CHAPTER—III

STATEMENT OF THE PROBLEM
CHAPTER 3

STATEMENT OF THE PROBLEM

In this chapter, discussion is focused on the nature, purpose and scope of the study. Various objectives that were envisaged to be addressed and the research questions raised in lieu of the objectives of the study is detailed under

3.1 - Nature, Purpose and Scope of the Study

3.2 - Objectives of the study

3.3 - Research Questions

As the study focused on certain aspects of mathematics education among a special group of children – visually handicapped, it was considered essential to create operational definitions for the terms used in study. The definitions of the various terms with specific meaning for the study is presented under

3.4 - Operational Definition

This study was designed with certain delimitations in mind. As the study was undertaken in a special school setting for the visually handicapped, some potential weakness were also anticipated. Hence, the delimitations and the limitations of the study is presented under

3.5 – Delimitations and limitations of the study.

3.1 NATURE, PURPOSE AND SCOPE OF THE STUDY

The study “Development of Arithmetic Skills among Lower Primary Visually Handicapped Children” was conceived as a descriptive-analytical study with a diagnostic approach. It was thought appropriate to conduct a comparative analysis of performance of Arithmetic Skills between the Sighted and the Children with Visual Handicap at lower primary level to probe into the differences if any in acquiring the Arithmetic Skills between the two groups. The
research design of the study included both quantitative and qualitative methods of collecting data. A combination of qualitative and quantitative methods were adopted as the study aimed to answer questions pertaining to special needs of students with visual impairment in special institutions. Paton (1990) in support of such a combinatorial research design writes: "Rather than believing that one must choose to align with paradigm or the other (quantitative or qualitative), I advocate a paradigm of choices. A paradigm of choices rejects methodological orthodoxy in favor of methodological quality. The issue whether one has made sensible methods decisions given the purpose of inquiry, the questions being investigated, and the resources available. The paradigm of choices recognizes that different methods are appropriate for different situation" (pp. 38-39).

For the current study, quantitative method was used to collect data for comparison of achievements between the Sighted and the Children with Visual Handicap. Qualitative methods were used to analyse the curriculum and the errors committed by the Children with Visual Handicap on given arithmetic tasks. It was also considered essential to analyse the performance of Children with Visual Handicap on certain selected cognitive capabilities (Piaget's tasks) rather than administering standardised intelligence tests on Children with Visual Handicap; Piagetian cognitive stages, concrete operational stage (7/8 years of age) in particular, provides a developmental perspective to yield a better insight into the thinking strategies of children than an IQ score at lower primary level (typical age range being 5-11 years). These strategies were considered for analysing the achievement of arithmetic skills appropriate to the achievement of

Thus, the nature of the study (Figure 5) was essentially an in-depth analytical study to probe into different aspects of development of Arithmetic Skills among Children with Visual Handicap on a small sample with qualitative approach of study rather than quantitative. An evaluative and diagnostic study seeking to answer certain research questions rather than testing various hypotheses through statistical techniques.
Development of Arithmetic Skills Among Lower Primary Visually Handicapped children

Mastery of Arithmetic Skills
Comparison with Sighted (V Graders)

Diagnostic Analysis of Arithmetic Skills
Categorisation of Errors (CVH - V, VI, VII Graders)

Acquisition of Cognitive Capabilities
Concrete Operational Stage (CVH - V, VI, VII Graders)

Appraisal of Arithmetic Curriculum
Special Institutions for CVH

Study Outcomes
Inform educational practitioners of Arithmetic Educational Needs of CVH

Figure: 5 Nature of the study
Scope of the Study

This study was primarily aimed at the lower primary grades (I – V grades with age range of 5-11 years), however, as the available sample was very small in the selected special institutions for the study, hence, Children with Visual Handicap at upper primary grades VI and VII were also considered for diagnostic studies. Age range for the lower primary grades Sighted is considered between age 5 and 11. In the selected two special institutions for the study age range for Children with Visual Handicap differed from the Sighted. The age range for grade I – IV was between 6 and 13. And the age range for Children with Visual Handicap at grades V, VI and VII varied between 14 and 21. Students above 16 years of age were not considered for the study.

Among the five grades of lower primary level, Children with Visual Handicap from grade V were considered for comparative analysis between them and the Sighted with respect to their arithmetic achievement. The Children with Visual Handicap were selected from two residential special schools of Mysore city, Karnataka, India. For diagnostic evaluation of errors in the performance of Arithmetic Skills, Children with Visual Handicap of VI and VII grades were also selected apart from V graders in order to get a better insight into the cumulative deficiencies (if any) in arithmetic learning. Few suitable cognitive capabilities tasks were selected from an array of tasks developed for Sighted children to study the attainment of Piaget’s concrete operational stage among Children with Visual Handicap.
The special institutions selected for the appraisal of arithmetic curriculum covered three southern states of India, bearing in mind the available cooperation of the institutions.

3.2 OBJECTIVES OF THE STUDY

Objective-I

The study sought to assess the Arithmetic Achievement among Children with Visual Handicap in comparison to that of Sighted Children, both studying in V standard.

Objective-II

The study sought to diagnostically evaluate the performance of Children with Visual Handicap studying in V, VI and VII grades, on Arithmetic Tasks to identify/describe the errors/failures in attaining the mastery of selected arithmetic competencies.

Objective-III

The study sought to analyse the performance of Children with Visual Handicap, studying in V, VI and VII grades, on selected cognitive capabilities tasks: (i) Classification, (ii) Seriation, (iii) Conservation of Number and (iv) Conservation of Quantity to study their attainment of concrete operational stage as Piaget has described.

Objective-IV

As a secondary objective, the study sought to appraise the arithmetic curriculum in different special institutions. Recognising the importance of several factors in judging the quantity of arithmetic curriculum, it was decided to study (i) the Arithmetic syllabus, (ii) Teaching methods, (iii) Modalities and strategies adapted for Children with Visual Handicap and (iv) Teacher perceptions on effective arithmetic curriculum.
3.3 RESEARCH QUESTIONS

In the pursuit of objectives I-IV that are exploratory and descriptive in nature, it was considered appropriate to raise research questions. Locke, Spirduso and Silverman (1987) emphasise that research question is appropriate when the research is exploratory. Marshall and Rossman (1989) reiterate the selected mode of questioning by stressing on how qualitative questions and problems usually come from real-world observations. These questions are not stated as hypotheses derived from theory, but rather as concerns that focus on interactions and processes in socio-cultural systems and organisations. Such questions (and any subsequent answers) are enriched by the complexities of their empirical context. Thus, following research questions were raised to be answered through qualitative analysis rather than formulating specific hypothesis to be tested through statistical techniques.

RQ1: To what extent have the lower primary Children with Visual Handicap developed Arithmetic Skills in terms of basic arithmetic concepts and operations? Do they differ in their Arithmetic Achievement from that of lower primary Sighted children?

RQ2: To what extent does Children with Visual Handicap studying in V, VI, VII grades master the basic arithmetic competencies? In other words what is the percentage of success or failure in each of the arithmetic competency selected for the study?

RQ3: What kind of errors does the primary school Children with Visual Handicap commit in solving different kinds of arithmetic tasks pertaining to basic arithmetic concepts and operations?

RQ4: How far do the primary school Children with Visual Handicap attain the cognitive capabilities – Classification, Serration? How far do the primary
Children with Visual Handicap attain the concrete operational stage – Conservation of Number and Conservation of Quantity as described by Piaget and his associates?

RQ5: What are the major factors that contribute to and affect the quality of arithmetic teaching-learning in special schools of Children with Visual Handicap?

With respect to Objective-I the following null hypotheses were formulated for comparative analysis between the Sighted and the Children with Visual Handicap with respect to their Arithmetic Achievement for the whole group as well as gender differences.

H1: There is no significant difference between the V grade Sighted students and the CVH with respect to their overall Arithmetic Achievement.

H2: There is no significant difference between boys and girls in the CVH group with respect to their arithmetic achievement on ADT.

H3: There is no significant difference between boys and girls in the Sighted group with respect to their arithmetic achievement on ADT.

3.4 OPERATIONAL DEFINITIONS OF KEY TERMS

Researchers define terms so that readers of the research report can understand the context in which the words are being used or their unusual or restricted meaning (Castetter & Heisler, 1977). Below given are the key terms that are used with specific meaning in the context of the study.

1). Arithmetic Skills
1. Arithmetic Skills

Arithmetic Skills for the present study had to be chosen carefully guided by important considerations. Chander (1992) suggests that any and every class of entities, which satisfies the Peano’s axioms, can be considered to exemplify the set of whole numbers. All the characteristics and properties of the whole numbers are logical consequences of these axioms only. Thus, the Arithmetic Skills for this study were mainly based on the following Peano’s axioms:

(i) Zero is a number,

(ii) The successor of any number is another number,

(iii) There are no two numbers with the same successor,

(iv) Zero is not the successor of a number,

(v) Every property of zero, which belongs to the successor of every number with this property, belongs to all numbers.

Arithmetic Tasks in this study are the problems framed for assessing the mastery of selected Arithmetic Concepts and Operations.

Thus, the Arithmetic Skills for the study was represented by the performance on the following arithmetic tasks as assessed by the Arithmetic Diagnostic Test, a criterion referenced test developed by the investigator for the purpose.

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5 Giuseppe Peano (August 27, 1858 – April 20, 1932) was an Italian mathematician, whose work was of exceptional philosophical value. The author of over 200 books and papers, he was a founder of mathematical logic and set theory, to which he contributed much notation. The standard axiomatization of the natural numbers is named in his honor. He spent most of his career teaching mathematics at the University of Turin. (http://en.wikipedia.org/wiki/Giuseppe_Peano)
I. Number

1. Counting Numbers

2. Odd and Even Numbers

3. Completion of Series

4. Ascending and Descending Order of Numbers

II. Place Value

5. Number Names

6. Number Expansion

7. Identification of Place Value

8. Number Formation

III. Addition

IV. Subtraction

V. Multiplication

VI. Division

The performance on these arithmetic tasks served two purposes of the study:
(i) to assess arithmetic achievement based on the total score of the test.

(ii) to evaluate diagnostically the mastery of selected competencies in arithmetic.

2). Children with Visual Handicap

Children with Visual Handicap are a highly heterogenous group whose one and perhaps only common characteristics is some degree of visual loss. Some are labelled totally blind while others are partially blind based on physiological measurements pertaining to their visual acuity or field of vision. Defining disability is difficult because there are dozens of definitions – each with a purpose to it. These range from very narrow to the very broad, from the medical to the social, from the cultural to the local, from the one intended to integrate them in society to the one for exclusion and segregation. Some of the definitions are given by authorities in the field are given below:

The Rehabilitation Council of India Act, 1992 defines visually handicapped as a person who suffers from any of the following conditions, namely:

(i) total absence of sight; or

(ii) visual acuity not exceeding 6/60 or 20/200 (Snellen Chart) in the better eye with correcting lenses; or

(iii) limitation of the field of vision subtending an angle of degree 20 or worse.
Similar definitions for blindness were prescribed by Planning Commission of India, the Ministry of Welfare, 1986 and by the new law – Persons with Disabilities (Equal Opportunities, Protection of Rights and Full Participation) Act, 1995.

As no one definition can accurately describe the heterogeneity of the visually handicapped population, Children with Visual Handicap for this study were considered on the basis of their admission to special schools for the blind; the criteria for admission to such schools being the functional aspect of visual loss rather than physiological measurements pertaining to their degree of visual acuity. Thus, totally blind – at birth and after birth, and partially blind – at birth and after birth as recorded in the admission registers of the school followed by the confirmation of the teachers were considered as ‘Children with Visual Handicap’ (also referred as CVH in this report).

However, Children who became Visually Handicapped after six years of age and with any multiple handicaps with visual impairment were excluded from the sample of the study.

3). Sighted

Children studying in regular schools who did not require special intervention for their educational needs based on their visual limitations were categorized as ‘Sighted’ for the current study.
4). Cognitive Capabilities

In Piaget's description of the stagewise progression of cognitive development, each stage is characterised by the emergence of certain clearly definable cognitive capabilities. The period of concrete operations (age 2-11 years) is further classified into three phases. During the first two phases, the child becomes increasingly independent of 'here' and 'now', i.e. seeing and hearing things and more dependent upon the use of images and things. Increased dependence on imagery releases the child from dependence on particular situations in such a way that it could open doors to mathematical experiences (J. D. Williams, 1971). During the last phase of the period of concrete operations (7-11 years) the child develops the ability to understand many basic arithmetical and other mathematical processes and concepts. At this stage, the child becomes capable of classifying, ordering and numbering. However, despite this impressive list of new abilities, the child still depends upon reference to concrete situations, and, deprived of the opportunity to interpret mathematical ideas in terms of concrete situations he is likely to resort to levels of understanding that are very primitive.

Piaget (1974) identifies Identification, Discrimination, Seriation, Classification, Numeration, and Conservation, etc. as 'mental operations' comprising the Concrete-Operational Stage. An 'operation' is a process which takes a specific track of mental activity that are necessary to derive a product (Siegel & Cocking, 1977). In other words, operations specify what particular
mental activity is involved in the given situation. For Piaget, psychologically, an operation, above all, some kind of action whose origin is always perceptual, intuitive (representational) or motoric. The logico-mathematical operations derive from actions themselves because they are the product of an abstraction which proceeds from the coordination of actions and not from the object themselves (Piaget, 1974).

For the present study Cognitive Capabilities of Children with Visual Handicap have been represented by four mental operations Seriation, Classification, Conservation of Number and Conservation of Quantity based on the standardised test – ‘Mysore Cognitive Capabilities Test’ (MCCT) developed by Padmini (1983). The investigator to suit the purpose of the study modified some of the tasks.

5). Lower Primary

As per the primary school model of Karnataka State, first to fifth graders comprise the Lower Primary Stage. Lower Primary CVH in this study was considered as V graders (typical age range 10 – 11 years). The focus of the study being the basic Arithmetic Skills, the V graders were expected to have attained the mastery of all the selected basic Arithmetic Skills. Hence, it was decided to select V grade children.
3.5 DELIMITATIONS AND LIMITATIONS OF THE STUDY

1) The study was limited to Children with Visual Handicap studying in residential special schools in the city of Mysore, Karnataka. The study did not cover Children with Visual Handicap attending the normal schools with integrated education for the disabled (IED). The sample of Children with Visual Handicap was chosen from two residential special schools in the city of Mysore in view of the need for repeated visits and sustained cooperation of the schools authorities.

2) Arithmetic Skills were limited to basic operations on whole numbers based on Peano's axioms with respect to Number, Place Value, Addition, Subtraction, Multiplication and Division.

3) Arithmetic Diagnostic Test (ADT) developed for the study was not standardised, as the study sample of Children with Visual Handicap was small for qualitative analysis.

4) Gradewise analysis with respect to I to IV grades could not be considered for following reasons:
   (a) I and II grade Children with Visual Handicap in residential schools were not amenable for research due to their problems of initial adjustment in the school environment.
   (b) Teachers of Children with Visual Handicap in both the schools suggested that the ADT is suitable for V graders with Taylor Frame, whereas III and IV graders may not be able to attempt the problems on all the four fundamental operations – Addition,
Subtraction, Multiplication and Division, through Taylor Frame.

5) Medium of language for administering the test was essentially chosen as 'Kannada' – the medium of instruction in both the special schools for Children with Visual Handicap. However, English as a medium of assessment was also used in the instance of collecting data from schools for Sighted where medium of instruction was English.

6) No other psychological assessment except cognitive capabilities of Children with Visual Handicap was considered for the study.

7) Only four cognitive capabilities representing the concrete-operational stage as described by Piaget, viz. Seriation, Classification, Conservation of Number and Conservation of Quantity were selected for the study.

8) Curriculum analysis for mathematics instruction was limited to the arithmetic curriculum followed in the three southern states of India – Karnataka, Tamil Nadu and Maharashtra.

The Next Chapter

As has already been stated in Chapter 3, the study was a descriptive-analytical one with a diagnostic approach seeking to study the Arithmetic Achievement among lower-primary Children with Visual Handicap in comparison to that of Sighted children on the one hand and conduct an error analysis of various arithmetic tasks performed by Children with Visual Handicap on the other. It was also considered to analyse their performance on certain selected
cognitive capabilities tasks. Further, the study sought to conduct an appraisal of arithmetic curriculum in different special institutions of Children with Visual Handicap. In the pursuit of different objectives of the study, the needed tool development and selection, techniques followed and other procedural details including sampling techniques for the collection of data are explained in the next chapter – Chapter 4 – Methodology of the study.