Chapter: III

REVIEW OF RELATED LITERATURE

3.1 Similar research studies carried out which are directly or indirectly related with the topic under investigation.

3.2 Related literatures/projects which help us to clarify the concepts involved in the study and bring to light the opinions proposed by eminent persons in the field.
CHAPTER III
REVIEW OF RELATED LITERATURE

The review of related literature implies locating, studying and evaluating reports of researches relevant to the topic under investigation. This will enable the investigator to develop a clear picture about the problem under study. Good (1959) has observed that the key to vast store of published literature may open doors to the source of a significant problem and explanatory hypotheses and provide helpful orientation for definition of the problem, background for selection procedure and comparative data for interpretation of results. In order to be truly creative and original, one must read extensively and critically as a stimulus to think. Mouly (1964) stated that the review of related literature is an exciting task, calling for a deep insight and clear perspective of the over all field. It is a crucial step which variably minimise the risk of dead ends, rejected topics and studies, wasted efforts, trial and error activity oriented towards approaches already discarded by previous investigators and even more important, erroneous findings based on a faulty research design.

Borg (1965) remarked that, the literature in any field forms the foundation upon which all future work will be built. The author further observes that, if anybody fail by the review of literature, his work is likely to be shallow and naive, and will often duplicate that has already been done by some one else.

When the literature related with any study, is considered it is seen that there are generally two types of literature.
3.1 Similar research studies carried out which are directly or indirectly related to the topic under investigation.

3.2 Related literatures/ projects which help us to clarify the concepts involved in the study and bring to light the opinions proposed by eminent people in the field.

3.1 Similar research studies carried out which are directly or indirectly related to the topic under investigation.

In this section, there is scope for enquiry, about the following aspects.

3.1.1 Related studies on diagnostic testing in Mathematics.

3.1.2 Related studies on diagnostic testing in subjects other than Mathematics.

3.1.3 Related studies on diagnostic testing in Mathematics on disadvantaged students.

3.1.4 Related studies on diagnostic testing in subjects other than Mathematics on disadvantaged students.

3.1.5 Related studies on the effective use of remedial materials in Mathematics.

3.1.6 Related studies on the effective use of remedial materials in subjects other than Mathematics.

3.1.7 Related studies on the effective use of remedial materials in Mathematics on disadvantaged students.

3.1.8 Related studies on the effective use of remedial materials in subjects other than Mathematics on disadvantaged students.
3.1.1 Related Studies on Diagnostic Testing in Mathematics

Attainment in the subject Mathematics depends upon acquiring of basic skills and competencies that are essential for learning the subject. This has been an area of interest for researchers and educators in Mathematics from 1940 onwards.

Brueckner, (1943)³, Wood (1951)⁵, Wilson (1954)⁶, and Schonell (1957)⁷, were the pioneers in the field of diagnostic testing and remedial teaching.

Brueckner, conducted two important studies in the area of diagnostic testing, one in the area of Fractions and another in the area of Decimal numbers. It was seen that approximately one third of all mistakes in Fractions were due to the pupil’s neglect to invert the divisor before performing the process of multiplication. The researcher found that most of the difficulties of children experienced with decimals were due to ineffectiveness in handling the four fundamental operations with whole numbers and in properly placing the decimal point.

Wood cites the case of a pupil by name Paul who hated Arithmetic because he was doing miserable work in it. It was believed that he was deficient in mathematical ability. However, when a number of diagnostic tests were administered to him, it was found that his knowledge about the fundamental process was good in all but a few particulars. Virtually all of his errors were caused by zero combinations, and by not knowing the multiplication combinations of seven times eight, six times four, four times eight, and four times nine. He consistently made the same errors whenever he met these combinations. For example, he always wrote six times four equals 25 and seven times eight equals 54. Once these few errors were discovered and pointed out to him, it was no time at all until he was doing satisfactory work in Arithmetic. Teachers had worked with this boy for years and yet had not discovered
the specific causes of his failure in Arithmetic. With the aid of a few diagnostic tests in Arithmetic, it took the psychologist only an hour to locate his difficulties and start him on the road to successful performance.

Wilson gave simple tests in the fundamental operations in Arithmetic and found that approximately 70 percent of the seventh graders and eighth graders needed corrective measures and instruction.

Schonell’s diagnostic Arithmetic tests were the most comprehensive tests in this field. It is the most important and fundamental study conducted in the field of diagnosis and remediation.

Schonell classified the nature of difficulties revealed by the pupils under four groups. They were:

**Group 1:** Learner in this group makes a large number of errors in diagnostic tests on fundamentals of addition, subtraction, multiplication and division. They are extremely slow and inaccurate in responding to the basic combinations.

**Group 2:** The learners in this group are accurate in their work but are so slow in producing the output.

**Group 3:** In the third group of learners, though they have a fairly good accuracy in the fundamental number combinations, they reveal in their diagnostic test results that, they possess certain special errors.

**Group 4:** This is a group of learners whose diagnostic test results show, not weakness in the basic number combinations, but insufficient knowledge of the steps in the four processes.
The diagnosis and subsequent clarifications are only part of the programme in helping those failing in their school work.

For the teacher, the remedial measures that follow diagnosis are often the more exciting and the more expensive part of the programme.

Schonell remarked that the remedial work for those who have failed in Arithmetic must be planned in a systematic and comprehensive way. Although each pupil’s difficulties should be treated, as far as possible, on an individual basis, yet it is convenient to consider those children backward in Arithmetic in different groups.

The studies discussed so far are the most important and fundamental studies conducted in the area of diagnosis. That is why, discussions were made in detail. Other studies related with the problem are discussed below.

3.1.1.1 Studies on Diagnostic Testing in Mathematics conducted in India

With regard to the studies conducted in India on diagnostic testing in Mathematics, eighteen studies were identified as the major studies. Among these, three prominent studies were related with the area Geometry. There were five studies in the area of Algebra, three studies in the area of Arithmetic, two studies on Fractions, two in the general category of Mathematics and three studies at higher secondary level Mathematics.

a) Studies in the area of Geometry

SIE, Gujarat (1969), Guruswamy (1990), Dutta and Anima (1990) conducted studies in this area.

State Institute of Education (SIE) Gujarat, developed a diagnostic test, to test the skill in using geometrical instruments for grade six and seven students. The
study revealed that most of the learners in the classroom have issues in using geometrical instruments.

The study of Guruswamy concentrated on the errors committed by children of standard nine in solving problems in Geometry. The study revealed that, lot of errors are committed by the students such as: not doing any rough estimate, lack of process based thinking about various steps for obtaining the answer, lack of reasoning power and the like.

Where as, the study by Dutta and Anima were concentrating on the reasoning power of students in Geometry: Diagnosis and Prevention. They have identified that majority of the students lack reasoning power. Checking the correctness of the results obtained is not at all discussed in the class room and the thinking process of the learners are not catered well and as a result learners are not motivated to learn Geometry.

**b) Studies in the area of Algebra**


Sharma prepared a diagnostic test in Algebra for eighth standard children where as Ashar concentrated on developing diagnostic tests in Algebra for eighth, ninth and tenth class learners. The fundamental concepts that are needed to learn equations, ideas of factors and multiples were given importance in the diagnostic test. The diagnostic test items were found useful for the class room teacher to give remediation as and when required.
Shah concentrated on development of auto instructional programmes in Algebra for standard eight and to find out their effectiveness in relation to different variables.

The study on auto–instructional programmes in Algebra conducted by Bhattacharya. D also concentrated on learning with the help of programmed instructional materials. Both the studies revealed that the auto instructional method helped a lot for the learners to improve their learning capacity.

Bhattacharya. M, made an investigation in to the learning disabilities of secondary school students in the area of equation-stems in algebra. The study revealed that need based, life centered activities are needed in the class room in order to sustain the learning atmosphere.

c) Studies in the area of Arithmetic

Three important studies were conducted in the area of Arithmetic.

Mehta (1966)\(^{16}\), Gosh (1982)\(^{17}\), and Bhattacharya, A. (1982)\(^{18}\) conducted the studies.

Mehta concentrated on preparation of diagnostic tests in Arithmetic of standards IV to VII where as Gosh concentrated on scholastic backwardness in basic processes in Arithmetic –diagnosis and prevention. Bhattacharya, A. studied on diagnosis and prevention of learning disability of primary school children in Arithmetic. The following common findings were made through the studies.

a) Errors were more in multiplication and division than in addition and subtraction.

b) The idea about multiplication facts were negligible.
c) Lot of difficulties was there in understanding the mathematical language used in the class room. (Example: what is four times four?)

d) Studies in the area of Fractions

Two major studies were available in the area of Fractions. Takore (1980)$^{19}$ and Sindhu (1996)$^{20}$ conducted the studies.

Takore concentrated on construction of diagnostic tests in Fractions and Decimals for standard five students and suggested remedial measures to overcome the difficulties. Sindhu studied the difficulties of fifth standard students in learning Fractions. In both the studies the findings were almost similar. They are given below,

1) Errors were more numerous on multiplication and division than on addition and subtraction.

2) Difficulties were more in the area of properly placing the decimal points.

3) In multiplication and division of decimals, the decimal point was misplaced by most of the students.

e) Studies in the general category of Mathematics

Two general studies are available in Mathematics. Vasanthi (1996)$^{21}$ and Chakrabarthi & Prasad (1999)$^{22}$ conducted the studies.

The social, psychological and educational factors in the achievement in Mathematics were studied by Vasanthi. Chakrabarthi and Prasad studied the impact of achievement cum diagnostic test in the performance of the students in Mathematics. Vasanthi had identified many mathematical learning disabilities and suggested some measures to overcome these disabilities. Chakrabarthi and Prasad found that the battery of diagnostic tests were useful for the teachers to give remediation as and when required in the class room.
e) **Studies in the area of Higher Secondary Level Mathematics**

Three studies were conducted at Higher Secondary Level Mathematics. Obiedat and Sultan (1992)\(^3\), Khichi (1998)\(^4\) and Paria (1999)\(^5\) conducted the studies at Higher Secondary Level Mathematics.

Obiedat and Sultan concentrated on Mathematics achievement of grade twelve students on GSCE, in Irbid, Jordan in relation to their gender, intelligence, mathematical thinking and socio economic status. Khichi analysed the errors committed by senior secondary students in Mathematics. Paria also concentrated on the errors committed by the students in some selected topics of Higher Secondary Mathematics. All the three studies gave some important findings with regard to Higher Secondary Mathematics such as

1) The errors committed were due to the lack of fundamental ideas in the concerned area.

2) Difficulties were more in the problem solving area.

3) The concepts presented without any illustration were not at all cared by most of the learners.

4) The practicability and usability of the content were not discussed in the class room. So there was lack of motivation in learning the subject.

5) The main errors identified were computational and conceptual.

6) The students faced difficulty in applying the laws of indices.

In short, the ignorance in the fundamentals prevented them from understanding the current topics properly.
3.1.1.2 Studies on Diagnostic Testing in Mathematics Conducted Outside India

(a) Earlier studies on diagnostic testing in Mathematics

Studies undertaken by pioneers in the field of education, such as Brueckner, Wood, Wilson and Schonell were discussed in the beginning of this chapter. Two other important studies also need attention. The studies undertaken by Buswell and John (1926)\textsuperscript{26} and Randball (1937)\textsuperscript{27} were based on the causes of difficulties in Arithmetic.

Buswell and John showed that learners of average mental ability possess so many defective work habits and make so many errors in the four fundamental processes of Arithmetic. Such results are indicative of very poor teaching and poor learning. The study by Randball showed that learners of junior high school age of average mental ability can attain 100 percent accuracy in the fundamental operations when careful diagnostic and remedial teaching is carried out.

(b) Recent studies on diagnostic testing in Mathematics

Five recent studies were identified in the area of diagnostic testing in Mathematics conducted outside India. Young \textit{et al.} (2003)\textsuperscript{28}, Tatsuoka \textit{et al.} (2004)\textsuperscript{29}, Gough (2004)\textsuperscript{30}, Dettori \textit{et al.} (2006)\textsuperscript{31}, Dogan and Tatsuoka (2008)\textsuperscript{32} conducted the related studies.

Young and others compared eighth grade diagnostic test results for Korean, Czech, and American students. Diagnostic analysis were conducted on data from the Third International Mathematics and Science study second population. From the U.S, Korea and the Czech Republic in terms of test item attributes and inferred student’s knowledge.
The second study by Tatsuoka and others was also an extension of the first study. The study used a diagnostic testing approach to compare the mathematical achievement of eighth grade learners across a sample of twenty countries. Clear differences were found in patterns of sub skills and achievements among the countries. U.S learners were strong in some content and quantitative reading skills, but weak in others, notably Geometry. Interestingly success in Geometry was found to be highly associated with logical reasoning and other important mathematical thinking skills across the sample of countries.

The study by Gough concentrated on algebra skills and traps and diagnostic teaching for the future. The purpose of this study was to explore some research into teaching and learning Algebra and to consider classroom related issues. These lead to the development of diagnostic instruments that may be used by senior secondary teachers as learners leave the middle years and embark on rigorous mathematical study.

The study by Dettori and others present the case of two learners who showed very serious, apparently similar learning difficulties, mainly in Mathematics. An analysis beyond appearance of their learning activities revealed remarkable difference between them, in terms of both weaknesses and strengths.

Dogan and Tatsuoka conducted an international comparison in Mathematics using a diagnostic testing model. The study was done on selected Turkish students. It was shown that, Turkish students were weak in Algebra and probability. They also demonstrated poor skills such as applying rules in Algebra, approximation, estimation, solving open ended problems, recognising patterns and relationships and quantitative reading.
Altogether twenty nine studies have been identified in the area of diagnostic testing in Mathematics. On the whole, it is felt that concrete efforts are needed to prepare diagnostic test batteries in all the areas of Mathematics. If such tests are available for the teacher, the teacher will definitely make use of it in the classroom.

### 3.1.2 Related Studies on Diagnostic Testing in subjects other than Mathematics

Apart from Mathematics, studies on diagnostic testing were undertaken on languages and sciences. Some relevant studies in this area are discussed below.

#### 3.1.2.1 Studies in the Area of Languages

Thirteen studies were identified in the area of diagnostic testing in languages. Most of the studies took place in the Languages- Hindi, Sanskrit, English and Arabic. There were five studies in Hindi, five studies in Sanskrit, two studies in English and only one study in Arabic.

**Rajappan Nair**(1961)\(^{33}\), **Ammal**(1978)\(^{34}\), **Chinnappa**(1978)\(^{35}\) and **Nanda**(1992)\(^{36}\) - **IT College project** (1971)\(^{37}\), conducted the studies in Hindi. Studies undertaken in the subject Sanskrit are done by the following investigators **Jain** (1984)\(^{38}\), **Sreekandan** (1987)\(^{39}\), **James** (1997)\(^{40}\), **Achary** and **Sudarsanan** (1997)\(^{41}\) and **Sreemathy** (2003)\(^{42}\). Two studies available in English are done by the following investigators - **Misra** (1986)\(^{43}\) and **Yusuf** (1989)\(^{44}\). Only one study was seen in Arabic in the area of Diagnostic Testing. This was conducted by **Muhammed** (1983)\(^{45}\).

Rajappan Nair and Nanda conducted research on the errors committed by secondary students in Hindi. They have identified the common spelling mistakes made by the children in Hindi at High School level. Both the studies revealed that majority of the High School students commit many errors in Hindi.
Major findings of the study conducted by Ammal are, difficulty in Hindi was more in conjunctions and letters having similar shapes. The learning difficulty was more in speaking Hindi. The transactional modality of the teacher needed change for the benefit of the children. Less mistakes were made in vowels, soft sound and two letter words, pronunciation and spelling errors were related.

The study of Chinnappa was also on the problems and difficulties in Hindi by Telugu speaking children of Secondary Schools in Andhra Pradesh. His major findings were: Hindi was taught through Telugu, so the students were not in a position to comprehend the ideas in Hindi. Poor listening comprehension of students, difficulty of expressing in Hindi were the findings.

IT College Lucknow conducted a project on construction and standardization of a diagnostic reading test in Hindi for class three - primary level. The words frequently used while speaking Hindi, common errors committed by the students in Hindi while reading, at primary level were identified.

In the subject Sanskrit, Jain concentrated on diagnosing the language errors in Sanskrit. Achary and Sreemathy concentrated on diagnosing the difficulties of secondary pupils in learning Sanskrit. All studies recommended that a well designed curriculum is necessary to build up a strong base of Sanskrit language. All the studies revealed that constructive effort on the part of the teacher is needed to minimize the difficulties of the learner.

Sreekantan concentrated on the attitude of secondary school students towards Sanskrit language. The study revealed that the language Sanskrit contains a wealth of vast literature. But the learning is not at the desired level. Learner centered, joyful approaches are essential to create a positive attitude towards the subject.
Two studies were conducted in English on diagnostic testing. Misra conducted a comprehensive study on problems and difficulties of English, Hindi and Sanskrit language teaching at secondary stage. Difficulties concentrated on all the areas such as speaking, reading and writing. Difficulty was much more in the area of comprehension. Khan constructed and standardized diagnostic tests in English for standard eight with regard to structures.

In the area of Arabic, Muhammed conducted the study. This diagnostic study revealed that the students felt difficulty in paraphrasing, prepositions, adjectives, verbs, pronouns, numerals, reconstruction of sentences, translation, expression and the like.

3.1.2.2 Studies in the Area of Science

There were four studies in the area of science. Rawat (1976)\textsuperscript{46}, Anju (1989)\textsuperscript{47}, Douglass et al. (1997)\textsuperscript{48} and Singh (1998)\textsuperscript{49} conducted the studies.

Rawat constructed a standardized diagnostic test in Chemistry at secondary level. The fundamentals of all areas of Chemistry were identified and standardised keeping the norms of standardisation. This was benefited much for the learners and teachers at secondary level.

Douglass et. al showed that there was significant difference among standard IX, X and XI students in writing and solving of chemical equations. A high percentage of errors committed by standard IX students were classified as instructional errors. Tenth standard students committed equal proportion of all types of errors. A high percentage of errors in class XI were classified as conceptual errors.
Anju explored the learning difficulties in critical thinking in some areas of Physical Science: diagnosis and prevention. Learning difficulties in selected areas were identified and remedial measures implemented were found statistically significant.

Singh analysed the common errors in Chemistry at plus two level. The study found that the errors were due to the non comprehension of pre-requisites that are needed for learning.

3.1.3 Related Studies on Diagnostic Testing in Mathematics on Disadvantaged Students.

Four studies were found in this area by the investigator. Good, Grouws and Ebmeier (1983)50, Kurian (1985)51, Kroesbergen et al. (2002)52, Maree and Erasmus (2006)53 conducted studies in this area.

Good and others did a series of experiments in teaching of the fourth grade Mathematics with relatively low socio economic students. The treatment practices involve daily review, development of new content, seat work, home work and the like. The students performed better in Mathematics computation, but there was no change in the performance of problem solving.

Kurian’s study revealed that the socio economic condition of the students affect the learning achievement of the students. The study recommended that individualized instruction from the part of the teacher is essential for the improvement of learning.

Kroesbergen and others conducted an intervention programme for students with difficulties in learning Mathematics at Primary level. They compared two kinds of Mathematics instruction – guided and structured in teaching multiplication to
low performers. This was done with regular and special education students aged seven to thirteen. The study found that both forms of interventions were effective for low performing students.

Maree and Erasmus conducted a study on mathematical skills of Tswana-speaking learners in the North West Province of South Africa. The study revealed that inadequate achievement in Mathematics frequently occurs especially among black learners. The finding suggested that Mathematics teaching can never be divorced from the socio economic context in which it is taught.

3.1.4 Related Studies on Diagnostic Testing in subjects other than Mathematics on Disadvantaged Students

Only one study was seen in diagnostic testing in subjects other than Mathematics on disadvantaged students. Mehta (1975) conducted the study on intellectually normal but low achievers. He studied the causes of low achievement among intellectually normal school children. The poor home environment, lack of encouragement, lack of proper guidance, poor economic conditions of parents and lack of interest of parents were the factors which affected the pupils’ achievement adversely.

3.1.5. Related studies on the Effective use of Remedial Materials in Mathematics

Twelve major studies were seen in this area. Four studies in the area of Arithmetic, three studies on Fractions, one study in Calculus at Higher Secondary level and four studies in the area of primary Mathematics were the studies identified in this area.

Das and Barua (1968), Gosh (1982), Rastogi (1983) and Japtap (1986) conducted studies on remediation in Arithmetic in Mathematics. The
fundamental operations in Arithmetic were the area of concentration. As part of
the study remedial materials for learners to improve learning were developed by
all the investigators. Some of the common findings are given below.

1) Remedial instruction even for a small period can effect significant
   improvement in the achievement in Arithmetic.

2) One of the important causes for the major backwardness in Mathematics
   was the poor command over basic Arithmetic skills.

3) Attitudes were closely related with achievement.

4) When command over basic Arithmetic skills improved, attitude towards
   Mathematics became more favourable and achievement increased.

5) Basic Arithmetic skills would be very quickly and conveniently mastered
   through the course of self help in basic Arithmetic.

**Angal** and **Shailaja** (1987)\(^{59}\), **Wagh** (1991)\(^{60}\) and **Bhatia** (1992)\(^{61}\)
concentrated on developing remedial materials in the chapter Fractions in
Mathematics. General Fractions and Decimal Fractions were studied by all the
researchers. Wagh concentrated on developing a multi media instructional system
for remedial measures in fractional numbers. The study was concentrated at Primary
level fractional numbers. Bhatia concentrated on identification and remedy of
difficulties in learning Fractions with programmed instruction materials. Angal and
Shailaja concentrated on diagnostic testing and remedial programmes on Decimal
Fractions for standard V Mathematics. The above mentioned studies revealed that
the remedial packages will surely be helpful for the students to acquire the concepts
related with Fractions.

**Raman** (1989)\(^{62}\) conducted research on the impact of remedial teaching
programmes for the common errors committed by the students of standard eleven
in Calculus. The study revealed that the practicability of Calculus was not explored
in the classroom. This created many difficulties for the students at the problem solving level in Calculus. The remedial materials suggested solutions for overcoming this difficulty. The study conducted by Mohan (1990)\(^3\) concentrated on diagnosis and remediation of under achievement in compulsory Mathematics of madhyamic examination and suggested remedial measures. The study revealed that, gaps in knowledge of concepts, difficulties in understanding of Mathematical language, lack of openness and flexibility in teaching, difficulty in mathematisation of verbal problems and interpretation of mathematical reasoning were some of the causes for under achievement in Mathematics. Bharadwaj’s (1987)\(^4\) work was on standardisation of a comprehensive diagnostic test and preparation of remedial material in Mathematics for middle school students of Haryana. Through the study the types of errors committed by the pupils in the context of the nature of teaching the topic units were identified. Paul (2005)\(^5\) conducted a study on identification and remediation of systematic error patterns in subtraction. The study investigated 90 elementary teachers’ ability to identify two systematic error patterns in subtraction and then prescribed an instructional focus.

3.1.6 Related studies on the Effective use of Remedial Materials in Subjects other than Mathematics

Fifteen studies were available in this area. Studies on the preparation and effective use of remedial materials in subjects other than Mathematics concentrated on the subjects English, Hindi, other languages in general, General Science and Chemistry.

There were six studies in the area of English. Joshi (1975)\(^6\), Kamala (1982)\(^7\), Kapadia (1988)\(^8\), Herbert (1989)\(^9\), Ashok and Rajagopalan (1995)\(^10\), and Geetha (2004)\(^11\) conducted the studies. All the studies concentrated on the common errors committed by children, diagnosing the errors and preparing
remedial materials. Joshi concentrated on finding the typical errors committed by the children of standard five to seven in written English. He tried to diagnose the causes of typical errors and formulated remedial materials. Kamala investigated the causes of poor attainment in English comprehension and prepared remedial materials. Kapadia concentrated on development and tryout of programmes for remedial teaching in English at post Higher Secondary level. Remedial packages were developed based on the concepts and ideas discussed at plus two level. These materials were tried out in selected higher secondary schools of Gujarat. The materials were found to be statistically effective.

Herbert studied the impact of remedial teaching programme on the common errors committed by the children of standard twelve in written English. Geetha concentrated on effectiveness of remedial programmes in improving the word recognition skills and reading comprehension skills of low achievers in English in the Secondary Schools of Kerala. The study found that the remedial programmes in English were effective for the low achievers.

There was only one study seen in the area of effective use of remedial materials in Hindi. GCPI (1981)
conducted this study. GCPI concentrated on errors committed by grade six students in oral testing in Hindi and suggested possible remedial measures. The study found that twenty percent of the students had oral reading ability equivalent to that of the students of standard six. Ten percent students had the level that of standard four students. Seventy percent had oral reading ability equivalent to that of students of grade six.

Two general studies were conducted in the area of remedial materials. The general study by Desai (1986)
concentrated on finding the defects of language ability and try out of remedial programmes. This study was undertaken to diagnose
the defects in language learning during the first three years and to try-out a remedial programme to correct the defects. Most of the defects in language learnt during the first three years of Primary school composed of spelling mistakes while writing, bad hand writing, faulty pronunciations, wrong form of tense and the like. Another general study was done by Bose (1996). He studied the effectiveness of computer programmes as remedial strategies for overcoming specific learning difficulties. The study showed that the use of Technology will enhance language learning.

There were six studies in Science. Sethia (1972), Rawat (1976), Borude (1986), Singh (1987), Rozario (1989) and Neekahra (1995) conducted the studies.

Sethia concentrated on remedial teaching in the subject Physics in class IX where as Rozario concentrated on diagnostic analysis and remedial teaching, where as Singh and Sathya Narayana concentrated on effect of remedial instructional micro teaching course for primary school science teachers. Rawat constructed and standardized a diagnostic test in Chemistry. The important findings are given below.

1. The fundamentals of Chemistry like concepts, processes, principles and new informations and decisions were not clear to the pupils.

2. Not able to comprehend the fundamentals and translate the language of Chemistry in to symbols, formulae and equations.

Borude and Neekahra also conducted studies in the subject Chemistry. Both the studies concentrated on diagnosing the errors and preparation of remedial teaching materials. Efficiency of remedial teaching was found significantly much higher than traditional teaching.
3.1.7 Related Studies in the Effective use of Remedial Materials in Mathematics on the Disadvantaged Children

Five studies were identified in the area of effective use of remedial materials in Mathematics for the disadvantaged children. Anderson, Eversten, and Brophy (1979)\textsuperscript{81} Good, Grows, Ebmeier (1983)\textsuperscript{82}, Price et al. (2000)\textsuperscript{83}, Dhall et al. (2000)\textsuperscript{84} and Minikutty (2005)\textsuperscript{85} conducted the studies.

Anderson and his friends identified that teacher practices are associated with the achievement in reading and Mathematics of low SES students. They concluded that practices most likely to be implemented were those that of specifically described skills, focused on behaviour that are familiar to the teachers and had a rationale based on other class room processes.

Good, Grows and Ebmeier did a series of experiments in teaching of fourth grade Mathematics with relatively low SES students. The study concluded that the students performed better on Mathematics computation but there was no change in the performance in problem solving.

Price and others studied the problems of diagnosis and remediation in dyscalculia. The study explored whether there is any justification for believing that specific difficulty with Mathematics arises jointly with a specific language problem, or whether a specific difficulty with Mathematics can arise independently of problems with language. The study used a case study to illuminate the problem faced by dyscalculic.

Dhall and others concluded that the teaching of low achievers with remedial materials has increased the Mathematics achievement by thirtyfive percent.

Minikutty found that the achievement in Mathematics of the academically disadvantaged students taught using concept attainment model of instruction was
very higher than the achievement through conventional teaching method. The intelligence level of the academically disadvantaged students and the influence of SES on them were also studied.

3.1.8 Related Studies on the Effective use of Remedial Materials in Subjects other than Mathematics on Disadvantaged Students


Carr and Ledwith conducted a study on helping disadvantaged children in teaching at a distance. The study revealed that the distance mode of helping benefited much for the disadvantaged children.

Reddy and Govinda compared the language development in socially disadvantaged and socially non disadvantaged children and found that the language development of socially non disadvantaged children were better than the language development of socially disadvantaged children.

Mohite and Prerana developed and implemented a classroom instructional programme for children with learning difficulties. The material was found to be useful and was used by teachers with enthusiasm.
Lidhon and others studied the bright under achievers among the socially disadvantaged. Counseling and remedial measures were provided and the same was found effective on these socially disadvantaged children.

Agarwal and Archana conducted a social, psychological and educational study of Scheduled Caste students studying in High Schools of Lucknow. They found that the reason for the low performance of these children were due to the low social, psychological and educational background.

Guptha, Mukkarjee and Chatterjee studied tenth grade students in West Bengal and found that intelligence and prolonged deprivation contributed most towards academic achievement.

Chauhan and Murthy studied the effect of achievement on adjustment of deprived adolescents. They found that the deprived condition prohibited the students to adjust with the co-learners and thus the achievement seemed to be declined when compared to other students.

Kathuriya and Ahluwalia in their study found that prolonged deprivation had adverse effect on achievement of the deprived pupils. This is partly because of highly deprived students perceived the socio- emotional climate on the school negatively.

Ambasht and Rath in their studies on class room processes and school effectiveness investigated the effect of the households, community and school factors on the enrolment, retention and achievement of ST children at primary level. They found that the house hold affairs, community and school factors had positive effect on enrolment, retention and achievement.
Jalali and Jayasree conducted an in-depth study for NCERT on innovative practices to ensure school effectiveness among deprived groups. The main objective of the study was to diagnose the extent of autonomy exercised by the lai autonomous district council.

Umadevi studied the effectiveness of remedial programmes in improving reading comprehension skills among dyslexic children. The package of remedial materials were found to be effective.

Buch studied the effectiveness of remedial package in learning spoken English by the low achievers at secondary level. He empirically showed the benefits of using remedial package for teaching oral skills for secondary students’ English learning.

Balesh through her research found that the learning style of advantaged children were better than the learning style of disadvantaged children. The socio-economic advantage has also a positive effect on the achievement of the individuals.

Geetha’s work was on the efficacy of remedial package in augmenting primary school teacher skills to help dyslexiac children was found to be very useful for the students.

A multiple cross-sectional study was undertaken by Shanbhag on logical reasoning among disadvantaged children. He concluded that the reasoning power was very weak among the disadvantaged students.

Rajeshwari’s research work on preparation and testing of remedial teaching materials for educationally backward students in chemistry at the secondary level revealed that the remedial materials were very effective for the educationally backward students.
Cumulative backwardness of high school students in English with special reference to the socially and culturally disadvantaged sections – diagnosis and remediation models was the study done by Rekha. Remedial materials were also developed for improving the learning capacity of the students and were found to be effective.

A thorough analysis of the related studies showed that, the diagnostic studies and corrective measures such as remedial programmes for the disadvantaged children in Mathematics are very limited. Out of one hundred and six studies identified as related studies, it was seen that only five studies were related with remedial measures in Mathematics for the disadvantaged children. This shows that this area is very much neglected. Urgent action in this matter is needed.

3.2 Related literatures/ projects which help us to clarify the concepts involved in the study and bring to light the opinions proposed by eminent people in the field.

Some of the important programmes and projects under diagnostic testing in Mathematics and remedial teaching are discussed below.

3.2.1 Mathematics Diagnostic Testing Programme (MDTP, 2001)

Mathematics Diagnostic Testing Programmes(MDTP) are administered by high school and middle school teachers as a diagnostic test in California. The test results provide diagnostic information to teachers for the purpose of adjusting curriculum and determining student readiness for advancement to subsequent levels of Mathematics. The Programme was developed jointly by California State University (C.S. U) and University of California (U.C) faculty members. This crucial programme consists of five tests. They are given below:
(1) Algebra readiness test.

(2) Geometry readiness test.

(3) Second year algebra readiness test.

(4) Mathematical analysis readiness test.

(5) Calculus readiness test.

Although the University of California has no official system-wide policy on Mathematics placement; however, U C campuses use the Mathematics Diagnostic Testing Programme (M D T P) to make placement decisions about Mathematics.

3.2.2. Programming Remediation and Intervention for Students in Mathematics (PRISM, 2004)\textsuperscript{185}

Programming Remediation and Intervention for Students in Mathematics (PRISM) is a project headed by Small from the University of New Brunswick, Canada and published by Nelson Canada during the year 2004.

The intent of the project was to use existing research-based programmes with students experiencing difficulty in Mathematics in order to provide learners with an opportunity to experience some degree of success.

Experimental and control groups were formed as part of the study. The analysis suggested that teachers in the experimental group had higher scores than the control group.

Overall recommendations of the Project are:

(1) Expansion of training of teachers in the use of developmental continuum and diagnostic tools in Mathematics for students in the intermediate grade, seven and eight grades.
(2) Expansion of school participation in the pilot project to lower grade, Primary-Junior level divisions.

(3) Expansion of the use of a collaborative professional learning community team model at both with in and across schools and school systems.

(4) Organisation of shared planning time for learning teams both with in and across school sites.

(5) Provision of time for teacher reflection of professional practice.

(6) Asking additional research questions that address more in-depth school-class room level teacher and student practices and achievement outcomes, a focus on parent involvement, and the role of system consultants.

3.2.3 A proposal for a Programme of Compensatory Education for Socially and Culturally Deprived Children Suggested by Soman (1998)106

The children belonging to weaker (socially and culturally) sections of the society start and function with an inherent disadvantage. The weaknesses in their socio cultural milieu, as reflected in their economic poverty, social disadvantages and cultural deprivation might lead to deficiencies, deficits and even to defects and distortions in their development in its different dimensions. Unless these are remedied in time, they are likely to be projected in schooling. The remedy suggested and tried out successfully in many parts of the world is a systematic scientifically designed compensatory education. This programme aim at optimally making up for the deficiencies, deficits, defects and distortions created by socio cultural deprivations and limitations. What is anticipated is that by such a programme at the early stages, before failures and frustrations of a very serious nature set in, we could lay a solid foundation for normal education.

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Any programme for compensatory education will have to suit specific
problems, conditions and solutions. Yet certain general procedures also could be
suggested as a model plan of action. This includes scientific planning, consolidation
of inputs and formulation of strategies that could be integrated to give shape to a
comprehensive programme.

1. Analysis of the various dimensions of development done with a view to arriving
   at optimal norms to be aimed at while imparting compensatory education.
   This may be done on the basis of a conceptual frame work and should include
   the following:
   a) Range of language mastery in the mother tongue expected of children
      at about the age levels of three, four, five and six.
   b) Range of specific cognitive capabilities expected of children belonging
      to healthy, social background at about age levels of three, four, five and
      six.
   c) Range of personnel and social qualities expected of children belonging
      to healthy socio cultural settings.

2. Assessment and diagnosis of the common deficiencies, common defects,
   distortions etc in terms of all the dimensions.

3. Planning of additional inputs in terms of materials, expertise, stage appropriate
   learning tasks helpful for remediation.

4. Organizing machinery for processing the additional inputs, for ensuring
   property management of time and for consolidating all material, social and
   economic supports that might become necessary for the implementation of
   the programme.

5. Frequent gathering of feedback of the programme in terms of qualitative
   improvement realized as well as in terms of active participation of all
   concerned.
3.2.4. Towards a Pedagogical Approach in using PLATO Learning in Sixth Grade Math(2005)\textsuperscript{108}

This project is an evaluation of instructional techniques using PLATO learning in a lab environment for the teaching of Mathematics. The study took place in one sixth grade team at Cleveland, TN middle school. Approximately one half of the students were not assigned to a PLATO lab. These students comprised the control group. Out of the remaining students, nearly two thirds were enrolled in a PLATO lab using a module titled ‘fast track advantage math’ to determine what math lessons students would complete on a daily basis. The last group of students, approximately 22 individuals, was placed in a PLATO lab where the lab instructor and core math teacher worked in tandem to decide math instruction on a day- to day basis. The purpose of this study was to determine if there were any differences between the two PLATO lab approaches. A pre test and post test on one unit of study were delivered to all students on the team to see if an appreciable difference in gains was noticeable between the two approaches.

The sample is selected in such a way that there are no statistical differences between students enrolled in PLATO and those not enrolled in PLATO.

A total of 50 students currently enrolled in PLATO completed the post test. Thirty eight students from the control group completed the post test. The mean score for PLATO students was 65.1, and the mean for the control group was 53.82. Again, the \(t\)-test shows no significant difference between the control group and the PLATO classes.

The one way ANOVA appears to demonstrate that the traditional class did show a significant increase in math scores when compared to the control group.
Conclusions and recommendations

This study demonstrates that participation in a PLATO class can increase student scores in math at the sixth grade level. In addition, it appears that the method of instruction in the PLATO class is a determining factor in its effectiveness. However, contrary to the hypothesis of this study, the use of Fast Track Advantage Math modules appears to bring a significant increase in post test scores whereas the experimental group appears to be less effective.

It may be that the sixth graders need to complete the ‘Fast Track Advantage Math’ modules to bring them up to grade level before a new model can be effectively utilized. In the future, the experimental model should be tried with seventh graders in an attempt to keep their math skill current. This may open the door to further study at higher grade levels.

Through the thorough reading of appropriate books, journals and reference materials connected with diagnosis, remediation and disadvantage, the researcher had obtained a clear idea about the new research to be undertaken. The hypotheses was formulated accordingly and the specific objectives of the research was emerged based on the review of related literature. It goes without saying, however, that the more thorough and complete the programme of preparation, the more successful and satisfying will be the outcomes of the researcher’s work.
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