Chapter II

REVIEW OF RELATED LITERATURE
Review of related literature

In a research, review of related literature occupies an important place, where it helps the researcher to plan the study properly. A systematic review and analysis of the previous researchers provide background for the development of the present study, along with giving direction to its progress. It provides the researcher to gain better knowledge of the methodology and procedures while conducting the research.

While reviewing the studies importance has been given to the academic skills of learning disabled children especially selected to Reading, Writing and Arithmetic. Researcher has taken care to maintain as far as possible the chronological order of the studies.

Every year number of studies are been completed relating to learning disabilities in Indian Universities. But hardly any research studies have been conducted on learning disabilities in Barak Valley.

The studies have been divided into following heads –

- Studies related to learning disabilities.
  - Studies related to reading disability.
    - Studies related to fading strategy.
    - Studies related to active voice strategy.
  - Studies related to writing disability.
    - Studies related to cursive strategy.
    - Studies related to multi-sensory strategy.
  - Studies related to mathematical disability.
    - Studies related to computer assisted strategy.

2.1 Student related to learning disability

Learning disabilities vary from person to person. Learning disabilities are characterized by a significant difference in the child’s achievement in some areas, as compared to his or her intelligence. Estimation of children with learning disability
appeared in literature range from one to thirty percent from general population. Educating the child with a learning disability begins with assessment process and continues through development of Individual Educational Program. Overall development of a child depends with close collaboration among parent and resource room teachers, regular class teachers and others.

**Gerber (1978)** compared learning disabled and non handicapped children of elementary level of social perceptual ability. Perceptual processing hampers academic related areas and social adjustment of an individual. Two groups of children age seven to eight years, and ten and eleven years were selected, while total number of learning disabled were thirty-two and even non handicapped children were thirty two. Each group was divided into sixteen each, and each group were matched according to chronological age, intelligence quotient, sex and race. Social perceptual ability was measured through the Test of Social Inference, and other subtests were used to measure the factors such as perceptual analysis factor of WISC-R was measured through Block Design and Picture arrangement. The result indicated that in social perceptual ability there was significant difference between the two group learning disabled and non handicapped aged between seven and eight years and even children aged between ten and eleven years. **Lijtmann (1978)** studied fifty three learning disabled children aged from seven to thirteen years who were selected from Evaluation Clinic of Learning Disabled children in the South Barons, to investigate the two minority groups of learning disabled children-Bilingual Puerto Rican and Monolingual Black American children. Among the fifty-three children, eleven were girls and forty-two were boys and they were all above 84 in IQ score. There were thirty-two Bilingual and twenty-one Monolingual. The study indicatd that in language comprehension Bilingual learning disabled children scored lower than Monolingual on Token test, while they were better on other non-verbal tests. The study viewed that Bilingual disabled children have frequently language problem as concluded by diagnostician.

**Trepanier (1978)** study compared the performance of learning disabled children with normal children on two arbitrary and two piagetic memory task where the study hypothesized that learning disabled children although having difficulty in remembering arbitrary stimuli they would use their cognitive operation to action their memory through piagetic memory stimuli. Thirty learning disabled children were
selected from learning disorder clinic and remedial classes ages between seven to ten years, with average or above average intelligence, low visual sequential memory and concrete operational thinking while thirty normal children included from first through fourth grade classroom with average intelligence and visual sequential memory and concrete operational. These students were tested on four memory tasks. Analysis of variance was used for statically analysis. The result indicated that on arbitrary memory task there was significant difference between the two groups while there was no significant difference between the groups in Piagetian memory task. Both the group were able to use cognitive operations to organize their memories while the result indicated that learning disabled children have deficit only in figurative functions.

Conderman (1989) studied the social status of learning disabled children of sixth and seventh grade attending public schools of eastern Iowa. Twelve schools were selected among which 1,077 students participated in the study of which one hundred were identified as learning disabled receiving resource room assistance with comparison to another one hundred non-learning disabled children who were randomly selected from class list and rest acted as raters. The students were identified based on socio-metric questionnaire and self rating questionnaire (both questionnaires by Brown and Hammill, 1983). The data revealed that lower scores were received by learning disabled children on all academic and school related factors compared to non-learning disabled children. Chi-square analyses was used to measure social status, among learning disabled and non-disabled children and it indicated that there was significant difference was observed between star and rejected categories.

Cline (1990) study tried to develop complete picture of secondary learning disabled program by examine learning disabled teachers and supervisor’s perspectives on their programs. The study included seven states, where survey was done to collect data through questionnaire. Response rate of teachers was seventy-two percent and supervisor was sixty-nine percent respectively. The study indicated more comprehensive programming for teachers and supervisors. Excessive time was devoted to paper work and non-teaching duties while minimum time was devoted to consultation and program planning and development. The study found that content area instruction and basic skill remediation were mainly used for instructional programs.
Klein (1990) studied the learning disabled children who showed learned helplessness in response to social failure feedback and factors which are responsible to social failure. The study included children from third, fourth and fifth standard with forty learning disabled and forty non-learning disabled children, while these children showed both positive and negative feedback toward social problem-solving strategies. The relationship was measured between problem solving strategies, social attribution of children and their social perception and verbal communication skills. The result indicated that learning disabled children usually showed learned helpless behaviour in response to social failure feedback than non learning disabled children. Deficit in verbal communication caused children helplessness in response to social failure while negative self-perception and intelligence did not effect.

Oermann (1990) study examined the phenomenon viewing identification of learning disabled children helps in placement in a special education classroom. Six hundred fourteen learning disabled children from urban mid-western setting were taken while they were compared intellectually, academically, and discrepancy (used to identify learning disabled children) over a three year period. To examine the measure of difference in race, level of intellect, age at time of initial evaluation, grade, score of subject (from regular and special education setting), and reading and mathematics scores (subject area) multiple analysis variance was used. Result revealed that there was regression on the verbal IQ score of all subject groups without discriminating in gender, colour, intellect, age at the time of initial identification. Male students who were earlier identified as learning disabled significantly increased their performance on IQ measures, while female decreased in full scale IQ scores. In the measure of academic score and discrepancy half the student demonstrated a decline in relative standing while there was no change in other half. In discrepancy measures involving classroom type, subject area and gender it present complex interaction.

Reardon (1990) studied on comparing the three groups of student's normal, learning disabled and severe behavior handicapped, each group included thirty students. They were compared on cognitive processing (including planning, attention, simultaneous and successive processing) depression and anxiety. The result indicated that learning disabled significantly scored low compared to normal students in cognitive processing. In planning, attention, simultaneous and successive processing
there was no significance between learning disabled and severe behavior handicapped students. In case of depression and anxiety scale, there was no significance between the three groups.

**Spindler (1990)** examined the relationship between verbal learning and motor encoding in learning disabled boys. Seventy-two male students ages from eight– zero to eleven – eleven were taken and divided into three group each having twenty-four subjects language disabled, arithmetic disabled and normal learners. Result reported that motor enactment instruction improved verbal learning of learning disabled children and normal learners. Eleven out of seventy-two students chosen motor strategy for learning and were highest performer.

**Mishra, S (1991)** study examined the factors of home environment affecting the learning disabled and normal children’s language acquisition. Twenty-six children were taken from class I belonging to age group 3+ and 4+ and whose mother neither have speech nor learning deficits. Mean, SD, t test and factor analysis used for analysis of the data. The result revealed that living condition of the home environment and parental objectives had significant effect on the test.

**Tripathi, Tripathi, and Srivastava (1991)** study tried to work up an adequate tool for diagnosing learning disabled children. One thousand fifty-three children were taken from five advantage and five disadvantage schools from grades of class (I), (II), and (III) and age ranging from four to nine years. The collected data were treated with ‘t-test’ Pearson’s Product Moment correlation and path analysis. Result indicated that learning disabled children were significantly poor in recognizing shape of the English alpha character and Arabic numerals presented through various rotated position. In competence level, there was significant difference between learning and non learning disabled children. Mariane frosting development test (MFDT) was used to assess perceptual motor behavior and it was found significant between two groups in whole test.

**Srivastava and Afiah (1992)** studies reviewed learning disability children’s ability in aspects of reading writing language and arithmetic and explore interaction among age sex and religion with reference to learning abilities among elementary school children. The study composed of one hundred fifty elementary school children aged ranging from eight to ten years, belonging to three main religions (Hindu,
Muslim and Christian). Tools used such as Raven's colored progressive matrices, Gray Oral Reading test, Peabody picture vocabulary test (revised version), Joe's spelling etc. Mean, SD, t-test and ANOVA were used as statistical analysis. Result viewed that age had significant effect on disability of reading writing, language and spelling. No significant difference was found between boys and girls having disability in reading, mathematics, language and spelling while writing disability was affected by sex. Religion did not differ significantly on aspects of learning disability.

Poitier-Johnson (1993) compared the three groups of adolescent-normal achievers, underachievers, and learning disabled, (where each group consisted of thirty students) using three different types of recall strategy on memory task. The three recall task are rival recall, free recall and paired associate recall were administered in each group of subjects. The result indicated that the study did not support the distinguish features of learning disabilities which view the failure in using memory strategies. Learning disabled students were less likely to report the use of elaboration strategies to facilitate recall on the paired associate recall task. Recall scores were significantly different between the groups, but it overlap between moderate and high percentage in individual. The study indicated that on the basis of recall scores of the memory, the individual grouping was difficult.

Preston (1993) studied the relationship existing between level of family function and ability of learning disabled and non-learning disabled students in academic performance. Students were selected from sub urban schools grades four through twelve along with one parent participatory. Multiple regression analysis was used. The result viewed that early intervention and support of the family helps in influencing performance of learning disabled children.

Carpenter(1994) study included sixty students from third and fourth grade, boys were thirty-three and girls were twenty-seven. The study examined knowledge structure of average, gifted and learning disabled students through graphical method of measuring structure called ordered tree technique. Through ANOVA two-way, the result found that learning disabled students were less organized in knowledge structure than average and gifted students in ‘ordered tree technique’. Colon-Rodriguez (1994) evaluated the choice of classification model and instrument used to determine discrepancy between intellectual ability and academic achievement of
learning disabled children. The result indicated that model used for classification of learning disabled children had overall lack of agreement. The study revealed that the choice of the classification model is the most significant factor in determining learning disabled children eligibility.

**Macdonald (1994)** examined the relationship between the PASS model in cognitive processes through compensatory strategies and study skill. Seventy adults of learning disability were included. The result indicated that scores of PASS model significantly contributed to prediction of academic achievement of learning disabled adults.

**Rizio (1994)** study compares student between mild learning disabilities and without learning disabilities in regard to effectiveness of In Class support with collaboration to teaching on academic performance of the students. Achievement test was access on general basic knowledge in two content areas. The result that there was no significant difference between learning disabled and without learning disabled groups, and even indicating that with proper intervention mild learning disabled student can academically achieve success as student without learning disability.

**Zammit (1994)** studied on IQ stability of learning disabled students in order to the benefit read ministering the test during mandated triennials. In the study included students who were identified as learning disabled by the school, sample of one hundred and eight age ranging eleven to fourteen. Wechsler scale-1990 and1993 were used for testing. Pearson correlation was used to determine the stability. The study revealed that learning disabled were more inclined to IQ variation than non-learning disabled children, due to their ongoing remediation and specific weakness, their verbal IQ remain stable while performance IQ increased.

**Sharma (1994)** attempted to study the improvement of academic performance of pupil with learning disabilities through Teachers’ Educational Intervention Programme (TIEP). From urban and rural areas of Rayalseema in Andhra Pradesh, forty two teachers of learning disabled and non-learning disabled students were selected. The result indicated that there was a significant difference in mean scores among learning disabled students on pre-post academic achievement tests.
Kogan (1995) studied compared forty learning disabled elementary school students aged from ten years nine months of suburban school district on identifying them through WISC-R and WISC-III. There was no statistical significant difference between these two scales. On WISC-III vocabulary and picture arrangement student performed significantly low while on Digit Span and comprehension the student performed better. Comparing with WISC-R, subtest of WISC-III provided bonus point speed was depressed, difference was significant in picture arrangement only. While measuring the profile patterns associated with WISC-R and WISC-III in performance of learning disabled children. It was indicated that presence PIQ>VIQ pattern. Gupta et al. (1996) study investigated on finding out the usual rate of children with learning disabilities in school Sehore block and construct tool in studying the nature of learning disabilities in Hindi and arithmetic. Twenty learning disabled children comprised the study. It resulted that seven percent of students in class III in government primary schools of Sehore who showed problems in written language, oral reading and recognition of words who had deficits in Hindi, while children with arithmetic disorder showed difficulty in arithmetic operation and concept formation. None the children were able to reach the mastery level of eighty percent irrespective of their gender.

Ramalingam (1996) studied on effectiveness and development of strategy training program for cognitive learning including aspects as memory, comprehension and problem solving comparing learning disabled, non-learning disabled and slow learner children. Included fifty-four student of class IV, from three general instruction schools. The result revealed that strategy training had significant effect on the test of cognitive learning among all the group of children.

Vasanthi(1996)studied mathematical learning disabled children having monolingual, bilingual and trilingual of class VII age ranging from eleven to thirteen years from Government Matriculation and Central Board. The result indicated that there was relationship between mathematical learning disabilities and psychological factors. Variation in socio-economic status of the student effect mathematical learning.

Rukmini(1997) study included thirty learning disabled and thirty non-disabled children age between eleven and twelve years. With special reference to reading
disability, these children were compared between each other on the basis of IQ. Mean, SD and t-ratio was employed in the study to collect data. The major findings of the study revealed that there was no significant difference between learning and non-learning disabled children on full scale score of intelligence. In verbal and non-verbal test score the non-disabled scored higher than learning disabled children.

**Sharma (2004)** study examined the personality characteristics of one hundred eighty learning disabled students from third to fifth grade raging from eight to ten years, from the primary school of Andhra Pradesh including both rural and urban. Based on Scholastic achievement subjects included were spelling dictation test, oral reading test, reading comprehension test and arithmetic test was developed by the investigator along with questionnaire for comparing group of children with and without learning disability. The result came forward with revealing that learning disabled children have problem in adjustment both socially and emotionally and even there was significant affect of gender among learning disabled children.

**Gray (2008)** study examined differentiated instruction which were used to identify learning disabled students in general education classroom, and measured student achievement through teachers stages of concern and level of use of differentiated instruction. Ninety-nine teachers from four schools of Los Angeles Unified school district were taken as sample. The sample responded in two research instruments: (i) survey assessing the teachers' stages of concern in implementing differentiated instruction (ii) intervention format of questions for assessing teaching level of use of differentiated instruction. The study concluded that limited use of differentiated instruction created barriers to teacher's abilities to significantly increase student achievements through differentiated instruction.

**Booker (2009)** study included all eligible students with or without learning disabilities from urban elementary schools of Georgia, where the study employing descriptive, longitudinal, expo facto research design for exploring the impact of the enforcement of No Child Left Behind (NCLD) on students performance on standardized test scores of math and reading. Criterion Referenced Competency Test was used to analyze the student enjoyed advantage relative to the percentage of meeting or exceeding standard in mathematics and reading on the criterion reference
competency test. The study indicated that students without learning disabilities outperform disabled students on the board.

Arhebamen (2011) studied the factors which contributed to the problem of low achieving achievement of student with limited English proficiency. Research question were used in identifying significant factors leading to learning disabilities. Data was gathered from elementary schools in rural area of Edo state, Nigeria through exploratory case study research design. The study indicated there is lack of academic progress of student due to limited English proficiency, poor resources and learning facilities.

Nielson (2012) examined the use of pattern of cognitive strengths and weakness in identifying student as specific learning disabled having deficit in reading. Sample included fifty-five students from class I to III were included who passed the criteria of the test. Multiple regression analysis was used to evaluate; where the result indicated that there was no gender differences in cognitive abilities. But there was significant difference between third grade and first grade in long term retrieval scores. The best comprehension knowledge (GC), Short term memory (Gsm) and Long term retrieval were regarded most important factor for instruction and remediation. In area of reading comprehension fluid reasoning is regarded as predictive of reading ability.

Going through the related studies, it was found that there were some studies which significantly highlighted points of the early intervention by Preston(1993), Rizio(1994); Reardon(1990) pointed difference of cognitive processing; Sharma(1994) and Gray(2008) significantly pointed affect of differentiated instruction which improves in students academic performance.

2.2 Studies related to reading disability

Seventy to eighty percent of children are found to have reading disability. It can affect any part of reading process such as causing difficulty in word-recognition or word-decoding, reading fluency and comprehension. The term reading disability is often applied to those children whose reading achievement lacks below the mental age by two or more years. Improving children with reading disability is a challenging task
which requires intensive intervention. Numerous studies have been done in the field of reading disability its development and awareness.

Kluever (1968) studied used Guilford's structure of the intellect (SI) model to compare the memory of disabled and normal readers. The study included only boys with normal vision and hearing with no emotional disturbance or speech articulation. The sample of sixty boys aged between nine and half and ten and half years, with IQ ranged use 85-115 in WISC full scale were divided in to two groups each thirty. Mean, SD, correlation F-ratio, and t-score and multiple discriminate analyses were computed. The study revealed that in every aspect, disabled readers scored lower mean than normal readers.

Uhry (1989) study examined the development of phonetic decoding strategies of early readers over the course of school year through phoneme segmentation and phonetic spelling training. The skills of reading and phonology were assessed after every eight weeks upon two groups through four times of testing with mixed factorial ANOVA and with repeated measures on time. Training of six and half month was found to be effective to both high and low students, it was found that there was higher effect of reading failure in control group than experimental group who were at-risk of being dyslexic at the times of screening. There was significant difference between trained group and control group at handwritten and spelling skills.

Kovner (1990) studied the use of specific WISC-R IQ criteria in identifying two subgroup of disabled readers and an average reading control group. The study included sixty students ranging from ten to thirteen years each age having five subjects while twenty subjects were divided into three groups who found to meet specific psychometric criteria. One group had below average PIQ but was average in VIQ, another group was average in PIQ but below in average in VIQ. Comparison was made between groups was in numbers of errors in pronouncing versus copying word from memory. The function analyses determined that one of four subtests of the original seven dependent variables significantly discriminated between reading disabled groups. The result revealed that disabled readers were verbally and linguistically deficit, while it failed to indicate differences between the number of errors made while pronunciation and copying the words from memory.
Mohapatra (1991) studied on the measures of decoding and comprehension by investigating differences between the normal and reading disabled children of grade II and IV. From each grade twenty students were selected among which ten were normal and ten were reading disabled. Mean, SD, and ANOVA were used for calculation. Result indicated that the normal students performed significantly higher than reading disabled children of both the grades in decoding and in oral reading.

Rath (1991) studied effect of Individualized Instruction Training approach on children with learning difficulties specially in reading and comprehension aspects. Five students ranging between twelve to nineteen years and whose reading level was below their mental and physical age were included for the study. Percentage was used for analysis and the result revealed that there was improvement in scores after the training session.

Abrahamson (1994) studied thirty-five children, were sixteen are reading disabled and nineteen were normal readers, who were either from second or third grade. These children performance was compared between themselves so as to identify cognitive and phonological processing factors which contributed in math skills. These children were screened on IQ and attention disorder later on reading and math phonological areas Result found that reading disabled children were less competent than normal readers in math.

Wleklinski (1994) examined the relationship between student reading progress with type of reading disabilities, and remedial instructional strategy. The study rendered special education services in development of word-recognition skills in reading disabled students. Four hundred and ten students of elementary level were taken for study. Statistical analyses ANOVA revealed that there was no significant change in student’s reading scores which attributed the factor-types and remedial strategy. It revealed that reading scores were significantly lower than their peer group, even after three years service.

Umadevi (1997) study included dyslexic children studying in grade IV of English medium schools. It examined the effectiveness of remedial programme on improvement of reading comprehension skill. Data analysis revealed that reading comprehension skill of the subjects did have positive impact through remedial programme.
Page (2005) investigated effectiveness of reading strategy of word families and repeated reading phonemes on learning and mildly mentally retarded students who were pre-tested by PIAT (Peabody Individualised Achievement Test). The student of fifth and sixth grade were included which consisted of twenty experimental group, and their score were compared with control group consisting of twenty-three students. ANOVA was used for analysis and it was found that experimental group significantly showed greater gains than control group. While among learning disabled and mildly mentally retarded students, learning disabled showed significant result of improvement on reading recognition through repeated reading.

Anjana (2006) studied the prevalence rate of reading disabled children and impact intervention programme in remediation of reading difficulties. Pre-post experimental design was used. Total population of student included was forty ranging between eight to ten years of grade IV selected from English medium schools of Panipat, Haryana. Mean, SD and t-test was employed for data analysis. The study revealed that 8.68 percent of students were found to have reading disability in grade IV and it reported that it varies from 8.29 to 9.60 percent. It also found that intervention programme was significant in remediating reading difficulties among learning disabled children.

Meta-analysis study of Wolf (2006) tried to provide educators of elementary and secondary school to understand the effectiveness of using reading instruction technology with learning disabled students. The study was conducted from January 1995 to March 2006, where fifty-six studies were synthesized from seventeen was used for analysis, which came forward and twenty-nine distributions. The study revealed that reading technology had positive impact on reading skill of learning disabled students and even helped in improvement of writing language.

Weiss (2008) study investigated four kindergarten factors which were regarded predictive in identification of learning disabled with Individualized Education Program goals in reading at third and fifth grades. The four factors were age on the first day in kindergarten, socio-academic behaviour in classroom, reading skills and sound-symbol relationship in reading skills. Logit analyses were used for Early Childhood Longitudinal study-kindergarten cohort (ECLS-K). The result indicated that entry age of kindergarten, social academic behaviour and reading scores
were significant predictor in determine learning disabled in reading at third grade level. While in fifth grade, reading and social academic behaviour were independently significant predictors for learning disability in reading.

Roberts (2010) viewed that teacher used Instant words to increase reading scores of first and second grade students. The investigator made the study to examine the effectiveness of the Instant Word Notebook in increasing student’s achievement in word-recognition. Both the group experimental and control were taught by Instant Word, while experimental group was taught word by Instant Word Notebook while control group was taught by teacher’s regular teaching strategies. The investigator selected four of nine Marzano et al (2001) instructional strategies for the study. Classroom observation and teacher interviews along with pre and post Instant Word recognition test was used to measure its effectiveness. The data indicated that Instant Word Notebook increases the word recognition capability of first and second grade students.

Sledge-Murphy (2011) studied the relationship between reading comprehension and oral reading fluency of one thousand ninety-four students who were diagnosed through Dynamic Indicators of Basic Early Literacy skills (DIBELS) and Integrated Louisiana Educational assessment Program in the year fall of 2008 and spring 2009.

DIBELS is a diagnostic tool which was used to identify reading disabled children of the state Louisiana and used iLEAP for meeting the child’s needs. Even the study examined the socio-economic states influencing in sub scores of reading achievement. Fifteen elementary school of North Louisiana districts were taken (seven Title 1 schools and eight non-Title 1 schools). Pearson Product-Moment correlation coefficient, linear regression analyses was as statistical analysis. The study found that DIBELS-ORF is significant predictors of student performance on iLEAP sub scores of reading. It also indicated that there is significant relationship between reading comprehension and oral reading fluency.

Larkin (2011) studied five elementary children with dyslexia who were given six weeks learning reinforcement so as to measure the development of reading disabilities. Three areas were assessed through pre-post test, reading fluency, prosody and punctuation comprehension. In a seven-day week, at least five session student
interacted with Ellah’s Tool learning modules. To reinforce comprehension of each week’s story was engaged with multiple senses. The result showed that in reading fluency, there were sixty percent students who showed development, eight percent in prosody and sixty percent in punctuation assessment. Online questionnaire used at home was effective as reported by parents. The study revealed that modern technology has positive impact on out-of-class learning for children with reading disability.


2.2.1 Studies related to fading strategy

Word-recognition plays an important role both in reading and writing skills. There are numerous studies in developing word-recognition ability, but there are hardly any studies related to use of fading strategy suggested by Lucy.C Martin (2009). The investigator has tried her level best in finding the related study.

2.2.2 Studies related to active voice strategy:

Fluency is one of the important components of reading skill which helps the reader to read a text with appropriate speed, accuracy and prosody. Studies shows active voice strategy as important technique to teach learning disabled children

Ferrara (1978) studied relationship between reading and physiological reaction to instruction. Students from grade fourth to eight, having learning disability were included, with sample of seventy-eight. Along with the resource room, corrective reading program was used to improve student reading performance. The lesson oral reading test was used as the pre – post test measure. Multiple correlation equation was used to measure the relationship. The result was found that there was no statistical significant between the physiology behaviour during classroom instruction with improvement in reading.
Shepero (1978) study included sixteen learning disabled children age ranging seven to eleven and thirteen years, examining children’s oral reading performance through comparing between the use of direct and supplemental reading instruction by parents. Both individual and group research design was employed. The result indicated that oral reading performance of learning disabled children improved through direct reading instruction given by parents.

Denning (1990) study compared between silent method using principle pictorial and visual configuration in teaching learning disabled children to read. Children aged between nine and fourteen with severe reading disabilities from the state of Maryland was taken for the study. The study included six dependent variables on which the study was measured. The study found that there was no significant difference between the two methods. The study indicated that pictures played important role in development of reading skill.

Shany (1992) study included twenty-nine subjects from eight urban schools to measure the effectiveness of reading practice on reading process and its speed and accuracy. The students were divided into two groups; where treatment group were taught through oral reading along with corrective modelling by teachers while other group practice through listening to the tape. Result revealed that reading practice based on context has significant effect on measures of performance involving text. Children taught through oral reading performed higher in accuracy for isolated words.

Shepero(1978) and Shany(1992) gave importance to direct reading instruction for oral reading; showing development in fluency.

2.3 Studies related to writing disability

Writing is regarded as one of the most important form of language as it is a basic form of communicator. Writing process mainly rely on encoding of ideas quickly and meaningfully by using multiple functions automatically and simultaneously. But many a times individual with writing difficulty goes unrecognized, which affects in everyday life. Learning disabled children have deficits mainly on handwriting, spelling and punctuations. A few studies are been related to writing disability.
Wiggings (1968) studied the relationship between written language and oral to increase the utilization of a variety sentence structures in a written assignment. One forty elementary students of fourth grade of Columbia, south Corolina belonging to middle-class communities were heterogeneously grouped for instruction. Pre and post experimental design was used. The result indicated that the mean scores showed significant at the. 025 level of confidence between grade placement of the experimental and control group on Form IV of the Iowa Test of basic skills.

Mohite (1989) study attempted for developing screening device for teacher in identification of children with learning difficulties in spelling and reading. From three municipal co-operation schools, forty-two children were included. The study revealed that the tool proved to be effective for experimental group in spelling and reading skill.

Walker (1990) studied reading and spelling in different transfer condition, where in pertained skills learning was based to read and spell. Second level where initial reading and spelling knowledge based for further reading and spelling, third level when learning to read was based on spelling and vice-encase. The major finding of the study related that writing letters, spelling helps children to read.

Cole (1992) study examined the effectiveness of strategy instruction and use of set of structured writing framework on teaching learning disabled students to write sequential expository paragraph. Learning disabled students from class III, IV, V were selected, taking sample of twelve. The findings of the study indicated that students from all the three classes increased in fluency over baseline level and even their performance level on writing increased.

Simle (1993) examined affect a spelling achievement scores on creative writing and effect of creative writing activity on the content and number of spelling errors of student’s writing at fifth level. These different instructional group was taken for study, where first group followed spelling lesson weekly developed by the school district, second group is the first treatment group, which spent spelling time solely on creative writing (where three to eight words were taught in each week), and third group is the second treatment group who spent time solely on creative writing activities. One-way analysis of covariance was used for statistical analysis. The result found that the treatment group one scored significantly higher than treatment group.
two, as they were exposed to spelling textbook or spelling list, but there was no significant difference between each group on the content and number spelling errors in final creative project.

**Fitzhugh (2005)** compared the scores of normal children and learning disabled children in spontaneous writing sample, which is used to assess students writing in mechanics, content and length. One hundred twenty-seven normal children and one hundred seventy-three learning disabled children from upper elementary level were selected for the study. In evaluating learning disabled students in writing samples, the study found that content and length were better predictor than mechanics. To avoid mechanics lessons learning disabled students write less with simple language as compared to normal children.

**Spencer (2008)** study includes students with literacy-based learning disability (LBLD) of middle school, exploring in three different aspects. First, student performance on measures of word reading, where the study included that student significantly performed better in accuracy than in fluency. Secondly, it studied the relationship between writing quality and writing skill. The result indicated that writing quality of student can be positively predicted by spelling ability. Students use easier words when they have poor spelling skills. Thirdly, investigator studied the two factors—content generation and mechanics. It was found that, mechanics had significant effect on content generation, while it did not have any direct effect in quality of writing.

Investigator found that Filtzhugh(2005) study discussed the points of difficulty of learning disabled children.

### 2.3.1 Studies related to cursive strategy

Handwriting is an effective skill which helps in reflecting an individual’s personality. Classroom activities are affected by children’s handwriting competence. Children with handwritten difficulty takes longer time in completing written assignment and it even affects in their scoring in term papers.
Twenty-seven original easy were studied by Sweedler-Brown (1992) in three graphic modes- nicely handwritten, typed and poor handwritten. The result revealed that nicely handwritten scored higher than typed and poor handwritten.

2.3.2 Studies related to multi-sensory strategy

Multisensory strategy is an intervention which is used to improve spelling skills using visual, auditory and kinesthetic – tactile senses. Visual learning includes projection screens, computer models, etc. audio strategy focus on sound music, instrument, rhymes, etc; kinesthetic strategy focus on body movement including flashcard races, clapping jump rope, etc. and tactile strategy using scene of touch including lead trays, sensory putty, finger paints, puzzles, etc. Multisensory strategy proves to have significant impact on spelling development.

Weaver and Rosner (1989) study included twenty-five learning disabled children aged between nine to thirteen years, who were compared on five tests auditory reception, word reorganization, visual reception test, listening and reading comprehension to measure the relationship between visual and auditory perceptual skill and comprehension. The study revealed that these were high significant relation between visual reception, listening comprehension and between visual perceptual skill and reading comprehension.

Khanna (1999) study compared the two methods multisensory instructional and play way approaches in remediating spelling of the learning disabled elementary children in words to anxiety, locus of control and self – concept. The study found that both approaches multisensory instruction and play way approaches were useful in remediating spelling of the children.

Gupta and Pavri (2000) study compared between effectiveness of two approaches TAK/v and VAKT in teaching spelling to disabled children. The study found that TAK/v was more significant in teaching spelling to children.

Devi (2004) studied on effectiveness of remedial measures to remove spelling problems and effectiveness of various strategies. The study included thirty-nine learning disabled children from fourth standard regular school. The study revealed
that there was significant difference between pretest and post test scores of mixed group; it shows that technique used through listening, speaking, reading and writing was useful in removing the deficiencies in spelling among mixed children. The study also covered that TAK/ v was useful in remediating spelling problems.

Observing the related studies, investigator found that Khanna (1999) and Gupta and Pavri (2000) study gave importance to multi-sensory strategy for developing spelling.

2.4 Studies related to mathematical disability

Among school age children four to eight percent have mathematical difficulty due to memory on cognitive deficit. McMenemy Smith stated, ‘Learning disabilities of children often spring from educational factors such as inadequate and insufficient methods of instruction followed by teachers, over emphasis on drill and memorization whereas concept formation seems to be neglected. The instructional defects include hasty introduction of new concepts and techniques before they are emotionally ready. There is also often insufficient attention paid to vocabulary of mathematics by the teachers, so that though the students learn techniques of doing such they cannot understand the language of the question posed’ (Arora, 1982).

Moroz (1978) study comprised of seventy-four students who were divided into two groups learning disabled and non-learning disabled children matched on age and sex and they were drawn from urban public school district of western New York State. The study examined correction between mathematical problem solving ability with memory capacity and memory organization on learning disabled children and non-learning disabled children. All children intellectual ability age ranged between seven - zero and nine - eleven years. t-test, correlation coefficients and two way analysis of variance were used for statistical analysis. The result indicated that strong relationship exists between memory organization and mathematical problem solving in learning disabled children in case of visual and auditory modality while age did not have any effect on mathematical problem solving ability to change memory. Organization even age did affect non learning disabled children. Memory capacity is
most important to mathematical solving ability while memory organization had significant effect on learning disabled children.

Ramaa (1990) studied whether there are sub categories within the group of dyscalculia who find difficulty in doing sums even though they were normal in reading and writing, it even analyzed the kind of arithmetic errors committed by these children and even study tried to find out whether these children demonstrate different pattern of deficiencies in cognitive abilities. The study include ten primary schools of Government and private having Kannada medium of instruction with fifteen children having identified as math disability. The data was compared through errors analysis. Finding of the study revealed that these children failed to solve problems related to spatial and numerical. These children found difficulty in solving simple addition and subtraction problem involving verbal and numerical relations and have difficulty in basic operation involving fraction even in understanding different arithmetic processes. Regard to classification ability, ‘only fifty percent of grade IV was able classify set of signs in terms of odd and even numbers’.

Behrend (1994) study examined the effect of dynamic assessment model in mathematical problem solving processes of primary grade learning disabled students. The study included five students from second and third grade, who were interviewed and observed the type of problem solving strategies they use and the errors they made. The result indicated that the students were able to solve variety of problem including the most difficult addition, subtraction, multiplication and division word problems with multiple step problems and extraneous numerical information. The result indicated that the learning disabled used appropriate strategies to solve problems which gave the need for explicit strategy instruction and provided the student use instructional approaches for natural problem solving processes.

Mehta (1994) study develops thinking strategy for overcoming learning disability. The study included class IV students who were average in intelligence but scholastically backward. The result revealed that thinking skill was improved through strategy of training programme. Even the programme was effective in improving performance of academic areas specially language and mathematics.

Neville (1995) study included five students with learning disabilities of fourth grade mathematics class. The study examined the effectiveness of assessment on
modification on math testing performance of students with learning disabilities. To compare student performance on modified tests and on conventional math textbook chapter tests by alternating treatment design. The result revealed that student’s mathematical knowledge was reflected accurately on paper-pencil measures when the test was constructed and administered on the basis of student’s strengths and weakness.

Goel (1996) study tried to identify arithmetic learning problems of class I students and suggested remedial programmes. Forty students with poor academic achievement in upper KG. and class I having IQ 95-120 were selected for the study. Mean, SD and t-test were employed. The result indicated that in the representation level (R) the student performance was higher than abstract level (A), while in concrete level(C) the student’s performance was much better than representation level and abstract level. It revealed that for mental structures and concept development concrete objects helps in actual manipulation.

Goel (1997) study examined the types of arithmetic difficulties and its specific pattern. The sample consisted of three hundred students of class I and II from rural and urban schools, but having IQ range between 90 to 120 and poor in arithmetic. With mean, SD and t-test and correlation the data was employed. The data revealed that student with learning problems have arithmetic difficulty and are identified to have memory, reading and language problem; they confuse symbols, inability to subtract and lack of computational skill.

Shih (2005) study investigated the meta-cognitive functioning of student of learning disabilities in comparison to low-achieving student and average achievement students with relation to math solving problems and comparing between student receiving instruction in number sense able to generalize their understanding of number and number system against untaught math skill students. A single subject multiple treatment design was used on six students showing early math learning disabilities. The result indicated that student receiving repeated practice through number sense showed better initial performance on fact of retrieval and was able to generalize their learning on tasks such as solving word and problem.

Oz (2008) student effectiveness of home- based condition of poor families in early intervention of math. Two parent- child were participated in the study, semi-
structured interview was conducted before the intervention. The result stated that collaborating work at home by parent and child helped in increasing number sense skills of children. The study indicated that parent used different strategies during session while teaching math.

Ota (2008) studied on response to instruction model. The study investigated the responsiveness of the elementary student of the instruction for mathematical calculation. The study assumed that learning disabled student would progress after receiving empirically derived intervention, learning behind placement in general or special education. Students were selected through experimental analysis and single subject design which was used for measuring the effectiveness of mathematical calculation of the intervention. The result supported the assumption, as the study indicated that empirically derived intervention helped in enhancing then calculation skill of student both with and without learning disability and they maintained the skill even after intervention phase. The study supported response to intervention model partially in the area of mathematics and even in identification of learning disabled children in mathematical calculation.

Thompson (2009) studied math scores of learning disabled children from Sparta, who were gathered to examine least restrictive environment affect on Tennessee comprehensive assessment program and Woodcock mini battery assessment. It also studied whether non-inclusive educational setting and inclusive educational setting affect academic progress of the student. Learning disabled students were included from the school year 2003 to 2008. ANOVA was used to find out significant difference between inclusive and non-inclusive setting. The result indicated that there was no significant difference between inclusion and non-inclusion disabled students on MBA mathematics and Tennessee comprehensive assessment program (TCAP) scores, and even placement did not have any effect on math scores.

Sweeney (2010) investigated meta-cognitive functioning of student in three groups (fifteen learning disabled, thirty-eight low achieving students and twenty-nine average achieving) in the context of math problem solving. It is viewed that deficit in metacognition imbalance the cognitive and meta-cognitive strategies for problem solving. Three components of meta-cognition: meta-cognitive knowledge, meta-cognitive experience and meta-cognitive skills and its influence on students math
word problem solving structured interview and survey was used for solving three math word problems. The study found that different pattern of meta-cognitive function was demonstrated by learning disabled students; even ability group difference was found in meta-cognitive skills. Problem difficulty gave raise to ability group differences in meta-cognitive functioning. Meta-cognitive knowledge was not significant predictor of math word problem solving performance for learning disabled and low achievers while it was significant in academic achievement of students instead with learning disabled and academic achievement students. There was significant difference was found in math word problem solving and meta-cognitive experience.

**Bressete (2010)** study measure the effectiveness of mathematics reasoning performance of fourth grade student with specific learning disability and compared specific learning disabled students to non disabled peers in their performance. t-test was used to compare the data. Five hundred students with specific learning disability and five hundred non-disabled peers were selected and three sub skill areas of strategic competence were measured accuracy, calculation and communication clarity. The result indicated that in sub skill areas significant differences exist between specific learning disabled and non disabled students. Specific learning disabled students showed greatest weakness in multistep problem solving, math communication and geometry, while they needed strength in problem solving task where addition, doubling, and multiplication are involved. The study found that intensive instructional interventions are needed in math to remediate reasoning deficit of fourth grade student with disability.

Ramaa(1990)study gave related points in regard to difficulty of learning disabled in classifying sets of signs while Behrand (1994) gave importance to appropriate strategies in problem solving process.

2.4.1 Studies related to computer based strategy

Computer is an electronic device which helps in solving mathematical problem by performing thousand of addition, subtraction, multiplication and division. Computer is an interactive machine providing feedback and allowing individual to
progress in his work at his own pace. There are various studies showing learning disabled children with mathematical deficit uses computer based instruction.

**Gmitter (1989)** compared micro-computer assisted (MAI), classwide peer tutoring (CPT) and traditional instruction in achievement of computational skill of third grade students. One hundred sixty-two students were selected from third grade classroom; quasi-experimental pre-test and post-test design was used. The result revealed that micro-computer assisted (MAI) was more effective than classwide peer tutoring and traditional instruction. The student learned the computational skill more quickly and showed greater enthusiasm while learning through micro-computer than classwide peer tutoring.

**Sinkis (1993)** study used quasi-experimental model with non-equivalent groups assess computer-instruction on the achievement of Chapter One students. The special strategy JOSTEN Integrated Learning System (ILS) was used to evaluate the impact. Eight hundred students between two to sixth grade were selected. Responses of the respondents were related to various issues regarding computer-assisted instruction in general ad JOSTENS (ILS) in a particular. The study revealed that students significantly achieved higher on test achievement, which were taught through JOSTENS (ILS) than students who did not receive any computer assisted instruction, even school administrators who had positive opinion on computer assisted instruction showed high achievement in comparison.

**Chen (1994)** study investigated effectiveness of computer based instruction on mathematics achievement and problem solving ability along with student’s characteristics. It is meta- analysis study, including seventy- six studies based on the criteria. Statistical analysis system was used to find out the effect of computer based institution on mathematics achievement and problem, solving abilities. Through one way ANOVA, result indicated that there was significant on student mathematics achievement through computer, while there was no significant effect on student’s problem solving abilities.

**Bose (1996)** studied the effectiveness for overcoming specific learning disabilities through remedial strategies of computer programmes. The result indicated that the student performance increased by five percent in math showing higher gains of experimental group than the control group.
Vassiliou (2001) examined the effectiveness of computer-assisted instruction method as an alternative to the traditional method of instruction for the lowest level of remediation in the content areas of mathematics, reading skills and specially determining effectiveness of the two strategies in terms of student’s success and retention. One hundred forty-nine students were participants of the study. t-test, chi-square were used. The study found that mean scores significantly increases of CAI student over time by 22.74 points to 72.6 points through ACCUPLACER. While in aspect of retention, traditional group of children were slightly higher than CAI group as 82.3 percent and 76.6 percent respectively. Success rate- 86 percent of CAI group passed the initial course, while only 59.8 percent through traditional method. CAI participant scored significantly higher than traditional method in subsequent class.

Seo (2008) study analysed the effectiveness of math Explorer used to deliver meta-cognitive and cognitive strategy instruction in one-step addition and subtraction word solving problem. The study used multiple probes across subject design, including four with mathematical disability. The result found that Math Explorer is an effective method for teaching one-step addition and subtraction with word-problem solving skills with mathematical disabled students.

Stultz (2008) study examined the effectiveness of computer assisted instruction for teaching mathematics in comparison to teacher directed instruction. Basic Math competency Skills Building program for fraction was used to teach mathematical concept to computer assisted group. High school students with specific learning disabilities were included in the study. .05 alpha levels were chosen for all statically analyses. The study indicated that there was no statically significant between the two strategies of instruction, instead the result indicated that other individual characteristics interacted with the method of instruction while teaching specific learning disabled students.

Zunker (2008) study investigated whether computer assisted instruction would help in overcoming the difficulties with learning mathematics and raising motivational level for elementary learning disabled students. A pretest-posttest control group design was used where one-way analysis variance was used for statically analysis. Result showed that learning disabled students improved in mathematical ability and motivational level after being instructed through computer.
Machanja (2009) study tried to determine the uses of computer in improving the problem solving skills of students and determining their attitude towards learning mathematics through computer assisted instruction. It includes eighty students for experimental design study. Result indicated that experimental group performed significantly higher than the control group and even students showed positive attitude towards the use of computer assisted instruction in learning mathematics.

Mohammed and Kanpolat (2010) study investigated usefulness of computer-assisted instruction on improving classification skills of second graders who are at-risk of learning disabilities. Repeated measures, t-test and ANOVA were employed for data analysis upon sixty-eight participant who were at-risk for learning disabilities. The result indicated computer-assisted instruction had significant gain in second-graders who were at-risk for learning disabilities.

Gesbocker (2011) studied effects of computer assisted instruction against traditional method of instruction in improving seventh grade students’ ability to master basic math facts and effectiveness of CAI in gender discrimination. The study examined upon nine hundred ninety-eight students from sixth, seventh and eighth grade. The result showed that traditional method was insignificant compared to computer assisted instruction, and there was no significant between male and female in 2-min drill scores. In whole result indicated that computer assisted instruction had impact on mastering math basic facts.

Going through the studies, investigator found that Gmitter(1989), Sinkis(1993),Bose(1996) and Seo(2008) gave importance to the use of computer in teaching learning disabled children as its an effective strategy.