## CHAPTER-2

### REVIEW OF THE RELATED LITERATURE

<table>
<thead>
<tr>
<th>TOPIC</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 REVIEW OF RELATED LITERATURE</td>
<td></td>
</tr>
<tr>
<td>2.1 Teaching of Mathematics to Blind Students</td>
<td>2.2</td>
</tr>
<tr>
<td>2.1.1 Appraisal in Mathematics</td>
<td>2.3</td>
</tr>
<tr>
<td>2.1.2 Curriculum for Mathematics</td>
<td>2.3</td>
</tr>
<tr>
<td>2.1.3 Problem Solving in Mathematics</td>
<td>2.4</td>
</tr>
<tr>
<td>2.2 Teaching of Mathematics to Blind Students: Review</td>
<td>2.4</td>
</tr>
<tr>
<td>2.2.1 Development of Cognitive Abilities</td>
<td>2.5</td>
</tr>
<tr>
<td>2.2.2 Tactile Discrimination Abilities</td>
<td>2.7</td>
</tr>
<tr>
<td>2.2.3 Improvisation of Teaching Aids</td>
<td>2.8</td>
</tr>
<tr>
<td>2.2.4 UNICEF Project for Development of Teaching Material</td>
<td>2.10</td>
</tr>
<tr>
<td>2.2.5 Adoption of Nemeth Braille Code in India</td>
<td>2.11</td>
</tr>
<tr>
<td>2.3 Programmed Learning Methodology</td>
<td>2.12</td>
</tr>
<tr>
<td>2.3.1 DISTAR</td>
<td>2.15</td>
</tr>
<tr>
<td>2.3.2 Remedial Instruction</td>
<td>2.16</td>
</tr>
<tr>
<td>2.3.3 Guidelines for Developing Programmed Learning Material</td>
<td>2.17</td>
</tr>
<tr>
<td>2.3.4 Programmed Learning Method in India</td>
<td>2.18</td>
</tr>
<tr>
<td>2.4 Conclusion</td>
<td>2.22</td>
</tr>
</tbody>
</table>
CHAPTER-2

REVIEW OF THE RELATED LITERATURE

2.0 Critical comprehensive review of related literature is sine-quo-non for any scientific investigation. Any further investigation requires thorough knowledge of the existing related literature. Best (1978) observed that the review of literature is brief summary of previous researches and writings of recognized experts. It provides evidence that researcher is familiar with what is already known and with what is still unknown and untested. Since effective research must be based upon past knowledge, this helps to eliminate the duplication of what has already been done and provides useful hypothesis and helpful suggestions to do significant investigation.

The review of literature facilitates greater understanding of the problem and its crucial aspects and ensures the avoidance of unnecessary duplication. It provides comparative data on the basis of which, interpretation of the findings and evaluation of the significance of results can be done. It also contributes to the scholarship of the investigator. Keeping these important aspects of the review in mind, the relevant studies conducted both in India and abroad having some bearing on the present study and those, which are competently executed and clearly reported, have been included in this chapter.

In the following sections of this Chapter, the investigator provides a vivid description of the literature related to teaching of Mathematics to exceptional children, teaching of Mathematics to blind children and use of programmed learning method. The various
developments in the area of teaching of Mathematics to the blind students have also been reviewed.

2.1 TEACHING OF MATHEMATICS TO EXCEPTIONAL CHILDREN: REVIEW

 Majority of research on teaching of Mathematics to Exceptional Children has focused on arithmetical computation. Within this area, the emphasis has been on Whole Numbers, further subordinated to addition and subtraction.

In spite of the fact that teachers have indicated that Division is the primary topic with which exceptional children have difficulty (McLeod & Armstrong, 1982), there is a paucity of research and instructional development on this topic. By contrast, the literature is replete with work in addition and subtraction (Thorton & Toohey, 1985).

Though children have their initial difficulties with these two computational skills, it is yet to be determined whether the early emergence of difficulties in addition and subtraction is due to deficiencies in concepts and principles, or the learners' deficiencies in attention factors or memory capabilities.

James Hanrahan, Socrates Rapagna & Katalin Poth, of McGill University presented the results at the mid point of a four year longitudinal study designed to identify developmental patterns in the responses of children with learning problems when attempting addition. Children with both moderate and mild levels of learning problems were presented with a series of addition problems on a computer monitor. The observed performance of both groups was similar to that previously reported for intellectually
normal children. The children with learning problems used specific strategies when adding numbers, and these strategies became more sophisticated with age (Canadian Journal of Special Education, 1993, Vol.9, No. 2).

2.1.1 APPRAISAL IN MATHEMATICS

Appraisal in Mathematics should be comprehensive and should include appraisal of concepts and skills; computation and problem solving in the topics of Numbers, Fractions, Geometry and Measurement, etc. The use of single topic measure (Wide Range Achievement Test, WRAT, a computation test, Jastak & Jastak, 1978) suggested the presence of a g-factor. Therefore, performance in one topic of Mathematics is sufficient to predict the performance in another topic. It also helps to recognize the areas of strengths and weaknesses.

The Key Mathematics Diagnostic Arithmetic Test (Connolly Nachtman & Prichett, 1976) covers more topics of Mathematics. It does not cover any single topic to the degree WRAT covers computation. The specialists have to make decisions regarding the component according to their approach.

2.1.2 CURRICULUM FOR MATHEMATICS

Special educationists have not given any significant attention to the development of curriculum for Mathematics besides a few exceptions (Cawley et. al., 1974, 1976). Curriculum choices determine content, the level of content and the sequence of its presentation. The sequence of content presentation determines the instructional choices.

Cawley has also studied the needs and problems of disabled students in Mathematics (1978, 1984). He advocates greater emphasis on "What shall we teach, When and in
What sequence "..." in imparting the knowledge of Mathematics to the exceptional children. He also recommends that mathematical structure should be tailored to their particular needs.

2.1.3 PROBLEM SOLVING IN MATHEMATICS

Another neglected area in Mathematics is problem solving. Special Education is yet to make the transition from a computational emphasis to problem solving. Performance in problem solving requires considerable knowledge and competence in pre-requisite skills such as language and reading.

2.2 TEACHING OF MATHEMATICS TO BLIND STUDENTS: REVIEW

All over the world Mathematics is included in the school curriculum because of its vital utility in developing scientific attitude in pupils. Mathematics instruction for blind students generally involves the same content areas as for the sighted children. However, the material and methods used are likely to be different (Napier, 1973). This is because of the limitations imposed by blindness resulting in more reliance on touch and audition. Chorniak (1977) has observed that it is improbable that visually impaired students acquire concepts vicariously, since they lack the opportunities to "see things in groups, to note sets and acquire Mathematics linguistics by seeing quantity, magnitude and number symbols".

Hartley's study (1963) emphasized that blind children need a unique programme in order to help them learn simple concepts that sighted children develop through incidental learning. Research studies (Davidson, 1988; Darling, 1985; Kalaiselvi, 1985; and Muthaiah, 1984) reveal that blind children can also learn Mathematics when they are taught in an appropriate manner. It is noted that provision of mathematical text material
would be of less use when the child is not proficient with mathematical Braille codes. Darling (1985) emphasizes the need for mathematical text material for effective integration of blind children.

The teaching of Mathematics is essential for training the mind to develop reasoning abilities and powers of abstraction. Mathematics has evolved to more than just the Arithmetic of numbers and the four basic algorithms of addition, subtraction, multiplication and division. It is now a study of symbols with respect to quantity, form, algorithms, sequencing, measuring, graphing and the methods for processing these concepts (Pete Rossi, 1986).

2.2.1 DEVELOPMENT OF COGNITIVE ABILITIES

Understanding of any concept depends upon the development of cognitive abilities. Blind children have been found to be lagging behind their seeing counterparts in cognitive skills such as acquisition of mature conservation concept (Tobin, 1972; Gottesman, 1973; Canning, 1957; Stephens & Simpkins, 1974), classification abilities (Higgins, 1973), use of spatial concepts (Hartlage, 1968, 1969) and in many other cognitive skills due to restricted experiences (Stephens, 1972). An important factor, which may be responsible for some of the cognitive lags found in early school age blind children is the child's reliance on "less sophisticated sensory discrimination abilities". With increase in age, blind children are found to improve gradually in their cognitive abilities because of their "increased reliance on integrative processes of cognitive functioning, rather than a reliance on the less sophisticated sensory discrimination abilities" (Gottesman, 1976).
Investigation with Piagetian tasks on conservation of mass, weight, and volume was conducted by Milton Gottesman and he found the differences on these tasks between blind and sighted children to disappear at the age level of 8-11 years. Similar observations were made by Higgins in 1973 while he investigated the two samples on classification abilities. His interpretation is even more specific and assuring. The deficiency appeared to be perceptual (figurative) and symbolic rather than of intellectual (operative) origin. Evidently, the loss is at the level of sense perception, the gateway to meanings and knowledge.

Evidently, cognitive structures of children are not affected by visual loss. What they grow deficient in are primarily their perceptions and secondarily their symbolic abstractions which are gained through visual perception. Given alternative perceptual inputs through touch and more time required for their effective understandings substantiated by teacher guidance, the visually handicapped children should not find mathematical concepts an impossibility or a distant possibility for themselves. Their learning should not be verbal but must be the result of direct observation (Berthold Lowenfeld, 1973).

In a study carried out in Indian situation using Cattell's g-factor questionnaire, whose items were based on reasoning skills and thinking abilities, the performance of blind students in comparison to sighted ones was found to be very poor on g-factor (Mittal, 1988).

Juurma (1967) investigated the ability structure of children in relation to loss of vision and the factor analysis revealed that blindness did not hamper differentiation abilities.
No factor was found for any retardation rather at an early stage the blind excelled in mental arithmetic. What they suffered from were 'spatial ability' and 'dexterity'.

Bhartiya (1979) reported a significant positive relationship between intelligence and creativity with mathematical achievement.

2.2.2 TACTILE DISCRIMINATION ABILITIES

Several studies have been conducted on tactile discrimination abilities of blind children which include cutaneous sensitivity, form discrimination, size and length discrimination, weight discrimination. An overall view of the tactile discrimination research suggests that there are no striking differences between blind and sighted children. Whatever differences do emerge, they are typically, although not strongly in favour of the blind children. Examples are cutaneous localization (Jones, 1972), form discrimination (Schwartz, 1972), length matching, (Jones, 1972), and weight discrimination (Block, 1972). Davidson, 1976 concluded that such differences are probably due more to differences in strategies of attention than to basic differences in sensory acuity. Block (1972) also found blind children somewhat worse than sighted children on a test of size discrimination. Several studies have not made comparison between blind and sighted but have evaluated relationships between discrimination performance and variables such as chronological age (CA) and Intelligence Quotient (IQ) within groups of blind children. There has unfortunately been very little research designed to assess the effects of variables such as age at onset of blindness and degree of residual vision.

Bruner & Oliver (1966) have talked of intellectual development through the progressive building up of mental images. Such images can be stored in memory, recalled and manipulated only through an expanding network of experiences. It is here that the
visually disabled child has his biggest deficit. Thus, the stimulating and experientially rich environment needs to be provided for learning Mathematics.

2.2.3 IMPROVISATION OF TEACHING AIDS

Usually, material for visually disabled children is prepared bearing in mind the suitable principles - the maximizing of the duplicated material, the modification of format and content for necessary adaptation, the substitution of ideas/lessons for optimum learning experience of the child and rare omissions under unavoidable circumstances. Mathematics being an abstract subject, which involves the appearance of concrete, pictorial and abstract concepts, all the four principles should be used in preparing text material. Muthaiah (1984) reports more duplication, modification, substitution and less omission of ideas in a mathematical Braille text material.

To supplement the use of mathematical text material, a small guidebook in Braille consisting of the model problems, certain diagrammatic illustrations, etc. can be provided to the child. Davidson's (1988) study also highlights this need. This helps the child, especially during the examination time, to revise. Even though it is experienced that Mathematics lessons could not be recorded into cassettes as whole, certain steps such as formulae, methods of constructing a diagram in the case of geometry, etc. can be recorded in a cassette. All possible alternatives have to be explored for making the teaching-learning in Mathematics more purposeful.

Mani (1993) highlights the importance of three-dimensional aids and the need and nature of improvisation of aids in the teaching of Mathematics to visually disabled children. Since vision plays a predominant role in the assimilation of ideas by observation, certain aids, which are commonly available for sighted children have to be adapted to suit the
needs of visually disabled children. The concept of tactile attraction is to be emphasized in preparing teaching aids, so that the child does not encounter any difficulty in understanding the concept.

In Mathematics, most of the teaching aids can be presented tactually because they are aiming at the development of certain concepts. Area, volume, height, weight, elevation, scale value, etc., are some concepts which can be effectively explained through three-dimensional teaching aids.

Geometrical devices can also be adapted to the needs of visually disabled children. For example, in the normal Protractor made out of plastic, big wholes can be made for every ten degrees and small wholes for every five degrees without breaking it.

 Blind children can have difficulties with Mathematics, as Clamp (1981) points out, this is likely to be due to underdeveloped mathematical concepts and not due to an inability to achieve. They can be good achievers in Mathematics if an emphasis on concrete experiences is given.

According to Brown (1983), in his concept on systematic approach to instructional technology, the central focus is on the students, their needs, capabilities and achievements as they work towards desirable levels of competence and performance. There are four fundamental questions. First, what goals are to be achieved. Second, how and under what conditions students aim to achieve these goals. Third, what resources are required for necessary learning experiences. And, fourth, how far the goals were achieved. This process also provides guidance for necessary improvements in instructions regarding what needs to be changed.
D.W. Rapp & A.J. Rapp (1992) conducted a survey of the current status of visually impaired students in secondary mathematics classes. Their teachers were questioned about the services that were provided, mathematical teaching tools used, and additional related issues. The results of the survey revealed that teachers encounter continuing difficulties in providing materials and equipment and few students are participating in the more advanced mathematics classes.

2.2.4 UNICEF PROJECT FOR DEVELOPMENT OF TEACHING MATERIAL

In 1988, a UNICEF funded project at National Institute for the Visually Handicapped at Dehra Dun was started. It adopted the NCERT syllabus of primary classes for the visually handicapped children for developing suitable learning activities and requisite teaching aids. In the first stage of the project, the NCERT syllabus was analyzed to identify the main concepts and the nature of problems experienced by blind children. A number of teaching aids were designed, tested and developed as a kit. The kit included:

1. Sorting tray and flexible compartments
2. Number rods with tray
3. Spike Board
4. Sliding Strips
5. Unit Cubes.
6. Magnetic Board with Graph
7. Number Board
8. Geometrical Solids
9. Geometrical Figured Tray with Wire Forms
10. Braille Clock
In the second stage, suitable learning activities and strategies were designed to aid teaching of Mathematics to the visually challenged students. A three-week orientation course for 21 teachers from various Institutions of India was organized to provide them training in the use of the kit. Each trainee was provided with a kit for use in classroom situations in their Institutes (Rumesh Chander, 1988).

Enrichment courses for Resource Teachers in Mathematics and Science are of crucial importance to promote school education of the visually handicapped children, as the teaching of these subjects is badly neglected in most of the schools in South Asian countries. The reason for this prevailing situation is:

(a) lack of appropriate and adequate teaching-learning material,

(b) lack of training of teachers for teaching these subjects,

(c) lack of interest in school administrators towards the children's learning needs and above all,

(d) the lack of realization of the fact that the teaching of these subjects cannot be ignored as they play a vital role in shaping of visually impaired child's thinking process (Mittal, 1996).

2.2.5 ADOPTION OF NEMETH BRAILLE CODE FOR INDIA

A UNICEF sponsored project - "Adoption and Introduction of an Appropriate Braille Mathematics Code for India" was initiated by National Institute for the Visually Handicapped, Dehra Dun in collaboration with the National Association for the Blind,
Bombay. The National Workshop on the subject was held in September, 1988 at NIVH, Dehra Dun. The workshop unanimously selected 'Nemeth Braille Code for Mathematics and Science Notation - 1972 Revision' for adoption in India. The Manual - 'Braille Mathematics Code for India' - was published by NIVH and NAB jointly in August, 1989. The manual consists of 30 Chapters and includes 183 signs in all. It also contains appendices, which give a list of all Braille signs with their ink-print equivalents and Hindi terms. The Manual, though based on the Nemeth Code, does not present the entire original text. This includes signs appearing in textbooks of Mathematics unto standard X being used in various States in the country.

2.3 PROGRAMMED LEARNING METHOD: REVIEW

National Policy on Education stresses child centred approaches in teaching methodology. Each child has his own needs, interests and limitations, which need to be taken care of. The teaching should generate stimulating environment in the class. Individualized instruction is the recent concept. Children can learn any concept by themselves at their own speed provided the facilities are available to them. Teacher as a facilitator has to provide opportunities to enable the children to learn things both at school and at home. NPE envisages the child centred and activity-based process of learning. The Programmed Learning Method has these features in-built in it. Our future society demands this as we require citizens who are competent, and those who have imagination as well as creativity. Education is a unique investment in the present and future. It carries the motto of ideal education scenario, which can prepare the children to face 21st century with confidence. The various studies have investigated the development and use of Programmed Learning Method for the purpose.
Home and Glaser (1958) studied the development of programmed learning material and investigated the characteristic influence on the size of step. The result showed that decreasing the size of step and thereby increasing the number of steps resulted in more efficient learning. They also reported a study where comparisons between groups who learnt using programmed textbooks and groups who used standard textbooks were made. Two types of subject matter was used, in both cases the experimental group, which had made use of programmed learning text, showed greater gain scores than controlled group.

Keislar (1959) devised a programme to teach rectangles in the fifth and sixth grade class to find out the effectiveness of programmed instruction in the teaching areas of rectangles. His conclusion was that a group taking programmed learning had significantly higher gain scores than controlled groups.

Goldbeck (1960) conducted a study on programmed learning approach to show effects of three different sizes of steps and the use of illustrations on the spelling achievement of fifth grade students. It was found that greater number of errors were made in the largest step.

Keisler and McNeil (1961) taught Molecular Theory particularly related to evaporation and condensation to a group of 13 first grade children to test the ability to teach scientific theory to first grade children with programmed learning method. The study showed that the experimental group attained significantly greater gain scores than controlled group.

The performance by Programmed Learning is better and it helps in retention, was found out by Gagne and Dick in 1962.
Read and Hayman (1962) compared a three month course using programmed learning text books, in English, to 600 students with normal instructions in 5 schools and found that in an overall comparison with pupils using self instruction gained as much knowledge as taught by teachers.

In an attempt comparing the efficiency of learning Elementary Statistics by scrambled textbooks and by lectures, Smith (1962) found that the study through scrambled textbooks helped in saving one-third time to reach the same level of attainment.

Lambert, Miller and Wiley (1962) studied the relationship of intelligence to programmed acquisition. They studied this through programmed learning material consisting of 843 frames on Mathematics on a sample of 552 ninth grade students. They found that intelligence was the primary factor associated with the acquisition.

Carroll (1963) studied the relationship between ability and effectiveness of the programmed instruction. In learning foreign language, Carroll found that greater the ability, quicker the completion of the programme and higher the criterion test scores.

Mcneil (1964) investigated the existence of sex differences in achievements in reading by using programmed instructions. The investigation revealed that boys showed significantly better scores than girls on word recognition in kinder garten using programmed instruction.

Holland, (1965); Leith, (1966); Anderson, (1967) proved that Linear Programmes were more likely to produce better test results with younger children.
Holland (1965); Anderson (1967) & Annett (1969) investigated the use of programmed learning with low ability learners and found that though they had high rate of error the strategy proved to be more effective in terms of acquisition of knowledge.

Seigals study (1967) proved that individualized programmed instruction is highly influenced by factors such as classroom climate, learning environment and educational Eco-systems.

Hartley and Holt (1969) have shown that the notion of Programmed Learning being free from teacher influences is erroneous. The attitude of teachers towards the method of instruction is very important. Hartley (1972a) has indicated that the teacher and the programmed learning together provide a more efficient teaching technique than in isolation.

The studies of Gagne (1970) and Gagne & Briggs (1974) are based on the approach to sequencing the internal structure of the subject matter with which they were dealing. Gagne argues that many subject matters have a hierarchical structure. One has to discover this structure.

2.3.1 DIRECT INSTRUCTIONAL SYSTEM FOR TEACHING ARITHMETIC AND READING (DISTAR)

In 1966, Bereiter and Engelmann designed the DISTAR (Direct Instructional System for Teaching Arithmetic and Reading) curriculum for Academic Pre-school, to help low socio-economic class children progress academically. The DISTAR teacher has aides to
help with the delivery of instruction. Small group lessons of 35-40 minutes employ programmed learning techniques of positive reinforcement, correction procedures and teaching to mastery. Criterion reference tests are administered periodically and are the basis for regrouping and staff training.

The Engelmann-Becker Model (1976) emphasized small group instruction. The Arithmetic curriculum of DISTAR programmed learning includes addition, subtraction, multiplication, Division, Measurement and word problems.

Baine (1978) points out that highly efficient instructional techniques are required to teach handicapped youngsters. He found the DISTAR to be well suited for the purpose.

Qualitative evaluations that surveyed teachers' opinions of the DISTAR programmed learning generally reported positive attitudes, particularly concerning slow learners and learning disabled students (Fleischer & Garnett, 1980; Guinet, 1971).

2.3.2 REMEDIAL INSTRUCTION

Cawley (1985), Reisman and Kauffman (1980), and Reisman (1981) presented a number of remedial instructional strategies (similar to programmed learning strategy). These include the following:

1. Present small amounts of a sequence to be learnt in an organised format,
2. Use visual or auditory cues that highlight what is to be learnt,
3. Use separating and underlining as cues,
4. emphasize patterns,
5. teach rehearsal strategies such as repetition, verbal elaboration, systematic scanning and grouping material to be remembered,
6. reinforce attention to a relevant dimension,
7. point out relevant relationship,
8. emphasize differences in distinctive features of stimuli,
9. control irrelevant stimuli,
10. replace incidental learning tasks with structured intentional learning tasks,
11. reduce complexity of task,
12. use consistent vocabulary,
13. use a model whose competency in the task has been established,
14. encourage deferred judgement during problem solving,
15. use peer team learning,
16. provide immediate knowledge of results,
17. plan for transfer in learning,
18. use short, simple sentences when giving directions,
19. use concrete examples of spatial and quantitative relationships,
20. use prompting.

2.3.3 GUIDELINES FOR DEVELOPING PROGRAMMED LEARNING MATERIAL

Five guidelines for developing programmed learning material are as follows:
First, select contents to be studied.
Second, select appropriate teaching-learning experiences and seek to individualize them.
Third, select one or more teaching learning modes in which to carry out learning.
Fourth, assign personal rules.
fifth, choose real life experiences.
2.3.4 PROGRAMMED LEARNING METHOD IN INDIA

Movement of programmed learning came to India in 1960s. In 1963 research students in NCERT started working on the development of Programmed Learning Material and took up research studies pertaining to the efficiency of Programmed Learning material.

Shah (1963) did the first systematic study in the field of Programmed Learning in India. She had developed programmed learning material on solving equations in Mathematics. She compared the results against those obtained through conventional lecture method. Her findings showed that experimental group taught through programmed learning material achieve more in less time.

Gupta (1965) found that even adapted programmed learning material could give good results. The advantage he pointed out was that adapted versions save much of our time and energy, which can be used for other programmed learning material essentially needed for Indian schools.

The studies of Sharma, Desai and Gibson (1965) confirmed the view that performance is better if taught through programmed learning material.

In 1967, enthusiastic persons interested in programmed learning movement formed an association of programmed learning, now registered as Indian Association of Programmed Learning (IAPL). The Association is doing very useful work in organizing annual conference on programmed learning and mobilizing researches for preparing programmed material on different units of curriculum.
Diwan and Kulkarni (1967) have explored the possibility of applying programmed learning principles to television instruction. Findings show the superiority of experimental group over the conventional television lesson group.

Mullick and Kulkarni (1968) investigated effectiveness of Programmed Learning Material in a correspondence course situation. Their findings revealed that programmed learning material proved more useful than conventional material.

The effectiveness of Programmed Learning Approach was studied both in terms of immediate scores in the post test and in terms of retention by Sharma (1966) and Kulkarni (1969) and found that retention of scores of experimental group was better than that of the controlled group. Their experiments revealed that programmed learning material is effective not only in terms of immediate and delayed achievements but also in terms of the time taken to learn a topic.

The Centre for Advance Studies in Education, Baroda has taken up Programmed Learning as a major field of research. During 1970s and 1980s many research studies have been taken up throughout the country. Some of the important studies are:

During 1977-81 Inamdar and Janakal Ambal studied the effectiveness of Programmed Learning Strategy for Mathematics for standard seventh in relation to some psychological correlates. Among the personality variables, interaction of anxiety with achievement through Programmed Learning Material was reported in two studies. Ahuja (1978) did not find a significant effect of anxiety on the performance of students while Sharma & Ahiya (1978) found its effect on the performance of the average-anxiety group.
Several studies have been reported regarding comparison of different styles of Programmed Material, different formats of presentation of the programmed material and between different approaches to teaching / learning with reference to Programmed Learning Material. The branching style of Programmed Learning Material has been reported as more effective than the linear style by Joseph (1983) and Kagathala (1982) in teaching English Grammar and a segment of Commerce respectively.

However, Kaur (1983) reported no difference between the two styles, while comparing the performance of college students in linear and mathetical styles of programming at information and skill levels of content.

In 1981 Mavi and Nirmal Singh of Kurukshetra University developed programme in Physical Geography for high school students and found it to be effective.

Rabindradas (1984) found that self-instructional programmed material on health education developed by him for school students resulted in better learning than the conventional classroom teaching. Learners also expressed a more positive attitude towards the self-instructional programmed material.

Sangnan (1984) reported better performance of B.Ed. students who learnt through programmed learning material developed in linear style when compared to the achievements of the students who were taught in the usual classroom.
Chaudhary (1985) worked on preparation and evaluation of Programmed Learning Material in Geography for the secondary level. His findings affirmed the effectiveness of Programmed Material in inducing learning among the students. The programmed material can be effectively used to teach the contents to the students of classes IX and X without any fear of failure. It could be used with junior students as well.

Desai, K.V. (1985) compared the programmed learning approach with learning through experiments, slides with discussion, the traditional way of teaching Science to students of class VIII. He concluded that the programmed learning approach was better than the traditional method, but on par with teaching through slides. Learning through the experimental approach was the best. The usual classroom teaching showed the poorest results.

Desai, R.M. (1986) studied the effectiveness of programmed learning strategy in teaching of Physics in the Class-XI. The major findings were that pupils took active interest in reading and learning through programmed material. They found the programmed learning approach easy and interesting as each pupil had an opportunity to learn at his/her own speed and capacity. It was also found that the pupils scoring high on intelligence test also scored high in the pre-test and post-test and those having low scores in intelligence test scored low on the post-test. The results were quite consistent with the concepts of intelligence and achievement.

Gautham and Pushpa (1987) studied the effect of linear and branching style of programming on performance of students in relation to creative thinking and levels of aspiration. Two levels of each of the personality variables were studied along with two
styles of programming. She reported a nil relationship between learning through either style of programming, linear or branching, with creative thinking or level of aspiration.

R.K. Gupta and V. Sharma (1992), investigated the effectiveness of programmed instruction on the development of number concepts in mentally retarded and non-retarded children. This included three components, symbol recognition, number value, and number order. Findings indicated that there is no significant difference in the performance of the two groups (i.e. mentally retarded and non-mentally retarded) after programmed instruction was administered on both the groups.

2.4 CONCLUSION

All these studies point that programmed materials can increase the effectiveness of individualized instruction through careful designing, testing and improving.

In India research in programmed learning started in 1960s. The most of research work has been done on testing its effectiveness. The investigator scanned extensive literature and research works on programmed learning method and development of programmed learning material. There was not a single study reported on use of programmed learning approach to teach blind students. Similarly the effectiveness of the approach has not been investigated for hearing handicapped students.

The availability of Programmed Learning Material is very limited in India as compared to that in the western countries. There is severe scarcity of suitable programmed learning material based on prescribed syllabi. So there is enough scope for developing programmed learning material to meet the needs of Indian classrooms. The blind
students have been deprived of the programmed learning material to learn various subjects including Mathematics. The material has only been created for non-disabled students. Over the years this has put them on an advantage. There is an urgent need to develop programmed learning material to meet the needs of children with disabilities. The material needs to be suitably designed and developed.

The various studies have revealed the importance of Mathematics for the blind students and it has been very well established that loss of vision does not restrict the learning of Mathematics. As Mathematics is an abstract science its teaching to visually challenged child requires exposing him to extensive tactile experiences supplemented with suitable instructions. Programmed Learning Method has been found to be effective for the non-disabled children. How effective it could be for teaching Mathematics to blind students, needs to be explored. It is in this scenario that the present research has its relevance in the field of education.

Having reviewed the relevant literature in the present Chapter, the investigator gives the methodology of the study in the following Chapter.