testing:** The first draft of the Gujarati version of the test was administered to selected 10 blind students who resembled the target group in age, mode and grade levels of education. Based on pre-test, various difficulties faced by the researchers and the respondents were identified and the test items were modified accordingly. The underlying principle followed, however, was that the translation of the test items must not alter the meaning conveyed by the original concept.

5.2.6.4 **Administration:** All the techniques as suggested by Mani (1991) viz. open ended questions, fill in blanks, multiple choice questions, use of two dimensional items and three dimensional aids, demonstration of skills for the administration of the test items (Annexure 13) have been used. Similarly, the test material as suggested in the original test has been developed locally and used while administering the test (Questionnaire IV).

5.3 **Subjects:**

5.3.1 **Modes of Education:** The focus of the study is comparative evaluation of the effectiveness of various systems of management of education of the visually impaired. A detailed questionnaire based study of various modes of education, explained in chapters II and III, reveals that only three modes of education viz. integrated, semi-integrated, residential are prevalent in Gujarat.

5.3.2 **Sample Size:** The findings of the questionnaire based primary studies of various modes of education reveal the extent of enrolment of students as per details listed in table 6.5.

After applying other criteria of age, extent of blindness, knowledge of braille, grade level of the pupils, only 5 per cent of the total strength of visually impaired students in Gujarat qualified as the target group. Out of all the 21 residential schools in Gujarat, only 54 blind children could be identified as the target group which is 5.68 per cent of the total strength of children enrolled with such schools (Annexure 6 & 7). Thus coverage of 5 per cent of total enrolment as the target group became the limiting factor.

Based on this limiting factor, 50 pupils from integrated education, 26 from semi-integrated education and 54 from the residential schools have been covered (Annexure 6 & 7). Thus out of total population of 2310, only 130 pupils (5.62 %) have been covered under the study.
5.3.3 Location of Subjects:

5.3.3.1 Exclusion of the Adult Blind: As the study intends to cover visually impaired pupils under the age of 15 years, all the residential schools and other educational programmes admitting students above the age of 12 years at the first entry point have been completely excluded from the purview of the study.

5.3.3.2 Integrated Education - Itinerant Mode: Integrated education so far has been initiated at 10 locations in Gujarat. As the study intends to cover children of 3rd standards and above, hence only such projects which have been in operation for the last at least 4 years have been selected. For the sake of uniformity, only such integrated projects which have been approved under the Central Scheme of Integrated Education have been covered under the study.

5.3.4 Age of the Target Group: The age of the children to be covered under the study would generally depend upon the following factors:

5.3.4.1 Braille Reading Skills: The adapted BMA Tooze braille speed test, Gujarati version (Questionnaire IV) is suitable for children at the primary level of education and between 7 to 13 years of age (Annexure 11). In-depth study of the primary graders in Gujarat reveals that most of children acquire adequate capacity of reading three-letter words after the third standard only. The average age of a fourth grade child is 9-10 years. Hence it became essential to cover the children in the age group of 10-13 years for the effective administration of the braille speed test.

5.3.4.2 Vineland Social Maturity Scale: As per the instruction manual, this scale can be used for the age groups of 0-15 years. Hence there is no limitation in respect of lower range of age. Thus administration of VSMS to the children of 10-13 years of age is within the prescribed age limits.

5.3.4.3 Mani's Test of Concept Development: Mani (1991) has developed a test battery for assessing the concept development for age groups 6-8 years and 9-11 years (Annexure 13). The test battery for the age group of 9-11 years is appropriate in the respect of age group of 10-13 years as required under other tests.

5.3.4.4 Social Integration: As use of these instruments for establishing the extent of social integration would require adequate understanding of these aspects among the target group, covering of 4th, 5th and 6th graders would be appropriate in this respect as well.

5.3.4.5 Limitation of Population Size: The total population of the research study is limited to 2310 only. The statistical analysis reveals that identifying the desired number of 120 pupils of same age and in any one grade is difficult. It also establishes that pupils of at least three grades would be required to be covered for the sake of coverage of at least 5 per cent of the total population in each mode of education.

5.3.4.6 Summary: Thus it is not possible to identify the desired number of pupils of the same age. It is essential to cover children in the range of age at least three years for the purpose of identifying an appropriate number of children studying under different modes of education. In view of the grade level and other requirements of the study, the age range of 10-13 years is suitable.

Considering the requirement of coverage of age group of 10-13 years for the sake of various tests and coverage of children of 4th grade onward for the sake of administration of braille speed test: and level of social maturity, it is desirable to cover children of 4th, 5th and 6th grades and of the age groups of 10, 11 and 12 years.
5.3.5 Knowledge of Braille: Every blind child is expected to acquire adequate skills of braille reading and writing during first three grades. In fact, knowledge and understanding of braille is essential for further academic progress of a child.

As administration of adapted BMA Tooze braille speed test - Gujarati version (Questionnaire IV) is one of the most important tools of comparing effectiveness of different modes of education, it is essential that the respondents must have acquired adequate skills of reading and understanding braille.

5.3.6 Consistency in Respect of Mode of Education: The primary focus of the research study is to compare effectiveness of various modes of education. If any child has availed education under different modes of education, he is expected to acquire skills specific to those modes. Thus coverage of such children in the research study would provide responses which are not specific to any particular mode of education. It is thus essential that a child covered under the study must have studied all through his educational career under the same mode of education and preferably at the same location.

Thus only such children who had studied under the same mode of education all through have been covered under the study. Such children who acquired blindness at later age while studying as seeing children and shifted to residential schools after acquiring blindness have not been covered under the study. Similarly such children who shifted from one mode to another mode of education have also been excluded from the purview of the study.

5.3.7 Extent of Blindness:

5.3.7.1 Definition: The definition of blindness as evolved and adopted by the appropriate authority in the country considers any person with residual vision of less than 20/200 (Snellen) or 6/60 in the better eye after all corrections and visual acuity of less than 20 degree as a visually impaired person (Ministry of Welfare, 1986).

5.3.7.2 Advantages of Functional Vision: If all the pupils who have been certified by the competent authority as “blind” as per this definition, are covered, the whole study will be distorted. The children between visual range of 5/200 to 20/200, categorized as Low-vision children, are able to generally read large print. They generally do not learn braille as they can sight-read braille. Due to adequate functional vision, they are able to understand the environment better and thus have better orientation of the things around. The level of conceptual understanding is bound to be better as compared to that of totally blind children.

5.3.7.3 Criteria for Rejection: It is thus essential to cover only totally blind pupils or those having light perception only. For the sake of uniformity, all those children who have functional vision and who could identify colours, read large print, count fingers or sight-read braille have been excluded from the purview of the study. Even such children who had adequate functional vision at the time of school admission which has since deteriorated have been excluded from the study.

Similarly children who acquired blindness during the preparatory classes and continued with their education subsequently have also been excluded from the study. Thus only such children who are either congenitally blind or acquired blindness at the age of less than 1 year have been covered under the study. All the children who acquired blindness subsequently and had thus developed visual images and vision-based concepts have been excluded from the study.
5.3.8 Summary: Criteria for Selection of Subjects: Based on discussion in the paragraphs 5.3.1 to 5.3.7, it may be concluded that only such children who fulfill the following criteria have been covered under the study:

The child should:

1. be congenitally blind or should have acquired blindness before one year of age;
2. be totally (stone) blind or should have light perception only;
3. must be 10 to 15 years of age on the date of administration of the questionnaire;
4. be studying in 4th, 5th or 6th standard under any mode of education on the date of administration of the questionnaire;
5. have acquired adequate skills of reading at least three-character Gujarati braille;
6. have studied preferably throughout under the same mode of education.

Only such children who fulfill all the six criteria have been covered under the research study.

5.4 Administration of Questionnaire:

5.4.1 Selection of Respondents: A proforma was mailed to all the residential schools, integrated education programmes and semi-integrated education centres in Gujarat for seeking relevant information about visually impaired pupils. The proforma sought information on age, extent of blindness, grade level, age at which acquired blindness, number of years the child has been with the programme, knowledge of braille, and mode of education.

All those blind pupils who fulfill all the criteria as listed in paragraph 5.3 were identified. Out of these, the children who are studying in the educational programmes in the north as well as south Gujarat and Saurashtra have been identified. This was done to eliminate any possibilities of any regional disparities. Thus children studying under different modes of education but in the similar geographical locations have been selected.

Based on this selection process, 130 blind pupils from different modes of education as listed below have been identified and covered under the research study (Annexure 6):

5.4.2 Procedure of Administration: The questionnaire IV was administered to the target group during March - April, 1993 and July - September, 1993. The researchers visited the selected projects offices in case of integrated education (Annexure 2), hostels for semi-integrated children and residential schools (Annexure 1). Each identified child was administered the questionnaire individually (Annexure 6). Each child was explained the purpose of the research study and encouraged to give responses to various questions to the best of his capacity.

On an average one hour was needed for administration of all the tests. As mentioned earlier, all the tools were translated into Gujarati. The whole questionnaire except braille test was administered verbally in Gujarati.

5.4.3 Computer Software: For statistical analysis, a standard computer software "SYSTAT" has been used. It has been used for computing mean, mode, standard deviation, and coefficient of correlation; for plotting graphs; and for applying the Tukey's test.
6. Hypotheses:

The research study intends to test the following hypotheses:

Null Hypotheses 1: The three modes of education do not differ significantly in respect of extending equal educational opportunities to:

a. blind girls,
b. younger blind children,
c. congenitally blind children, and
d. children from lower castes.

Hypotheses 2: Integrated education will be more effective than semi-integrated education which in turn will be more effective than residential education in terms of extent and level of social integration which can be measured:

i. in terms of acceptance of blind students among:

a. friends in general
b. sighted fellow students
c. blind friends, and
d. neighbours

ii. in terms of performance of activities:

a. total activities
b. active activities
c. passive activities

Null Hypotheses 3: The three modes of education do not differ significantly in respect of speed and accuracy of braille reading.

Null Hypotheses 4: There is no significant difference between three modes of education in respect of developing independence and social maturity among visually impaired students.

Null Hypotheses 5: There is no significant difference between three modes of education as regard improving conceptual understanding and concept development in respect of following indicators:

a. body awareness
b. object awareness
c. time and distance awareness
d. spatial awareness
e. skill oriented concepts
f. measurement concepts
g. orientation of environment
Methodology & Procedure

7. Analysis of Data:
A variety of statistical tools including analysis of variance, Chi-square test, normative analysis, coefficient of correlation, Tukey’s test, two-tailed test of significance, arithmetic mean, mode, standard deviation, test of median, and F-distribution have been used to establish if there is a statistically significant difference at the 0.01 or 0.05 level among different variables.

Various inferences of the study have been drawn depending upon the results of statistical analysis of available data. In most cases, more than one statistical tests have been used to cross check validity of other tools. The inferences have been drawn on the basis of collective results of all the statistical tests used for a particular hypotheses, variable or parameter of evaluation.

7.1 Statistical Inference About Variances: Chi-square Test:
As research study intends to test 4 null hypotheses and 1 hypotheses, extensive use of analysis of variance has been made for carrying out statistical analysis. The Chi-square test has been used for establishing statistical inference about variances in case of following variables:

1. Three modes of education do not differ significantly in respect of extending equal educational opportunities to blind girls.
2. Three modes of education do not differ significantly in respect of extending equal educational opportunities to younger children.
3. Three modes of education do not differ significantly in respect of extending equal educational opportunities to congenitally blind children.
4. Three modes of education do not differ significantly in respect of family occupation of blind children.
5. Three modes of education do not differ significantly in respect of caste of blind children.
6. Three modes of education do not differ significantly in respect of speed and accuracy of braille.
7. Three modes of education do not differ significantly in respect of extent of concept development.

In this case, all the seven components of Mani’s test on concept development have been subjected to test of significance using Chi-square distribution. The Chi-square values for all the seven components and for all these components collectively have been worked and then subjected to test of significance at 0.01 level of significance. The table value of P at 0.01 level has been compared with actual value of P for deciding whether the null hypotheses of no significant difference between three modes of education stands rejected or retained.

Universal Assumption: While applying the Chi-square test, universal assumption has been made that the target group follows normal distribution in respect of various performance indicators. As almost all the children who fulfilled all the criteria for selection have been covered under the research study, the coverage of target population is cent per cent. Hence it is desirable to expect normal distribution in respect of performance of different activities, demographic details, family background, speed and accuracy level of social integration and level of concept development.

7.2 Normative Analysis:
For various instruments of social integration, suitable null hypotheses could not be framed. Similarly, as it was not possible to apply the chi-square test or any such other test on analysis of variance, normative analysis has been done for drawing various inferences.

7.2.1 Average Number of Friends: For establishing as to which mode of education is more effective in terms of nature friends (blind and sighted) as well as location of friends (neighbor, fellow-student...
or relative), the indicator of “number of friends” has been used. This indicator is superior to just doing percentage analysis of average number of friends of different categories.

7.2.2 Average Number of Activities: In this case also, number of activities per child enrolled under different modes of education has been considered an appropriate indicator of comparative effectiveness. As objective is inter-mode comparison and not that inter-child comparison of performance in this respect, total number of activities performed by all the children studying under a particular mode of education divided by the number of children would yield average number of activities per child.

The comparison of active, passive and total activities per child under each mode of education would provide effective inter-model comparison of performance in this respect.

7.2.3 Performance in Braille Reading: As analysis of variance establishes that there is significant difference between three modes of education in respect of speed and accuracy of braille, normative analysis is desirable to establish as to which mode is comparatively more effective in this respect.

For convenience, the four categories of performance of braille reading have been clubbed into two broad categories viz. (a) proficient braille which includes score of good and moderate braille; and (b) deficient braille which covers score of poor as well as ‘no braille’ (Table 6.19C - page 224). A percentage analysis has been done for establishing comparative effectiveness of a particular mode of education.

7.2.4 Number of Words per Minute: To substantiate the findings of the research study in respect of preceding normative analysis, average number of words per minute in case of each mode of education has been compared to further establish the comparative effectiveness of different modes of education (Table 6.19D). In case, the average number of words per minute has been worked out in case of two categories of children viz. (a) all children, and (b) only those children who know braille. A comparison of absolute figure of number of words read per minute under each mode of education reflects the comparative effectiveness of each mode of education.

7.2.5 Outstanding Braille Readers: To investigate the performance of respondents further in respect of speed and accuracy of braille reading, the first 10 most outstanding braille readers have been identified, on the basis of words read per minute, to examine as to which mode is more effective in this respect. The students who read 79 three-character words in one minute has been listed as the most outstanding braille reader. The other respondents have been listed in the declining order of the number of words read per minute.

The comparison of number of respondents appearing in this list from a respective mode of education would reflect the level of effectiveness of that particular mode of education. The findings from this normative analysis have been used in conjunction with findings of other statistical tools viz. two-tailed F-test of significance and median test in respect of speed and accuracy of braille and not in isolation. The final inferences in respect of this parameter have been drawn on the basis of results of all these statistical tests (paragraph 11.3 page 228).

7.3 Analysis of Variance - Two Tailed Test:

7.3.1 Indicators of Social Integration: It was not possible to evolve null hypotheses for individual indicator of social integration. Hence, for the evaluation of individual indicators, normative analysis has been done. The rating of individual indicators under each mode of education has been listed in Table 16.18d (page 220). The variance of rating of all 3 indicators of social integration has been
subjected to analysis of variance using the two-tailed test. The F-value between adjacent means as well as extreme means has been worked out using SYSTAT software. The test of significance has been carried out at 0.05 as well as 0.01 level.

Using the analysis of variance, null hypotheses in terms of variance of populations in respect of promotion of social integration has been tested.

7.3.2 Speed and Accuracy of Braille Reading: As test of null hypotheses of mean through assumed and expected mean establishes that there is significant difference between three modes of education in respect of speed and accuracy of braille, it is desirable to carry out two-tailed test as to which mode is comparatively more effective in this respect.

A population mean as well as variance of performance scores under different modes of education has been worked out using SYSTAT software. By formulating null hypotheses as well as alternate hypotheses for all the three pairs, two-tailed test of significance has been carried out thrice. For evolving the F-value, the standard statistical formula $F = \frac{\text{Higher Variance}}{\text{Lower Variance}}$ has been used. The observed F-value has been compared with the table F-value at 0.01 as well as 0.05 levels of significance.

The results of three sets of two-tailed test of significance have been used for establishing as to which mode of education is comparatively more effective than the other modes of education in respect of speed and accuracy of braille of the students.

7.3.3 Level of Social Maturity: As Tukey test establishes that there is no significant difference between three modes of education in respect of level of social maturity, it is desirable to carry out two-tailed test to substantiate this observation further.

The analysis of variance in respect performance score of all the respondents under each mode of education has been worked out using SYSTAT computer software. By formulating null hypotheses as well as alternate hypotheses for all the three pairs, two-tailed test of significance has been carried out in the similar manner as explained in case of preceding paragraph 7.3.2.

The results of three sets of two-tailed test of significance have been used for establishing as to whether there is any significant difference between three modes of education in respect of developing independence and social maturity among the students.

7.4 Test of Median:

7.4.1 Explanation of the Test: Through this test, the hypotheses that there is no difference between the median of a population and any desired number on this basis. The probability is 0.5 that any observation will fall on either side of true median. The test, therefore, involves counting the number of observations above and below the assumed value of the median, and then applying a Chi-square test. The expected value is half the sample size (Rickmers & Todd, 1967).

7.4.2 Purpose: To substantiate the findings of the test of significance through variance of means as well as through two-tailed test in respect of speed and accuracy of braille, test of median has been carried out.

7.4.3 Null Hypotheses: Using the median score, test of significance has been carried out. The null hypotheses that there is no significant difference between median performance of integrated as well
as residential students has been tested.

7.4.4 Procedure: The performance score of integrated education and semi-integrated education has been merged and considered collectively as integrated education. Thus performance score of 76 integrated students has been tested against 54 residential students. The performance score in respect of number of words read per minute of all children has been listed in a declining order. The number of students who fall above median or below median in case of integrated education and residential education has been listed in Table 19-F (page 226).

The observed values have been derived from the performance score, whereas the expected value is 32.5. For carrying out the test of significance F-value has been worked out using the standard formula.

7.5 Tukey Test:

7.5.1 Explanation of the Test: It is called a test of nonadditivity. Its purpose is to help in the decision between two different models. This test has also been used to choose between alternative possibilities for the scale for measurement for the criteria, the decision being made in favour of the scale for one is more appropriate model as compared to other (Rickmers & Todd, 1967).

7.5.2 Null Hypotheses: The test has been used successfully by Mcguinness for establishing difference between different modes of education in respect of social maturity. As this is the most relevant statistical test of nonadditivity, it has been used for carrying out the test of significance. The null hypotheses in the present case is "there is no significant difference between three modes of education in respect of extent of social maturity and independence of the students".

7.5.3 Parameters of the Test: The Tukey value has been worked out using value of K=3, mean standard error of 0.364, Alpha level of 0.01, degree of freedom of 2, and sample size of 130. The mean standard error, and critical range for pairs of mean has been worked out using SYSTAT software. The computer software also provides the end result as to whether the counts per group are equal or not.

7.5.4 Purpose: The Tukey test enables to establish as to whether there is significant difference between three modes of education in a particular respect, which is extent of social maturity and independence of the students in the present research study.

7.6 Analysis of Variance: F - Distribution:

7.6.1 Explanation of the Test: An F-distribution displays the expected pattern of sample variance ratios for a common variance. By the test of distribution, we can test whether or not a specific observation of a sample variance ratio indicates that the two samples really came either from a single population or from two populations having equal variance. An F-test helps us to decide whether or not two processes have similar variability. Thus F-test is often a useful preliminary test when we intend to test a sample mean against another sample mean (Rickmers & Todd, 1967).

7.6.2 Null Hypotheses: To decide whether different components of concept development have different variability, F-test has been used. The null hypotheses is that there is no significant variance of two population; the alternate hypotheses is that a significant difference exist. This test has been used to decide whether there is a significant difference in case of variability of performance score of students studying at present under different modes of education in respect of different components
7.6.3 Procedure: The F-value has been worked out by using variance within the class and variance between the means. The observed F-value has been compared with the table F-value at 129.2 degrees of freedom and 0.01 level of significance. The comparison of these two values would establish whether the null hypotheses stands rejected or retained.

7.6.4 Statistical Inference: Wherever, the null hypotheses stands rejected which signifies significant difference between three modes of education in respect of that particular component, a normative analysis of absolute performance scores has been used to identify as to which mode is more effective in that respect.

Wherever the null hypotheses is retained which signifies no significant difference between different modes of education in respect of that component of concept development, no further analysis has been done and it is concluded that three modes of education do not differ significantly in respect of concept development as far that component is concerned.

7.6.5 Summary: A variety of statistical tools including analysis of variance, Chi-square test, normative analysis, coefficient of correlation, Tukey's test, two-tailed test of significance, arithmetic mean, mode, standard deviation, test of median, and F-distribution have been used to establish if there is a statistically significant difference at the 0.01 or 0.05 level among different variables.

Various inferences of the study have been drawn depending upon the results of statistical analysis of available data. In most of cases, more than one statistical tests have been used to cross check validity of other tools. The inferences have been drawn on the basis of collective results of all the statistical tests used for a particular hypotheses, variable or parameter of evaluation.