Chapter II

REVIEW OF RELATED LITERATURE

The present researcher went through the studies pertaining to her field of research to find out what has been done, what remains to be done, and to compare her interpretations of factors with those of the former researchers. She came across the following relevant studies:

**Brown (1910)** carried out a research to answer the question as to whether there is a unitary trait of mathematical ability. Using the technique of partial correlation, Brown came to the conclusion that geometrical ability was related to algebraic ability only through the mediation of arithmetical ability. The defect of the partial correlation technique is that it is usually uncertain as to what exactly is being partialled out, as Brown’s conclusions were only tentative.

**Brown (1913)** himself later stated an opposite point of view that the balance of evidence seems to be in favour of the existence of a special capacity or faculty underlying mathematical ability distinct from and with essentially no close connection with other forms of intellectual capacity.

**Rogers (1918)** carried out an investigation by factor analysis of the scores on geometry tests and found that the geometry tests have a high loading on the special factor.

**Blackwell (1940)** carried out a study by factor analysis of the attainments in the following tests, viz., Arithmetic Reasoning,
Missing Number, Algebraic Computation and Reasoning, Spatial, Geometry, Selection and rejection, Selection of Words in Context, Analogies, Sequences and Mixed Relations.

He found that the first factor of importance in the mathematical ability of boys & girls is a common factor which appears to be similar to the ‘g’ of Spearman. This factor, in both sexes the most important component of mathematical ability, is described as the capacity for selective, quantitative thinking and deductive reasoning, involving the ability to apply general principles to particular cases in number, symbolic and geometric work, and the power to abstract, generalize and use the essential features of a given situation and to make deductions from these for the elucidation of other complex situations.

Next in importance comes a factor which has been designated O, an operation in imagery factor, involving the manipulation of spatial and verbal data. This factor is found to play a relatively larger part in the mathematical ability of boys than of girls, being involved in a greater number of tests of a verbal character.

A difference in the mathematical functioning of the two sexes is shown by the third factor too. In the case of girls, a factor of verbosity ‘v’, operative in the verbal tests, is clearly defined and can be named with confidence. In the case of the boys, however, the actual character of the tests with significant saturations of this factor suggests that in their case verbal material is used in a psychologically different manner. This factor which has been named w, is not purely verbal, but rather a verbal reasoning factor, which from this study,
appears to involve the power to manipulate ideas in a verbal form, to wield words, to classify them and to make deductions from them.

Barakat (1951) carried out a research on the analysis of a mathematical ability of boys and girls. He took some care in assembling his test battery to envisage the sort of pattern-factor which was likely to emerge. His tests included a nonverbal intelligence test, a test of verbal reasoning, a letter series test, several memory tests, some number tests and a spatial test, as well as of mathematical ability. He planned to allow six possible factors to emerge from his analysis (1) general, (2) verbal, (3) spatial, (4) mathematical, (5) numerical, and (6) memory. His mathematical tests were much closer to attainment tests. He employed Burt’s technique of group factor analysis and concluded that “after eliminating the effect of the general factor of intelligence there was a significant tendency for the mathematical, symbolic, and numerical tests to cluster together and further that three mathematical achievement tests form a possible sub-division of their own; and the factorial results indicate that the verbal facility is not necessarily needed in mathematical thinking. The appearance of the negative signs in the verbal factor, in case of numerical and mathematical tests indicates that mathematical reasoning may be hindered when accompanied by language and verbalization. Barakat also showed that his geometry test had an appreciable loading on a spatial factor.

Wilson et al (1954) administered fifty three tests designed to measure aspects of creative thinking to 410 air cadets and students officers (adults). The scores were intercorrelated and sixteen factors
were extracted. Orthogonal rotations resulted in fourteen identifiable factors. These factors were:


Lee (1955) for a study of specific ability and attainment in Mathematics, constructed twelve tests of mathematical ability and fifty three attainment tests to assess how far mathematical ability enters into success in School Mathematical Work. Two intelligence tests (one verbal and one non-verbal) were combined with the ability tests.

The intelligence tests and the tests of mathematical ability were administered to 100 boys and girls in each of five year levels of school course. The attainment tests administered to children at any one-year level were based on the corresponding mathematical work carried out by the group during the year.

Examination of the raw tests score showed that no testee obtained consistently low marks for the tests of mathematical ability while obtaining consistently high marks for the corresponding attainment tests. On the other hand, quite a number of testees scored well on the ability tests and badly on the attainment test.
From factor analysis, he found that mental abilities working on the tests of mathematical ability also entered into the working on the attainment tests in Mathematics.

An academic validation study by Hill (1957) was confined entirely to mathematics courses at the upper division and graduate level in three institutions of higher learning in the Los-Angeles area. Most of the criterion variables were indications of achievement in different levels of calculus. This study was done in the early days of the ARP (Aptitude Research Project) development, when only few factors of intelligence had been found. The analysis of the psychological nature of these abilities indicates that special factor is playing a dominant part, flexibility and logical evaluation being next to it.

Wrigly (1958) conducted a study by factor analysis of the attainments in Algebra, Geometry and Arithmetic; and the Verbal Tests, Number Tests and the Spatial Tests. The following conclusions were drawn:-

(i) There is a close connection between mathematical ability and general ability.

(ii) There exists a clearly identifiable mathematical group factor. The different branches of Mathematics are linked together more closely than they would be if only a general intelligence factor were in operation.

(iii) Verbal, Spatial and Numerical group factors were isolated.

(iv) Performance in geometry is connected with spatial factor.
(v) Performance in mechanical arithmetic, and to a lesser extent performance in algebra, is in part dependent upon numerical ability as measured by a number factor.

(vi) When the influence of general ability is eliminated, verbal ability has little connection with mathematical ability.

Guilford et al (1961) validated divergent production abilities that seemed quite relevant logically to creativity for younger boys and girls (ninth grade). It was expected that the tests of fluency, flexibility and elaboration that had been successful in determining the factors in young adults could be used with ninth-grade students. The selected factors were ideational fluency, spontaneous flexibility, associational fluency, originality, semantic elaboration, adaptive flexibility, figural elaboration, word fluency and expresional fluency.

All the factors received at least some support. There was some evidence that the same divergent production factors found in adult male population can also be demonstrated to ninth grade population. The same factors were usually found for both the sexes.

Merifield et al (1962) initiated a study to explore the intellectual factors which are supposed to be involved in human adult problem solving.

Guilford et al (1965) validated sixteen SI abilities for ninth grade Algebra and concluded that:

(i) Batteries of factor scores were better predictor of achievement than any of three standard tests combination especially in the prediction of achievement in algebra.
(ii) Numerical ability was a leading predictor in all mathematics courses except accelerated algebra and reading-comprehension was a significant predictor in two courses basic mathematics and accelerated algebra.

(iii) Combinations of factor test scores discriminated between successful algebra students and successful general mathematics students with accuracy of about 90.

Joshi and Pathak (1966) extracted five centroid factors by factor analyzing the scholastic achievement scores obtained by the non-medical group of students in their final Examinations at the Higher Secondary stage. The factors were named as below:

Factor I (Complex Factor of General Mathematical Ability), II (Mechanical Ability), III (Verbal Ability), IV (Non-Symbolic memorization or general memory and V (Symbolic Memorization)

John Mcleod (1968) studied dyslexia in young children with special reference to the Illinois test of psycholinguistic abilities, from factor analysis, the study had the following findings:-

1. It seems therefore that the relationship of reading disability of skills which are tapped by tests such as WISC Coding depends upon the number and/or type of symbols and upon the chronological age of the child.

2. The Illinois Test of Psycholinguistic Abilities discriminated significantly (p 01) between the dyslexic and control group, over and above the WISC. That is, there was still a significant
difference between the two groups’ scores on the ITPA after adjustment had been made for differences in I.Q.

3. Within the ITPA itself, the Auditory-Vocal Automatic, the Auditory-Vocal Sequential and the Auditory Decoding tests discriminated in favour of the control group and Motor Encoding discriminated in favour of the dyslexic group, after adjustment had been made for the difference between the two groups on overall ITPA Language Age, because of a significant heterogeneity of variance of the groups’ on the Visual-Motor Sequential test, data on this test could not validly be analyzed.

4. The dyslexic group was consistently inferior in reproducing visual letter sequences at all levels of approximation to English, that is, their inferiority was neither more nor less marked when zero-order approximations words were used.

**Joshi and Passi (1970)** in a factorial study on a random sample of 200 pre-engineering students whose achievement scores in English, Mathematics, Physics and Chemistry were noted down from the Higher Secondary Examination records of the Punjab University.

They were further given four of the differential aptitude tests, namely, (i) Numerical Ability, (ii) Mechanical Reasoning (iii) Abstract Reasoning, and (iv) Space Relation and the scores on the tests were also recorded.

The technique of cluster-analysis was employed in order to see the factorial nature of the test. They concluded that the following factors were there:
1. General Factor of Scholastic Achievement.
2. General Reasoning Factor.
3. Associative Memory Factor.
4. Scientific Aptitude Factor.

**Michael (1972)** investigated predictive validity of some SI factors for high school modern algebra. On the basis of findings it would appear that mathematics instructors must consider seriously the use of SI factor tests for the selection and placement of students. It will be less time consuming and will duplicate the major psychological operations involved in the curricula.

**Gupta (1974)** administered 9 tests designed to measure the attainment of higher/pre-university passed students in different aspects of physical sciences and mathematics on 200 Non-medical students of Haryana State. The scores were intercorrelated and five factors were extracted. The factors found are: (i) general mathematical ability (ii) general factor of scientific ability (iii) symbol and number factor (iv) deductive reasoning (v) spatial factor.

**Keller (1974)** studied relationship between certain SI abilities with one concept of chemistry i.e. “molecular bonding” not with comprehensive course.

**Sharma (1974)** found certain psychological predictors (cognitive and non-cognitive) of science achievement. The cognitive factors studied were well established 20 factors selected from the studies of Guilford, Thurstone, Catell and Taylor and were measured through 45 tests. Three non-cognitive factors were also included.

Thus it could be inferred that the psychological factors included in the study could discriminate between awardees. This study was confined to NSTS awardees and non-awardees only. The testing time was of very long duration (14 hours). Since the size of the sample was very small (N=70), and sample was not representative one of the whole population for chemistry course (The sample was taken from only one school i.e. Calcutta Boys school).

Spero (1974) found that the factor tests of SI model are more effective than previous course grades in predicting pssc physics course achievement. Ten factors from SI model were selected to find out correlation between those selected factors and measures of achievement in physics. Out of ten SI factors selected only seven were found most significant. It was found that the factor tests of SI model are more effective than previous course grades in predicting pssc physics achievement.

Majumdar (1976) administered the “Scientific Creativity Achievement Test (SC), the Culture Fair Test and the Mandsley Personality Inventory to 60 Indian higher secondary science students of Lady Irwin School, New Delhi. The criterion was the marks scored by the students in Delhi higher secondary (science) examination. The SC test was administered on the sample in July-August 1973 and
results in examination were collected for the same sample in 1974, April. Product moment correlation between various variable were found out. The results indicated that the SC test has significantly high predictive validity with respect to achievement in science courses (physics, chemistry, math and biology).

Adkins (1979) reported in a study that understanding of gram molecular mass concept in chemistry is mainly facilitated by a student’s mathematical ability.

Michael (1981) found the factorial validity of three measures of critical thinking within the frame work of construction provided by Guilford’s structure of intellect theory for a sample of 35 ninth grade students

Ignatz (1982) identified sex difference in predictive validity of SI factors for physics achievement. The purpose of the study was to determine the relationship of each of 12 selected SI cognitive factors to physics achievement.

In other study, Hyman (1982) found a significant relationship between the initial and spatial visualization ability (CFT in terms of SI ability and achievement in organic chemistry).

Thompson and Anderson (1983) investigated the construct validity of divergent production subtests from the structure of intellect learning abilities (Soil A) test. This test was designed on the basis of Guilord’s model but the population was elementary school children not adults:-
Chauhan (1984) validated certain abilities to predict achievement in tenth grade algebra. The study had the following objectives:

1. To determine the pattern of selected abilities as predictor of achievement in tenth grade algebra.
2. To examine the relevance of previous finding in this regard to Indian situation.
3. To investigate sex differences in the role of abilities in predicting achievement in Algebra.

Results:

1. Out of the eight SI abilities selected for the present investigation only 3 were found to be relevant for prediction of achievement in Algebra.
2. The finding did not completely concide with the finding of previous studies, since out of eight most relevant SI abilities selected. Only three were found relevant in Indian situation.
3. The pattern of predicator variables exhibited sex differences.

Lyn Gow, David Kember and Rosalia Chow (1989) provided evidence of a relationship between a surface approach to learning and low level of English Language ability among auxiliary language students. Students who were weaker in English language tend to use a surface approach to learning. It seems that students who have limited proficiency in the language might have to resort to surface strategies whereby they decipher small chunks of information to be reproduced in the examinations. These findings are interesting particularly with regards to the implications for instruction.
However, with the exception of the work of Biggs (Biggs, 1987a; Cantwell & Biggs, 1988), there have been no other studies of this type cited in literature.

Pintrich, Paul R (1990) carried out a research on motivational and self regulated learning components of classroom academic performance. It is found that self efficacy and intrinsic value were positively related to cognitive engagement and performance, self-regulation, self-efficacy and test anxiety emerged as the best predictors of performance. Intrinsic value did not have a direct influence on performance but was strongly related to self regulation and cognitive strategy use, regardless of prior achievement level. The implications of individual differences in motivational orientation for cognitive engagement and self regulation in the classroom are discussed.

Tanwar, B. Prakash (1994) carried out a research on a factorial study of ability involved in learning different aspects of Chemistry at Senior Secondary Stage. The major findings of research were (1) the score distribution of this paper had to be normalized by transforming the score on the ‘T’ scale. (2) The reliability coefficient of the present test is satisfactory. (3) Factorization was carried up to five factors only in one reiteration. (4) Thurstone’s method of extended factors was preferred, because it was likely to lead to the simple structure. (5) ‘Factor A’ may be called a “conceptual and visual perception factor”. It has a very high correlation with Factor E (Inference factor). (6) Deductive reasoning factor has an appreciable correlation with all other factors except with mechanisms/nomenclature factors. This is
understandable since deductive reasoning is required in all branches of chemistry. (7) Factor “C” is regarded as a “Mechanisms and Nomenclature factor”. (8) Factor (Mechanism factor) requires some mathematical manipulation in the form of addition and removal of chemical species from a compound. Similarly Factor B (Deductive Reasoning) requires logical reasoning in the form of mathematical manipulation. (9) On the basis of electronic configuration, examinee can draw inferences. We may call this factor as an inference factor. This factor has very high correlation with Factor A (Conceptual and visual perception).

D. Scott Enright (2001) and Mary lou Mc Closkey (2001) found that the processes of children’s first and second language development has yielded a number of insights which have been combined to create the communicative language teaching model. This model should be useful to English as second language (ESL) teachers; both in planning their own instruction and in advising the increasing numbers of regular classroom teachers with limited English-speaking (LES) students in their classes. This article summarizes the central assumptions of the communicative language teaching model and specifies the potential difficulties that regular classroom teachers may face in adopting it. It then presents seven criteria to be used in organizing communicative classrooms and describes specific application of these criteria to decisions about organizing classroom interaction and the physical environment.

Kember, David (2003) published his paper “understand: Another approach to learning” and he found that in distinguishing
deep and surface approaches, an important determinant is the intentions to understand and memorize respectively. A student adopting a surface approach does not seek understanding and, therefore, relies upon memorization. Understanding and memorizing are, then, seen as almost mutually exclusive as far as intent is concerned, although those seeking understanding may make some strategic use of memorization for particular tasks. This paper reviews emerging evidence of an approach which combines memorizing and understanding. The research has been conducted in the Asian region, and so provides part of the explanation for the “paradox” of the Asian students. There has been widespread anecdotal evidence of rote-learning and yet Asian students are often high achievers. Several plausible explanations for the occurrence of the approach are advanced. These include limited ability in the language of study leading to a narrow systematic pattern of study, cultural traditions respecting order and diligent study, and the need for children to learn the language characters.

GWO-Hsiang Tzeng, Cheng-Hsin Chiang and Chung – Wel Li (2007) carried out a research on evaluating intertwined effect in e-learning programs. A novel hybrid MCDM model based on factor analysis and DEMATEL. It is observed that internet evolution has affected all industrial and commercial activity and accelerated e-learning growth. Due to cost, time, or flexibility for designer courses and learners, e-learning has been adopted by corporations as an alternative training method. A large effort has been made regarding e-learning effectiveness evaluation; however, a generalized quantitative evaluation model, which considers both the
interaffected, relation between criteria and the fuzziness of subjective perception concurrently, is lacking. In this paper, the proposed new novel hybrid MCDM model addresses the independent relations of evaluation criteria with the aid of factor analysis and the dependent relations of evaluation criteria with the aid of DEMATEL. The AHP and the fuzzy integral methods are used for synthetic utility in accordance with subjective perception environment. Empirical experimental results show the proposed model is capable of producing effective evaluation of e-learning programs with adequate criteria that fit with respondent’s perception patterns, especially when the evaluation criteria are numerous and intertwined.

Ya-Ting C Yang and Chai-Ying Chan (2008) conducted a research on comprehensive evaluation criteria for English learning websites using expert validity surveys. This study aimed to develop a set of evaluation criteria for English learning websites. These criteria can assist English teachers/web designers in designing effective websites for their English courses and can also guide English learner in screening for appropriate and reliable websites to use in increasing their English course and can also guide English learners in screening for appropriate and reliable websites to use in increasing their English ability. To fulfill our objective, we employed a three-phase research procedure (a) establishing a preliminary set of criteria from a thorough review of the literature, (b) evaluating and refining the preliminary criteria by conducting interviews with in-service teachers and learners, and (c) validating and finalizing the criteria according to expert validity surveys. The established criteria
have 46 items, classified into 6 categories (the number of items within the category) – general information (12) integrated English learning (13) listening (4), speaking (6), reading (5) and writing (6). The general information evaluates the authority, accuracy, and format of the learning websites. The integrated English learning evaluates the overall information relevant to English learning materials as well as the common features of the four language skills. The criteria for listening, speaking, reading and writing, for example, examine the suitable intonation, skills of discourse, classification of reading articles by their attributes, and the proper use of discussion boards for students when practicing their writing skills. Based on qualitative and quantitative analysis of the interviews and expert validity surveys, we confirmed the effectiveness of the developed evaluation criteria with satisfactory indices of inter-rater reliability, content validity and factorial validity.

Jane R. Shore and John Sabatini (2009) published research report on “English language learners with reading disabilities: A review of the literature and the foundation for a Research Agenda”. It contains the issue of identifying reading difficulties and disabilities in English Language learners (ELLs) is a complex one. It is an area that draws on the diverse disciplines of first-and second language acquisition, literacy, English language learning, and reading, including differences and disabilities research. This literature review aims to synthesize the research that aims to address the topic, focusing on the following three questions:
1. How does one identify reading difficulties/disabilities (RD) in individuals who are learning the English language?

2. What needs to be done to aid in identifying RD in ELLs?

3. What does one do with this information to support the English reading instruction of ELLs with RD?

The first section of the report covers basic terminology and gives an overview of the problem. The second section presents some of the challenges in distinguishing between what might be normal ELL language development from what might be identified as a disability or difference. The third section reviews reading difficulties in various languages and then focuses on reading difficulties when learning a second language. The fourth section provides an overview of the issues surrounding the process of identifying reading difficulties or differences in ELLs. The challenges begin at referral to services and span to measurement of disabilities. The fifth section provides information on interventions and the application of information gained through assessment. The sixth section, the conclusion, points to key considerations related to the identification of RD in ELLs on the K-12 level, especially in the area of the definition, measurement, and instruction of ELLs identified with RD. It also examines the potential for further development and research of assessment and effective instructional programs. Key findings and implication are summarized in the areas of RDs, referral, current assessment, assessments in development, instructional practices, and teacher preparation.
**Jihui Wang (2010)** carried out a research on how to develop college students autonomous English learning skills and found that the computer aided autonomous English learning model benefited the experimental students (Group A) since they had improved more greatly than other students, who had been taught in traditional way. Besides, the teaching experiments promoted the students English learning attitudes and competence, which would help in future English learning and studying abroad.

It is expected that the students’ positive attitudes towards language learning and their autonomy in learning would lead students to bigger success in the long run and even to their future career. It is strongly hoped that the experiments of autonomous learning in HCFT can be of broad significance to the Chinese college English education system and Sino-foreign joint –program teaching model in improving the teaching effectiveness and fulfilling the final aim of world-wide higher education.

**Hildebrand H.P.(2011)** conducted a research on a factorial study of introversion-extraversion and it is found that previous research suggested that Jung’s Theory of Psychological types could best be examined by factorial methods. Two orthogonal factors of neuroticism and introversion-extraversion were hypothesized in order to explain Jung’s theory. A varied neurotic population was examined on a large battery of tests, and factors identified as ‘neuroticism’, ‘g’ and ‘introversion-extra version’ extracted. Further evidence confirming Jung’s theories was given by using regression
equations and factor scores which enabled criterion groups not included in the original matrix to be correctly identified.

John T. Crow & June R. Quigley (2012) is currently engaged in research in the psycholinguistic aspect and they found that vocabulary study has been based on a word by word approach and, as such, has often been criticized as a component in ESL curricula. This study compares a traditional approach to vocabulary instruction with an approach based on the semantic field of words that appeared in college level reading texts. Half of the words presented to experimental groups (semantic field approach) were randomly selected and presented to control groups (traditional approach), according to the format used in current vocabulary texts. The semantic field approach was based on the association between five related words and a keyword that could be mentally substituted in context. Testing revealed some short-term advantage for the control groups, but no significant differences were revealed on long term testing. Since experimental group were exposed to twice as many words in the same amount of time, the findings lend support to the use of the semantic field approach. In addition, long term testing revealed, for the words in this study, a rightly significant difference favouring vocabulary taught experimentally over incidental learning that may occur during exposure to academic English.

J. Michael O’ Malley and Anna Stewner – Manzanares (2012) conducted the research in cognition and language learning. Recent research on cognition has indicated the importance of learning strategies in gaining command over second language skills. Despite
these recent advancements, important research questions related to learning strategies remain to be answered. These question concern 1) the range and frequency of learning strategy used by students learning English as a second language (ESL) and 2) the effects of training in learning strategies on English language skill. This study, which was conducted with high school ESL students, was carried out in two phases corresponding to the two research questions. In Phase 1, ESL students and their teachers were interviewed to identify strategies associated with a range of tasks typically found in ESL classroom and in other settings. Results indicated that students used a variety of learning strategies but typically used more familiar strategies and applied them to discrete point rather than integrative tasks. In Phase II, ESL students were randomly assigned to receive learning strategies training on vocabulary, listening, and speaking tasks. Results varied depending on the task but generally indicated that strategy training can be effective for integrative language tasks. Results are discussed in terms of implications for teaching and future research.

Keeping in view the need to use well established abilities to predict English achievement like other school subjects, the researcher aimed to conduct a study to explore some abilities with English achievement of students at Secondary stage.