CHAPTER – II

REVIEW OF RELATED LITERATURE

INTRODUCTION

This chapter deals with review of past studies carried out in the field of psychological testing and studies of metacognition in relation to problem solving abilities and self-esteem. Such review can provide guideline for planning and execution of the present research work.

IMPORTANCE OF THE REVIEW OF THE RELATED STUDIES

The search for related material is a time consuming but fruitful phase of any research programme. It helps research worker to find what is already known, what others have attempted to find out, what methods of attack have been promising and what problems remain to be solved.

The importance of the review of the related literature according to Singh & Bajpal1 (2007),

"For any specific research project the researcher must be thoroughly familiar with both previous theory and research. To assure this familiarity, every research project has as one of its early stage, a review of the theoretical and research literature"

According to Brog & Gall (1963), "The literature in any field forms the foundation upon which all further work will be built."

Wiersma (1976) states that, "Educational research is not or at least should not be, carried out in an informational vacuum."

Purposes of the survey of related literature according to Good, Barr and Scats (as cited in Sukhia & Mehrotra, 1996) are as follows:

1. To show whether the evidence already available solves the problem adequately without further investigation and thus to avoid the risk of duplication.

2. To provide ideas, theories, explanations or hypotheses valuable in formulating the problem.

3. To suggest methods of research appropriate to the problem.
4. To locate comparative data useful in the interpretation of results.

5. To contribute to the general scholarship of the investigator.

A review of related literature not only helps researcher for planning of research work, but also provides a degree of familiarity to the researcher with past work done, as well as inputs to the research the vast knowledge pool that has already been tapped. Hence, it becomes extremely crucial to locate, reveal and evaluate the past research reports.

General Guidelines for the Source of the Previous Studies

The concept of Metacognition is in its infant stage in the field of Psychological testing. In developing country like India, researches regarding Metacognition are very few in numbers. Specifically in Gujarat State there is not any standardized tool available to measure the construct metacognition. In such situation, the investigator has to depend upon the international resources available from the internet for the reviews of the past research done in this field.

The investigator has downloaded the scholarly articles and research papers from the internet with the help of INFLIBNET center, Ahmedabad. INFLIBNET - Information and Library Network Centre (www. Inflibnet.ac.in or mirror at www. Inflibnet.ernet.in) is an Autonomous Inter University Centre (IUC) of University Grants Commission (UGC) involved in creating infrastructure for sharing of library and information resources and services among Academic and Research Institutions. INFLIBNET works collaboratively with Indian university libraries to shape the future of the academic libraries in the evolving information environment. Further more, some articles and research papers which are not freely downloadable from the INFLIBNET centre were purchased online from their publishers.

2.1 STUDIES CONDUCTED ABROAD

*Bisanz, Vesonder and Voss (1978)* showed that there are developmental differences between young (i.e., first and third grade students) and older children (i.e., fifth graders and college students) in the ability to monitor current knowledge in
memory and in how the results of monitoring are used in the allocation of study effort. These authors first asked students to learn lists of picture pairs. Knowledge of the picture pairs was tested by presenting students one of the pictures from each pair to serve as a cued recall for the second picture. After all of the picture pairs were tested, students were told that they were going to learn all of the picture pairs until they got them all right. They were again presented with each of the picture pairs and asked to answer whether they had gotten each correct. They were then encouraged to try to remember each. After all the picture pairs had been restudied, students were retested. This procedure was followed until each student reached a criterion. Results showed that discrimination between correct and incorrect items was accurate for all grades, although first grade subjects made more false positives (i.e., said they had gotten a pair correct when in fact they had not) than older subjects. In addition, older students utilized their on-going monitoring judgments by allocating greater study to those items they had reported as incorrect, whereas younger students were less inclined to do so. Thus, students at all four grades could monitor current knowledge and processes in memory, but monitoring ability increased with age. Moreover, older students were more inclined than younger students to use memory monitoring information to allocate greater study to those items they had monitored as incorrect.

Flavell (1979) was one of the early researchers to recognize metacognition as thinking about your thinking or "knowledge and cognition about cognitive phenomena". Metacognition refers to higher-order mental processes involved in learning such as creating learning plans, using appropriate skills and strategies to solve a problem, making estimates of performance and calibrating the extent of learning (Dunslosky & Thiede, 1998). Researchers distinguish between metacognitive knowledge and metacognitive regulation (Schraw & Dennison, 1994). Metacognitive knowledge is comprised of declarative knowledge (knowing which learning strategies work and which ones do not work), procedural knowledge (knowing how to use learning strategies) and conditional knowledge (knowing when and why to use strategies). Metacognitive regulation refers to activities that control one's learning, such as planning, information management strategies, comprehension monitoring, debugging strategies and evaluation of progress and goals. One line of metacognition
research has shown that metacognition is an important predictor of academic performance; students able to effectively distinguish information they know and do not know are more likely to review and retain new information (Dunning, Johnson, Ehrlinger, & Kruger, 2003; Dunslosky & Thiede, 1998; Kruger & Dunning, 1999). Metacognition has been described as a discrepancy-reduction strategy where the learner begins study by setting a specific desired state of learning for the material (Dunslosky & Thiede; Thiede, Anderson, & Therriault, 2003). The student allocates resources to learn new information and monitors the degree to which new material has been learned. Learning is discontinued when the student believes that he or she has mastered the information and achieved the desired state of learning. A second line of metacognitive research has shown that metacognitive training, even if administered for a short time, can improve performance considerably (e.g., Nietfeld & Schraw, 2002; Thiede, Anderson, & Therriault, 2003). These researchers have shown that students provided with metacognitive training, in addition to task-based training, are likely to improve their performance scores much more than students who receive only task-based training. Even more encouraging is that academically weak students are found to benefit from metacognitive training (White & Frederiksen, 1998). Since all students do not spontaneously engage in metacognition, some require explicit training and coaching to learn such skills (Chi, Bassok, Lewis, Reimann, & Glaser, 1989; Lin & Lehman, 1999).

Corsale and Ornstein (1980) provide an example of this category of metacognitive research. Third- and seventh-grade students were assigned to one of three conditions, each condition receiving different instructions concerning a sorting task that used semantically unrelated pictures. Students in one condition were instructed to sort pictures into groups that "go together," however, they were not told that they would need to subsequently recall the pictures; students in a second condition were instructed to sort the pictures so that they would be able to recall them at a later time; and students in the third condition received a combination of the instructions given to the other two conditions. Results showed that for seventh-grade students there were no differences among the three conditions in the amount of recall. Apparently, even the seventh-graders who were not forewarned of the recall task were

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able to use organizational strategies to facilitate recall on a par with those students who had been forewarned. Surprisingly, third-grade students who were told to sort the pictures for later recall performed worse than third graders in the other two conditions. Even though these younger students later indicated that they knew a sorting strategy would help their recall, being forewarned of future recall did not help them develop such a strategy. Their production deficiency could be explained by a lack of knowledge concerning the kind of strategy to use with unrelated items or when a strategy should be used. But, for whatever reason, by the time students reach seventh grade, knowledge of strategy production and use appears to develop.

In a study by Salomon, Globerson and Guterman (1989), a Computer Reading Partner presented four reading principles and metacognitive-like questions to seventh graders as they read texts. The reading principles taught by the Computer Reading Partner included generating inferences, identifying key sentences, creating images and summarizing. Those students who worked with the Computer Reading Partner reported more mental effort, showed far better metacognitive reconstruction and improved more in reading comprehension and quality of written essays than did those who received embedded factual or inferential questions in the text or who simply read the texts.

McLain, Gridley, & McIntosh (1991) had evaluated metacognitive reading awareness inventory named Index of Reading Awareness prepared by Jacobs & Paris in 1987, for the students belong to grade 3 to 5. Subscales of the scale were Evaluation, Planning, Regulation and Conditional Knowledge. The results indicated that the scale should be used cautiously as a measure of metacognition in reading. Thomas (2003) had developed the metacognition orientation learning environment scale-Science, for the students of age group of 14 years to 17 years. Subscales of the MOLES-S were 1) Metacognitive demands, 2) Student discourse, 3) Student-Teacher discourse, 4) Student voice, 5) Distributed control, 6) Teacher encouragement and Support, 7) Emotional Support.

Delclos and Harrington (1991) found that fifth and sixth graders who received problem-solving training combined with self-monitoring training solved
more complex problems and took less time to solve them than did control students and those who received only problem solving training.

King (1991) taught fifth-grade students to ask themselves questions designed to prompt the metacognitive processes of planning, monitoring and evaluating as they worked in pairs to solve problems. The students in this guided questioning group performed better on a written test of problem solving and on a novel problem-solving task than did students in an unguided questioning group and a control group.

McLain (1991) conducted a study, “Value of a Scale Used to Measure Metacognitive Reading Awareness, University of Houston. In 1987, Jacobs and Paris had developed and used a multiple choice instrument called the Index of Reading Awareness. That scale was used to measure Metacognitive Reading Awareness (IRA). However it was not clear from their results whether the IRA was a reliable or valid way of measuring metacognition in reading. The purpose of this study was to determine preliminary reliability and validity data on the scale. The sample consisted of 145 students in the third, fourth and fifth grades from a laboratory school affiliated with a mid sized public university in the Mid West. The average age was 10 years, with standard deviation of 10 months. There were 76 males and 69 females. The Index of Reading Awareness (IRA) and Wood cock Reading Mastery Test-Revised (WRMT-R) were administered on the sample students. Cronbach's alphas for the IRA subscales were as follows: Evaluation: .31, Planning: .32, Regulation: .15 and Conditional Knowledge: .20. Internal consistency reliabilities for the total test score were calculated using both item (.61) and subscales scores (.56). Reliabilities of the subscales from .15 to .32 were too low to support use of the subscales as separate scores for any analysis. The validity of the scale was examined with two different aspects. If performance on the IRA conforms to the proposed developmental nature of metacognition in reading then scores should increase with age. However, there was significant differences between third and fourth graders and third and fifth graders but not between fourth and fifth graders. The second aspect of the validity was the relationship between metacognition in reading as measured on the IRA and reading comprehension on a standardized reading test WRMT-R. Moderate correlations were found between scores on the IRA and measures of reading comprehension. The
analysis leads to conclude that the IRA should be used cautiously as a measure of metacognition in reading for both research and classroom use.

In the last study to be discussed, Nelson and Dunlosky (1991) used judgments of learning (JOLs) to investigate whether accuracy of memory monitoring of recently learned knowledge was affected by the amount of time that was allowed to transpire between learning and monitoring. A JOL is made after a person has studied an item; it reflects the person’s confidence that a recently studied item will be remembered on a future test. Nelson and Dunlosky hypothesized that if a memory-monitoring judgment is made immediately after an item has been learned, there is a possibility that what the person is monitoring is short-term memory rather than long-term memory. Because future test performance depends on knowledge in long-term memory, a JOL based predominantly on knowledge in short-term memory will be of little predictive value. To test their hypothesis, these researchers asked college students to make JOLs either immediately after learning an item or after a filled delay. They found that JOLs made after a delay were dramatically more accurate than JOLs made immediately or shortly after learning. Thus, in determining whether people can accurately monitor their memories, it is important to consider whether it is long- or short-term memory that is being monitored. Long-term predictions of future test performance based on monitoring of short-term memory are likely to be inaccurate.

Schraw et al. (1994) conducted a study, “Assessing Metacognitive Awareness”. The purpose of the present research was to generate and test an easily administered metacognitive inventory suitable for adolescents and adults. The researchers focused on three related issues: a) whether there was empirical support for the two components view of metacognition, b) whether the two components were related to each other and c) whether either of the components was related to empirical measures of cognitive and metacognitive performance. An initial pool of 120 items was written, including at least eight items in each of the eight categories. Items were piloted on a group of college undergraduates (N=70), revised and eliminated where appropriate. Items with extreme mean scores were dropped. Some highly intercorrelated items were dropped such that only one of these items remained on the
scale. The final version of the instrument consisted of 52 items distributed across the eight scales with at least four items per scale. Ratings on each item were made on 100 mm bi-polar scale adapted from the multidimensional scaling literature. Finally 52 item - self-report instrument was prepared and then administered on 112 females and 85 males, total one hundred and ninety seven (N=197) undergraduates. There was no time limit for the scale. Coefficient a for items loading on each factor reached .91 indicating a high degree of internal consistency. Coefficient (a) for the entire instrument reached .95. The purpose of the experiment 2 was to validate the MAI using empirically derived measures of metacognitive knowledge, test performance and metacognitive regulation. Individuals first were asked to complete the MAI. General instructions were given next regarding the reading comprehension phase of the study. Individuals next rated their monitoring ability, completed the practice reading passage and then completed the four reading comprehension tests. The format for each test was identical; Individuals read the story, turned to the next page in their booklet to complete the test and then rated how much confidence they had in each response. Participants were not allowed to look back at text passage once they began the test. There were no time limits on any phase of the experiment. This experiment was carried out on one hundred and ten (69 females, 41 males) undergraduates. Data were analyzed using Factor Analysis, MNOVA and ANOVA statistical techniques. The major findings of the study were: (i) Both experiments strongly supported the two component model of metacognition. The forced two factor solutions observed in these experiments corresponded closely to knowledge and regulation of cognition’ (ii) In contrast, neither experiment supported the multiple subcomponents view of metacognition; (iii) Both experiments reported a statistically significant relationship between knowledge and regulation of cognition (i.e., r = .54 and .45 respectively); (iv) Experiment 2 reported a number of statistically significant relationships among the MAI and measures of metacognitive awareness and performance.

Berardi-Coletta, Buyer, Dominowski and Rellinger (1995) found that college students given process-oriented (metacognitive) verbalization instructions performed better on training and transfer problem-solving tasks than did students given problem-oriented verbalization instructions and those given simple think-aloud
instructions. The process-oriented instructions induced metacognitive processing by asking students questions designed to focus their attention on monitoring and evaluating their problem-solving efforts. In contrast, the problem-oriented instructions focused students’ attention on the goals, steps and current state of the problem solving effort. Berardi-Coletta et al. suggested that future problem-solving research should emphasize the critical role of metacognition in successful problem solving.

O’Neil and Abedi (1996) made an assessment, “Reliability and Validity of a State Metacognitive Inventory: Potential for Alternative Assessment”. The main objective of the study was to establish reliability and validity of a state Metacognitive inventory. In this study metacognition was consisting of Planning, Monitoring, Cognitive strategies and Awareness. The measure had been validated in a series of experimental studies. Initially the self-monitoring questionnaire of 26 items about students' planning monitoring, cognitive strategy used and awareness was prepared. Then it was administered on community college students and university undergraduates (N=120). Then afterwards more items were created for the development of subscales for the state Metacognitive inventory. There were total 39 items in a scale. The state Metacognitive inventory consisted of four subscales of metacognition was administered to a group of 219 community college students along with 20 item math test. Item means, item remainder correlations, factor loadings, commonalities and reliability coefficients were calculated and then 15 items from different subscales were removed. At this stage 8 new items were added to the scale because the sample was of high school students. At this stage 32 item inventory was administered on a group of 230 high school students. Means and standard deviations as well as alpha coefficients for each of the subscales were computed and principal components factor analysis with varimax rotation was applied on the subscale items to see how items grouped together under each subscale. This set of studies investigated two objectives: a) the impact of various experimental treatments on test performance and b) the reliability and validity of the state Metacognitive inventory. In this set of studies, at three different stages the state metacognitive Inventory along with math achievement test was administered. 12th Grade pilot sample (N=213) who received 50¢ per correct test items, 8th Grade sample (N=744) who received 1$ per correct
item and 12th Grade main sample (N=715) who received 1$ per correct item. The major findings of the study were: (i) For the 12th graders, the results of both alpha reliability estimates and factor analysis indicated that subscales are reasonably reliable (alpha above .70) and unidimensional. Further, since the subscales have only 5 items each, they meet the standard of brevity; (ii) The construct validity was measured with respect to construct validity; the following prediction was preliminarily supported: Higher level of state Metacognition would lead to better academic performance. Since the reliability of the inventory is marginal for the 8th graders, the current state metacognitive inventory is not recommended for 8th graders or younger students. This inventory is useful for the 12th graders and older students only.

McInerney, McInerney and Marsh (1997) explored the benefits of training in self-questioning within a cooperative learning context. College students received modeling from the instructor and practice in the use of higher order questions designed to induce metacognitive strategies in cooperative groups. These researchers reported better achievement as a result of the questioning training in the cooperative group as compared to a group who received traditional direct instruction.

Hammann and Stevens (1998) conducted a study, “Metacognitive Awareness Assessment in Self-Regulated Learning and performance measures in an introductory Educational Psychology Course”. This study had two objectives (a) to expand on the previous research of the metacognitive Awareness Inventory (Schraw & Dennison, 1994) by investigating its usefulness in the context of course learning and (b) to investigate the relationship between metacognitive awareness and motivational factors in more ecologically valid context of an academic course. Nineteen volunteers from an introductory educational psychology course at a large eastern university were selected as a sample. Metacognitive Awareness was measured by Metacognitive Awareness Inventory (MAI, Schraw & Dennison, 1994) Motivation and strategy used were measured by the Motivated Strategies for Learning Questionnaire (MSLQ, Pintrich, Smith, Garcia & Mckeachie, 1991) Both the MAI & MLSQ have likert type scales. Academic performance measures included a 20-item multiple choice tests from questions from the course test bank on material covered in class. Online confidence ratings followed each item on the 20-item test. These online
confidence ratings were on a 0-100 mm bipolar scale. Subjects drew a line on the scale, from 0% confidence on the left to 100% confidence on the right that indicated their confidence that the previous item was correct. The second performance measure was of pretest judgments, made before the subjects took the test. These subjects believed they could monitor the accuracy of their performance on these kinds of multiple choice tests. Subjects drew a mark on a bipolar 100 mm scale labeled 0-100, with poor monitoring ability (0) at the left end and excellent monitoring ability (100) at the right. An iterative principle axis factor analysis forcing two factors with orthogonal (varimax) loadings was performed on the item responses for the metacognitive Awareness Inventory. This factor analysis yielded loadings corresponding theoretically with knowledge of cognition and regulation of cognition. Factor loadings also supported Schraw & Dennison's (1994) item loadings. The first objective of the study was to expand upon the pervious research of the MAI by investigating it in the context of learning behaviours and test performance in the context of a college course. The MAI measure of knowledge of cognition was positively correlated with pretest judgment and on-line confidence ratings of the test, pretest judgment was positively correlated with both the test and on-line confidence. Students seemed to be aware of how they would do on tests in this course. In addition, they seemed to be able to monitor their answers to test items. The second objective was investigating the relationship between metacognition and motivation factors in course performance. Metacognition processes and motivational ones appear to be correlated on subcomponent levels related to performance measures. Knowledge of cognition was correlated positively with self-efficacy for learning performance and negatively with test anxiety. Self-efficacy was correlated with test, pretest judgments and online confidence. Test anxiety was negatively correlated with pretest judgment and online confidence. Regulation of cognition was correlated with the individual learning strategies scales of the MSLQ. Metacognitive self regulation (learning strategies MSLQ) was correlated with both knowledge of cognition and regulation of cognition of the MAI. This study provides evidence that students' metacognitive awareness is related to their task motivation and their subsequent use of strategies in preparing for classroom assessment. It seems that students need to be metacognitively
aware of the need to use strategies, knowledgeable about strategies and motivated to use those strategies. Without such awareness, strategy instruction seems futile.

King (1998) developed the ASK to THINK—TEL WHY®© model of peer tutoring to promote higher level thinking (including metacognition), which also featured training in questioning techniques. Learning partners are trained in communication skills, explanation and elaboration skills, question-asking skills and skills of sequencing those questions. Students learn to use a variety of questions, including review questions, thinking questions, probing questions, hint questions and metacognitive “thinking about thinking questions.” A preliminary investigation (King, 1997) indicated that thinking about thinking questions made a significant contribution to the effectiveness of the model in that students constructed more knowledge and increased their awareness of thinking processes. Cooperative learning contexts also can be engineered so that the partner is a computer rather than another student.

Thomas and McRobbie (2001) conducted a study “Using a metaphor for learning to improve students' metacognition in the chemistry classroom”. A constructivist framework was used in conjunction with an interpretive methodology to investigate the effect of an intervention using the metaphor "learning is constructing" on students' metacognition and learning processes. The metaphor was used to communicate with students regarding learning processes consistent with constructivism. Students were initially found to be generally non-metacognitive regarding their learning processes. Despite some students possessing metacognitive knowledge.

Kouider and Carla (2002) conducted a study “Assessing Students' Metacognitive Awareness of Reading strategies”. The main objective of the research was to develop and validate a new self-report instrument, the metacognitive awareness of reading strategies inventory to assess adolescent and adult readers' metacognitive awareness and perceived use of reading strategies while reading. Initially, a pool of nearly 100 items was generated from which the final set of items was constructed. Afterwards, these items were sent to three expert judges. These judges were instructed to review the initial pool of items for clarity, redundancy and readability. The initial review resulted in the elimination of 40 items due mainly to
redundancy among the items used. They field tested the inventory with a large sample of students (N= 825) in Grades 6-12 drawn from 10 urban, suburban and rural school districts in five Midwestern states. In addition to completing the inventory students were asked to mark the items that were unclear or confusing to them. Exploratory Factor Analysis using common factor model was used to identify potential factors or subscales for the 60 item instrument and to help identify any items that might need to be refined or deleted. The screen plot from the first factor analysis suggested that three factors should be retained 1) Global Reading Strategies, 2) Problem Solving strategies, 3) Support Reading strategies. Cronbach's alpha was calculated for each subscale and for each grade level, coefficients ranged from .89 to .93 and reliability for the total sample was .93. A number of other items were reworded or considered for deletion owning to a combination of (a) low factor loading (b) loading on more than one subscale (c) reduced reliabilities or (d) duplication with other questions. The resulting instrument contained 30 items that were reviewed for readability, response format and completeness. These remaining 30 items were reviewed by three raters (expert judge). After some revisions in wording, the inventory was administered to a small pilot group of students. The feedback was used to produce final version of the inventory. This final instrument was administered again to a sample of N= 443 students in Grades 6-12. Factor analysis yielded the same result, three factors or subscales. Cronbach's alpha was calculated for each subscale and for each grade level. Reliability for the total sample was .89. The relationship between self reported reading ability and strategy usage provided preliminary evidence of construct validity.

Pelin Cetinkaya and Emine Erktin (2002) made an Assessment of Metacognition and its Relationship with reading Comprehension, Achievement and Aptitude, Bogazici University”. The main purpose of the study was to construct an assessment tool for metacognition for Turkish regular and gifted preadolescents. The study was composed of two phases. In the first phase, a metacognition inventory was developed. The inventory consisted of four subscales, namely evaluation, self-checking, awareness and cognitive strategies. In the second phase of the study, correlations of metacognition with reading comprehension, achievement and aptitude were tapped. The first form of the self-report inventory was consisted of 53 items and
seven experts evaluated it and rated the items. As a second step, 60 students consisting of 39 males and 21 females, from the Department of Secondary school science and mathematics education of the faculty of education of Bogazici University were administered the inventory. The alpha coefficient was found to be .91. Items with item-total correlation coefficients lower than .15 were eliminated from each domain. Items were then reviewed for face validity. Wordings and grammatical structures were improved. The inventory, after undergoing these processes ended up with 32 questions. In order to measure the reliability and validity of the metacognition inventory a pilot study on 111 sixth grade students, consisting of 60 males and 51 females was conducted. For the internal consistency of the scale, Cronbach alpha and item total correlation coefficients were computed. The value of alpha coefficient was found .87. Results of factor analysis showed that the inventory had adequate construct validity. In the second phase of the study total 206 students of sixth grade were selected based on convenient sampling. A standardized reading comprehension test and metacognition inventory was administered on the students. Students' average grades in Turkish, Mathematics and Science courses obtained by the end of the academic year were used as achievement scores. The result showed that the awareness and cognitive strategies subscales of the inventory were significantly and positively correlated with reading comprehension, self-checking and evaluation. Subscales of the inventory were significantly and positively correlated with science course grades of the gifted students. No significant correlations were found between the metacognition scores and the achievement in the Turkish, Science and Mathematics courses.

Cetinkaya & Erktin (2002) had also developed metacognition inventory for the sixth graders. Subscales of the inventory were Evaluation, Self-checking, Awareness & Cognitive Strategies. Ahmet TOSUN & Metehen IRAK (2008) had translated a Metacognition Questionnaire-30 from English to Turkish. The original questionnaire was prepared by Cartwright-Hatton and Wells in 1997, which consisted of five factors named 1) Cognitive Confidence, 2) Positive Beliefs, 3) Cognitive Self-consciousness, 4) Uncontrollability and Danger and 5) Need to control thoughts. This questionnaire was standardized on university students. Panaoura & Philippou (2003)
had constructed and validated an inventory for the measurement of young pupils' metacognitive abilities in mathematics, for the pupils of grade 4 to 6. According to them, components of metacognition were, 1) Knowledge of Cognition and 2) Regulation of Cognition.

Cetinkaya & Erktin (2002) showed that awareness and cognitive strategies subscales of the inventory were significantly and positively correlated with reading comprehension. Self-checking and evaluation subscales of the inventory were significantly and positively correlated with science course grades of the gifted students. No significant correlations were found between the metacognition scores and the achievement in the Turkish, Science and Mathematics courses.

Mokhatari & Reichard (2002) had developed an inventory to assess student's metacognitive awareness of reading strategies for the students of grade 6 to 12. Subscales of the inventory were Global Reading Strategies, Problem Solving Strategies, and Support Reading Strategies.

Sperling; Howard; Miller and Murphy (2002) conducted a study, “Measures of Children's Knowledge and Regulation of Cognition”. Two studies were conducted to investigate measures of children's metacognition. Experiment 1 presented two versions of a self-report inventory, the Jr. MAI, appropriate for assessing metacognition in children in grades 3-9. Factor analyses are interpreted that illustrate how the items measure components of metacognition. Experiment 2 further addressed properties of the two versions and compared the instrument to other inventories, teacher ratings of children's metacognition and student.

Wu and Tsai (2002) conducted a study, “Development of elementary school students' cognitive structures and information processing strategies under long-term constructivist-oriented science instruction”. The main purpose of this study was to explore the effects of long-term constructivist-oriented science instruction on elementary school students' process of constructing cognitive structures. Furthermore, such effects on different science achievers were also investigated. The subjects of this study were 69 fifth graders in Taiwan, while they were assigned to either a constructivist-oriented instruction group or a traditional teaching group. The research treatment was conducted for 5 months.
Panaoura & Philippou (2003) assessed “The Construct Validity of an Inventory for the Measurement of Young Pupils’ Metacognitive Abilities in Mathematics”. The major objective of the study was to develop an inventory for the measurement of young pupils' Metacognitive ability in mathematics and the examination of its construct validity. Participants included all 246 children in grade four to six of an elementary school. The questionnaire was consisted of two basic parts. The first part measured Metacognitive abilities in mathematics. The initial scale was made up of 30 items. The second part was about their cognitive ability in problem solving in mathematics. The 30 items were checked with respect to skewness and kurtosis and all items were found within normality criteria. The inventory demonstrated an overall high reliability. The value of Cronbach's alpha was .8298. Firstly, exploratory factor analysis was done. Then confirmatory factor analysis and structural equation modeling was used to test hypothesis on the existence of the two first order factors and a second order factor. Fifteen items were dropped depending on their low loading on the hypothesized factors and three items were connected with both the factors. As a result of factor analysis a first order factor contained items for the knowledge of cognition and a different first order factor contained items for the regulation of cognition, the existence of the three common items for both the factors indicated the high correlations between the two factors because of the high correlation between the two basic dimensions of metacognition: knowledge of cognition and regulation of cognition.

Veenman and Beishuizen (2004) conducted a study, “Intellectual and metacognitive skills of novices while studying texts under conditions of text difficulty and time constraint”. This study investigated the nature of the relation between intelligence and metacognitive skillfulness as predictors of novice learning from text studying. Additionally, effects of text difficulty and time constraint were examined. The intelligence of 46 social-sciences students was assessed before studying two texts on different topics. Half of the participants studied the difficult text under time pressure, while the other half did so for the easy text. Metacognition was scored from.

Marcel, Veenman and Anke (2005) conducted a study, “The relation between intellectual and Metacognitive skills in early adolescence”. The first
The objective of this study was establishing to what extent Metacognitive skill is associated with intelligence. As a second objective, the impact of hints on the execution of Metacognitive skill was investigated. Forty-one secondary school students in the age of 12-13 years from a small middle class town in the Netherlands (Delft) participated in the experiment. First a standardized intelligence test (Groninger Intelligence test) was administered on school students. Next, these students solved six Math word problems, three without Metacognitive hints and three including these hints. Metacognitive skillfulness was assessed through systematical observation, while learning performance consisted of performance on a math task and grade point average (GPA). A major finding of the study was that Metacognitive cueing triggers a higher level of metacognitive activities that are explicitly addressed by such cues, as well as other metacognitive activities that implicitly prosper by cueing. Moreover, metacognitive cueing yielded better learning outcomes. With regard to the relation between intelligence and Metacognitive skillfulness, results clearly reflect that metacognitive skills have their own virtue in learning, partly independent of intellectual ability, even for young adolescents who are in an early stage of metacognitive skill development.

Marcantonio, Ana, Giovanni and Judy (2006) conducted a study, “Metacognition as a Mediator of the Effect of Test Anxiety on a Surface approach to studying, Roehampton University”. This study investigated the role of metacognition as a mediator of the effect of test anxiety on a surface approach to studying. The approach students’ use in their study has a significant impact on both the quality of their learning and their academic success. Marton and Saljo first introduced the idea of contrasting "deep" and "surface" approaches of studying. A deep approach requires the cognitive capacity to analyze, re-interpret and give personal meaning to the material being studied. Conversely a surface approach is mainly characterized by rote learning strategies that do not involve significant interpretation and deep understanding of the material being studied. In later work, Tait and Entwistle identified a further orientation to studying: the strategic approach. This is characterized by a target oriented attitude towards academic work. Test anxiety refers to the set of phenomenological, physiological and behavioural responses that
accompany concern about possible negative consequences or failure on an exam or similar evaluative situation. A convenience sample of 109 social science undergraduate students (79 female and 30 male) from two London universities participated in the study. Participants were administered following questionnaires. 1) The Metacognition Questionnaire (MCQ: Cartwright-Halton & Wells, 1997). This measure was developed to assess individual differences in metacognitive beliefs, judgments and monitoring tendencies. The MCQ was also validated in both normal and clinical groups. Scale reliabilities (alpha coefficients) range from .72 to .89. 2) The Approaches and Study skill Inventory for students (ASSIST) - short version (Tait, Entwistle & M. Cune, 1998). This measure was developed to assess individual differences in approaches to studying. Scale reliabilities range from .75 to .87 The hypothesized mediation model was tested using structural equation modeling. The aim of the present study was to investigate the role of metacognition as a mediator of the effect of test anxiety on a surface approach to studying. The results of structural equation modeling supported the meditational hypothesis and suggested that the mediation is complete. Findings suggest that metacognition appears to play a central role in determining whether or not test anxiety leads to a surface approach to studying. The key implication of this finding is that without intervening on a metacognitive level, efforts at reducing test anxiety aimed at minimizing the adoption of a surface approach to studying may well be fruitless.

Spada, Nikcevic, Moneta & Ireson (2006) suggests that metacognition appears to play a central role in determining whether or not test anxiety leads to a surface approach to studying.

Ahmet and Metehen (2008) conducted a study, “Adaptation, validity and Reliability of the Metacognition Questionnaire-30 for the Turkish Population and its Relationship to Anxiety and obsessive compulsive symptoms”. Metacognition Questionnaire (MCQ) was developed and psychometrically studied by Cartwright-Hatton and Wells in 1997, which consists of five factors that were conceptually dissimilar but interrelated. The purpose of the study was to translate Metacognition Questionnaire into Turkish sample, thereby bringing into use a questionnaire that assesses metacognition in psychopathologic as well as in normal sample populations.
for research and clinical implementation. The study included 850 university students from 15 Turkish universities. Mean age of the participants was 21.22 years, 282 were female and 568 were male. In the first step the items of the questionnaire were translated from English to Turkish and evaluated by seven experts with Ph.D. in psychology and advanced English language skills. In the second step three specialists translated the questionnaire in to English and latest version of the questionnaire was consequently formed. Metacognitive Questionnaire 30, Trait Anxiety Inventory and Maudsley Obsessive Compulsive Inventory were administered on the sample students. The MCQ-30 was re-administrated to a group of 49 students 20 days later, for assessing test-retest reliability. Construct validity was evaluated by exploratory and confirmatory factor analysis, exploratory factor analysis revealed that the Turkish version of MCQ-30 has five components, which is same factor structure as the original form. In addition, the fit indices of confirmatory factor analysis suggested an acceptable fit to a 5-factor model consistent with the original MCQ-30. The Turkish MCQ-30 showed acceptable good test-retest reliability, internal consistency and convergent validity. Significant positive relationship between the subscales of MCQ-30 and measures of anxiety and obsessive-compulsive symptoms provided further support for the convergent validity of the Turkish version. Moreover, significant negative correlations were observed between age and MCQ-30 subscales and the effect of gender was significant on some of the subscales.

Marcus and Nathan (2008) conducted a study, “Study Habits, Skills and Attitudes: the Third Pillar Supporting Collegiate Academic Performance”. They pointed out that study habit, skill and attitude inventories and constructs were found to rival standardized tests and previous grades as predictors of academic performance, yielding substantial incremental validity in predicting academic performance. This meta-analysis (N 5 72,431, k 5 344) examines the construct validity and predictive validity of 10 study skill constructs for college students. We found that study skill inventories and constructs are largely independent of both high school grades and scores on standardized admissions tests but moderately related to various personality constructs; these results are inconsistent with previous theories. Study motivation and study skills exhibit the strongest relationships with both grade point average and
grades in individual classes. Academic specific anxiety was found to be an important negative predictor of performance. In addition, significant variation in the validity of specific inventories is shown. Scores on traditional study habit and attitude inventories are the most predictive of performance, whereas scores on inventories based on the popular depth-of-processing perspective are shown to be least predictive of the examined criteria. Overall, study habit and skill measures improve prediction of academic performance more than any other noncognitive individual difference variable examined to date and should be regarded as the third pillar of academic success.

**Thomas, Anderson and Nashon (2008)** conducted a study, “Development of an Instrument Designed to Investigate Elements of Science students' Metacognition, Self-efficacy and Learning Processes”. The main objective of the study was the development of an empirical self-report instrument for providing a measure of students' metacognition, self-efficacy and constructivist science-learning processes. A review of the range of literature related to metacognition, self regulation and constructivist learning processes resulted in the development of an initial bilingual (English and Traditional Chinese) instrument. The items were reviewed by colleagues, including readers of both English and traditional Chinese, from Hong Kong, Canada, the USA and Australia, who had expertise in metacognition, science learning and scale construction. Such scrutiny of the items and their face validity led to the deletion, modification and inclusion of some items prior to field testing. The resulting 72 item initial instrument utilized a five point likert scale. Prior to the large scale field testing of the instrument, advice from a sample of 40 students on the nature of the items and their comprehension of the items was sought. The initial instrument was administered to 465 students across 19 classes of forms two to seven (13-18 years of age) during their science classes of this sample 163 were from form two, 154 were from form four and 148 were from form six and seven. The data were subjected to analysis which employed exploratory factor analysis and Rasch analysis in an iterative manner. The subsequent refinement process resulted in a final version of the self-efficacy and Metacognition Learning Inventory-Science (SEMLI-S) consisting of
30 items and 5 subscales. These five subscales, each reflecting a dimension of students' self-perceived Metacognitive science learning orientation, were named.

1) Constructivist Connectivity (CC)
2) Monitoring, Evaluation and Planning (MEP)
3) Science learning Self-efficacy (SE)
4) Learning Risk Awareness (AW); and
5) Control of concentration (CO)

The value of Cronbach alphas for different subscales were 0.77 to 0.85 which suggests there is an acceptable level of internal consistency among the items for each of the subscales. The discriminant validity for each of the subscales indicated that, while there is some overlap between the dimensions, they each measure distinct aspects of Metacognitive learning orientation. According to Rasch analysis the Real item reliability is .97, suggesting high internal consistency and Real Person Rasch reliability is .92. The person separation index is 3.33, well above the .7 threshold criterion. The point bi-serial correlations are generally high and this suggests that all of the SEMLI-S items are good indicators of a unified construct.

Nbina, J.B. and Viko, B. (2010) conducted a study, “Effect of instruction in Metacognitive self-assessment strategy on Chemistry Students self-efficacy and achievement”. This study examined the effect of instruction in metacognitive self-assessment strategy on senior secondary school students’ Chemistry self-efficacy and achievement. The study also explored the interaction effect of instruction in metacognitive self-assessment strategy and gender in their Chemistry self-efficacy and achievement. The study was guided by five research questions and four hypotheses. A non-equivalent control group pretest and posttest design involving one treatment and one control group was adopted. A total of 192 SS 2 students from Port Harcourt Education zone were used for the study. The Self Assessment Instructional Programme (SAIP) was developed, validated and used for the study. Three instruments: Chemistry Achievement Test (CAT), Self Assessment Scale (SAS) and Chemistry Self-efficacy scale (CSS) were adopted, validated and used for data collection. The results suggested that instruction in the metacognitive self-assessment strategy improve the students’ chemistry achievement and self-efficacy.
Sunday (2010) conducted a study, “Students’ Ability Level and Their Competence in Problem-Solving Task in Physics”. This study was carried out on students’ ability level and their competence in problem-solving task in physics. The study used for the study was selected randomly from four Secondary School in Kosofe Local Government Area of Lagos State. A total of two hundred (200) randomly selected SSS Physics students in Kosofe Local Government Area served as the subject for the study. Three null hypotheses were postulated and tested at 0.05 level of significance to find student’s ability level and their competence in problem-solving task in physics. The instrument used for the study was students’ questionnaire and students’ achievement test. The data collected were analysed using simple regression analysis. The results of the findings showed that students’ ability have significant influence on problem-solving task are discussed.

Johnson, N. (2012) examined Self Regulated Learning In Relation To Certain Selected Variables. The present investigation was carried out in S.R.V.S Higher Secondary school, Karaikal. A sample of 90 XII students was taken for the study. Out of 90 students, 45 students belong to computer Science and 45 students belong to Biology group. Both of the groups have Physics as the compulsory subject. The students are divided into two groups namely control and experimental group based on the mathematical ability and Physics achievement score. Experimental research method with control design was adopted for the study. The major findings of the study reveal that there exists marked difference between Post-test 1 and post-test 2 for the following variables of experimental group in Physics problem solving ability, self regulatory awareness, knowledge of ICT and students attitude towards learning Physics. It is also noted that self-regulatory strategies with interactive multimedia effective for enhancing problem solving ability in physics among higher secondary students.

Sharei, Kazemi and Jafari (2012) conducted a study, “Investigation the effect of emotional intelligence skills and metacognitive capabilities on student's mathematical problem solving”. The main purpose of this study is to investigate of the relationship between emotional intelligence and metacognitive capabilities with
the ability of mathematical problem solving in the students. The statistical sample in this research includes 54 female and 60 male students who were chosen randomly from the Iranshahr high schools in Iran. The Bar-On and Panaoura et al. scales are used in order to assess the emotional intelligence and metacognitive capabilities of the students. The results showed that, there is a significant relationship between the general scores of metacognitive capabilities and emotional intelligence skills and some of their components with mathematical problem solving ability. Regarding gender specificity of the students, the findings represent meaningful difference between males and females in three variables; in fact, the performance of male students was better than females in metacognitive capabilities and problem solving, but the score of female students was higher than males in emotional intelligence skills. Also the results of a multiple regression analysis showed that metacognition and emotional intelligence contribute significantly to the prediction of problem-solving ability. However, metacognition is a stronger predictor than emotional intelligence. The results of this study reveal that, national education system of any country must consider a specific and noticeable position to develop learners non-cognitive variables, such as metacognitive capabilities and emotional intelligence skills at all educational levels.

*Catherine M. Aurah (2013)* conducted a study, “The Effects of Self-efficacy Beliefs and Metacognition on Academic Performance: A Mixed Method Study”. This study investigated the effect of Self-efficacy Beliefs and Metacognition on Academic Performance among high school students using a mixed method approach. A total of 2,138 form four (12th grade) students participated in the study. The mixed-method study consisted of a quasi-experimental approach and in-depth interviews. Quantitative data were collected from self efficacy questionnaire (SEQ), biology ability test (BAT), genetics problem solving test (GPST) and metacognitive prompting questionnaire (MPQ). Qualitative data were collected using in-depth interviews. Quantitative data were analysed using both descriptive and inferential statistics (hierarchical linear regression and factorial ANOVA). Qualitative data were coded, categorized and reported thematically. Regression analysis indicated that self-efficacy was a strong predictor of academic performance. ANOVA analysis displayed
statistically significant differences in metacognition in form of metacognitive prompts between groups. Gender effects were also noted with female students outperforming male students on the genetics problem solving test. Subsequent qualitative data suggested that highly efficacious students did better on the tests than less efficacious students. The metacognitive prompting experience provides a rich environment for the development of metacognitive strategies that can promote problem solving skills among high school students.

Harandi et al. (2013) conducted a study, “The Effect of Metacognitive Strategy Training on Social Skills and Problem-Solving Performance”. The purpose of this study was to assess the effect of Metacognitive strategy training on Problem solving Performance and social skills in high school girls. The population of this experimental study consisted of all high school girls in Yazd city in Iran. Sample size in this study, 80 subjects was selected from the population (random clustering). Subjects completed the Wales’ Metacognition Questionnaire, The Teenage Inventory of Social Skills and Problem-solving Inventory and then randomly. Then were divided two groups of 40. Six sessions (1.5 hour per week) curriculum based on Metacognitive strategies and problem-solving methods and various types of social skills was performed on the experimental group. One week after last session, the same Questionnaires were taken from both groups. Data analyzed with covariance. In the post-test stage, the average scores of the positive style scale of Problem-solving in the experimental group was estimated 21.7, but in the control group 17.32. The average scores of the negative style scale of Problem-solving in experimental group was estimated 16.47, but in the control group 21.77. Conclusion: The results indicated that students in the Metacognitive treatment group significantly improved in both social skills and problem-solving performance.

2.2 STUDIES CONDUCTED IN INDIA

Maqsud (1997) investigated the effects of metacognitive skills and nonverbal ability on academic achievement of high school pupils. Maqsud found that metacognitive ability tends to associate positively with academic attainment of high school pupils
Kumari (1991) studied the problem solving strategies of ten to twelve years of age children and examined their relationship with certain capability (e.g., conservation, combinational thinking, proportionality and probability reasoning). The findings revealed that overall problem-solving ability and the success on different types of problems was significantly and positively related to each cognitive ability, separately as well as globally. There was also evidence for some sequential steps in problem-solving and for different forms of responses to be associated with the tactics used by children. A wide range of variations in the strategies appeared to be related to the nature of problems.

Ponnusamy (2003) conducted a study, “The Impact of Metacognition and Problem Solving Strategies Among Low-Achievers In History”. The present study investigates the impact of metacognitive strategies among lower achievers in secondary schools. Much has been said about the use of thinking strategies in the teaching of History. However, until now, little emphasis has been given to the use of metacognitive strategies in the teaching and learning of History. A teaching task accomplished in the classroom is not a signal that learning has taken place. If learners are to be afforded the opportunity to regulate their own learning, then a metacognitive theory of learning has to be developed in order to redefine the outcome of learning. Based on this assumption, a research was conducted using a quasi-experimental design with pre- and post-tests. A total of 90 Form 4 students were selected and they were divided into three groups. The first experimental group was taught metacognitive and problem solving strategies while the second experimental group received only metacognitive strategy. The control group was taught using traditional strategies. Two teachers were trained by the researcher to teach metacognitive and problem solving strategies for a period of one month. The experiment was carried out for 15 weeks. The aim of the research was to investigate whether metacognitive strategies have an impact on teaching and learning. The results revealed that the group which received metacognitive and problem solving strategies out-performed the other two groups in objective, subjective and essay tests, reported higher metacognitive awareness, used more metacognitive strategies during problem solving, attained higher metacognitive knowledge and could answer more higher level cognitive
questions. With regard to attitude, both the experimental groups showed more positive attitude towards the learning of History compared to the control group. The study showed that metacognitive and problem solving strategies can have a significant impact on academic achievement, metacognitive awareness and metacognitive knowledge. Also, the ability to use and reflect on metacognitive strategies during problem solving can bring about a positive attitude towards the learning of History and the ability to answer higher level cognitive questions.

**Thomas (2003)** made an attempt “Conceptualisation, Development and validation of an Instrument for Investigating the Metacognitive Orientation of Science Classroom Learning Environments”. This study was about the conceptualization, design and validation of an instrument for evaluating the metacognitive orientation of science classroom learning environment. The metacognitive orientation of a learning environment was the extent to which that environment supports the development and enhancement of students' metacognition. The first step of this research was the conceptualization of the dimensions of learning environments that characterize metacognitively oriented learning environments. This conceptualization involved identifying characteristics of classroom learning environments that, on the basis of available research, have been found to influence the development and improvement of students' metacognition and that guide and support students to participate in a learning community where such metacognitively oriented learning and practices are valued. Accordingly, an extensive review of research into metacognition across science education and in other subject areas was undertaken. The characteristics of metacognitively oriented learning environment were reflected in eight dimensions. Items were written that were salient for each of the eight dimensions. The items were written in English and translated in Cantonese because Cantonese was the mother tongue of the student participants. Peers, both English and Cantonese speakers and readers, including bilingual speakers and readers, with expertise in psychology, metacognition and scale construction evaluated the face validity of the dimensions, the items and the instrument in general. Further, 24 practicing science teachers from Hong Kong secondary schools reviewed the items and provided feedback on their salience in terms of suitability for the age levels concerned and the appropriateness of
the language used. Such scrutiny of items in both a linguistic and conceptual sense led to the deletion, modification and inclusion of some items prior to field testing. The result of this process was the Metacognitive Orientation Learning Environment Scale-Science (MOLES-S), a 67-item instrument consisting of eight scales. The instrument employed the use of a five point Likert scale. The initial instrument was administered to 1026 students across 29 science classes of Forms 3 to six (14-17 years of age) students in 16 Hong Kong schools, roughly equal numbers of students from each grade level were sampled. The data were subjected to principal components factor analysis followed by varimax rotation and estimation of the internal consistency. These analyses resulted in a refinement of the initial instrument through the deletion of items and reduction of the scales from eight to seven. Each of the remaining seven scales was further reduced to five items. These seven scales were: (1) Metacognitive demands, (2) Student-Student discourse, (3) Student-Teacher discourse, (4) Student voice, (5) Distributed control, (6) Teacher encouragement and support, (7) Emotional Support. The Cronbach Alpha suggested that there is an acceptable level of internal consistency among the items for each of the scales. For the seven scales, the discriminant validity suggests that while there is some overlap between the dimensions, they measure distinct aspects of the psychological environment. Further, the instrument's ability to differentiate between classes was measured using a one way analysis of variance (ANOVA) with class membership as the main effect. The results show that each of the scale did significantly discriminate between classes. Support for the independence of the seven refined scales was found in the result of the factor analysis on the items.

Imtiaz (2004) conducted a study, “Metacognitive Strategies of Reading Among Esl Learners, Aligarh Muslim University”. This study identified metacognitive strategies of reading among ESL learners. The result showed that there were certain strong agreements to the questions raised in “Assessment of oneself as a reader”. Majority of our respondents pointed out that the reading speed in L2 is better than in L1. The majority also agreed that prior knowledge is used in understanding, that it is easier to read a culturally familiar text and that they were able to anticipate what will come next. Regarding monitoring of one’s reading under the heading
“Knowledge of reading goals”, a large section agreed that they monitored their reading and tried to locate the topic sentence and could recognize reasons for failure in understanding a portion of a text. While the respondents displayed neutrality towards their awareness of the ways in which different texts differ, but when it came to clarifying difficulties in the reading of a text, majority of the respondents were able to overcome their difficulties through indulgence in extensive and intensive reading. In the subsection ‘advance organizers’ as part of the section “Knowledge of reading strategies”, 52.38 % agreed that they skimmed for the main idea before reading and 57.14 % agreed that they also they related the main idea to other related ideas, thus suggesting that there is learners’ awareness about the importance of skimming the main idea and of relating it to others. In the subheading ‘directed attention’ the majority agreed that they attended to tasks of reading while reading. The subheading ‘selective attention’ suggested that the majority established intersential ties by reading the text and by relating it to other texts. The last component of reading difficulty suggested that difficulty level was on account of grammatical structures, followed by text organization, inability to guess sounds and meaning problem.

Ramanigopal (2008) conducted a study, “Self-Esteem and Decision Making Styles of School Teachers.” According to him, A teacher is the focal point in an educational system. Kothari Commission (1964 - 66) emphasized in its report that the teachers are having crucial role to play in educational reform. It also stressed the importance of professional development of the teachers at various levels. The conflict model of decision making is of recent origin. We do not have adequate investigative results to definitely prove the relationship between self-esteem and decision making styles. The present study was conducted to examine the relationship between self-esteem and decision making styles of school teachers. 132 teachers of various higher secondary schools (male 82 and female 50) have participated in the study. Leon Mann's Decision Making Questionnaire I and II were used to collect the data. The findings of the study revealed that (i) there is a significant positive relationship exist between self-esteem and vigilant style of decision making, (ii) there is a significant negative relationship exist between self-esteem and non vigilant styles such as hyper
vigilance, defensive avoidance, rationalization, buck passing and procrastination styles of decision making.

**Nagar, Sharma and Chopra (2008)** conducted a study, “Self Esteem among Rural Adolescent Girls in Kangra District of Himachal Pradesh, Anthropologist”. The present study has been conducted with an aim to know the self-esteem of adolescent girls and the factors affecting in Kangra District of Himachal Pradesh. A total sample of 112 school going girls in the age range of 14 to 19 years were selected from five villages of Kangra district. Self esteem was measured through self esteem scale and the means and percentages were calculated. Results indicated that majority of the girls had average scores of self-esteem with an average of 83.56. Self-esteem scores were found to be positively correlated with the educational status of the girls. The analysis also revealed that the family type of girls affected the scores of self-esteem.

**Anderson (2011)** conducted a study, “Relationship of Self-efficacy, metacognition and performance” to examine the relationships among self-efficacy, metacognition and performance. Regression analysis showed that the relationship between self-efficacy and performance was not mediated by metacognition. However, another analysis showed that the relationship between metacognition and performance was fully mediated by self-efficacy. This suggests that students with effective metacognitive strategies also have strong belief in their capabilities to successfully perform a task. These findings lend support to training programs for students that enhance self-efficacy and strengthen their metacognitive strategies and skills. A popular area of investigation for education researchers tends to be the relationship between learning variables such as goals, self-efficacy, metacognition, learning styles and techniques and test anxiety, as these variables influence learning and performance. However, individual researchers typically focus on children in elementary or middle school and not on college students or adults. This leaves a gap in our understanding of how such variables change and operate as students grow older. Additionally, variables such as self-efficacy and metacognition tend to improve with age and so the relationship between these variables with learning and performance is difficult to ascertain with school children (e.g., Bisanz, Vesonder, &
Voss, 1978; Bransford, Brown, & Cocking, 1999). The purpose of this study was to assess the relationship between self-efficacy and metacognition among college students and understand how these variables relate to performance as measured by GPA. The importance in understanding these relationships lies in research showing that metacognitive skills can be taught to students to improve their learning (e.g., Nietfeld & Schraw, 2002; Thiede, Anderson, & Therriault, 2003). This article will first elaborate on metacognition and self-efficacy, followed by details on research methodology and will conclude with results and discussion.

Mankar (2011) conducted a study, “Impact of Self-Esteem on Scholastic Achievement and Adjustment of Adolescents”. A sample of 610 boys and girls students of seventh and eighth standard have been studied. A standardized scales of Self-esteem, Scholastic Achievement and Adjustment were used. This study consistently found a significant association ($\chi^2=27.66$) between high self-esteem and good scholastic achievement, whereas, lower level of self-esteem associated with poor achievements of adolescents in school. High self-esteem enhances their willingness to try hard at challenging tasks ($r=0.26$). Adjustment level of adolescent was found to be highly associated ($\chi^2=40.61$) with self-esteem level; a feeling of self-worth and competence make an adolescent able to adjust adequately with the surroundings’ ($r=0.26$).

Khadivi, Adib & Farhanghpour (2012) conducted a study, “Relationship between spiritual intelligence and self-esteem with students’ educational improvement”. The purpose of present study was to investigate the relationship between spiritual intelligence and self-esteem with students’ educational improvement. The design of the study was survey. The data were collected by standard questionnaires of spiritual intelligence and Eysenck’s self-esteem questionnaire. 357 third grade high-school students of Tabriz were selected according to Cochran formula and interviewed the validity of questionnaires was calculated by Alpha Chronbach. The results of the study indicated that there was a significant and direct relationship between spiritual intelligence and students’ self-esteem. There was no significant relationship between spiritual intelligence and students’ educational improvement, however. The study showed that the spiritual intelligence of boys and
girls is the same. Girls’ self-esteem is more than boys, but boys’ educational improvement is more than girls. Also, the results of multiple regression displayed that among the four variables of spiritual intelligence. The spiritual belief, the capability of dealing with problems, self-consciousness, interest and moral beliefs consist the 46% of students’ self-esteem.

Kapadia and Garg (2013) conducted a study, “Metacognition in Relation to Learning Environment as Perceived by Students of Different School Types”. The study aimed at ascertaining correlation between metacognition and perceived learning environment scores of students. Comparisons were made between students studying in different school types i.e. SSC, ICSE and CBSE schools. Results revealed that CBSE students possessed better metacognition and they also perceived their learning environment more favourably than SSC or ICSE students. A significant, direct, positive correlation was found between total metacognition and total learning environment scores. Componentwise analysis revealed task orientation component of learning environment to be a strong and significant predictor of all the components of metacognition for SSC and ICSE students. However task orientation predicted only subtask monitoring and evaluation components of metacognition for CBSE students. The study highlights the need for a conducive learning environment for supporting students’ metacognition.

Jayapraba and Kanmani (2013) conducted a study, “Metacognitive awareness in science classroom of higher secondary students.” According to them, metacognition is the awareness one has about his/her thinking process and how he/she is able to control these processes. This study aims at examining the effects of inquiry based learning and cooperative learning on metacognitive awareness in science classroom. A quasi experimental design involving three groups namely, two treatment groups- inquiry based learning and cooperative learning and control group was adopted. Standardized tool developed by Schraw and Dennison(1994) was used to measure metacognitive awareness in three groups. Results revealed that students in cooperative learning received higher metacognitive awareness compared to other
groups. The researchers recommend that cooperative learning be adopted regularly in classroom to enhance metacognitive awareness of higher secondary students.

Keshi and Basavarajappa (2013) conducted a study, “Effectiveness Of Cognitive Behavior Therapy On Self- Efficacy Among High School Students.” This study investigated the effectiveness of cognitive behavior therapy (CBT) on self-efficacy among high school students. The sample of the study includes 60 high school girls and boy students that selected from a large poll of high school students (N=400) randomly. It should be mentioned that about 400 students, 130 of them had low scores in self-efficacy. Then 60 of them selected randomly and assigned into two groups (30 of them in the experimental and 30 of them in control group). Subjects in the experimental group received individual CBT interventions (including positive thinking, cognitive restructuring, self-assertiveness training, time management and study skills) for 10 sessions and control group subjects didn’t receive any intervention. The design of this study was a pre-test, post-test with control group. The collected data analyzed with statistical methods such as independent t-test and repeated measure ANOVA. Results showed that there was a significant enhancement from pre to post assessment in self-efficacy. The Comparison of means in post-test showed a significant difference between the scores of subjects in two groups, indicating a significant increase in experimental group rather than the control one in self-efficacy. But, the effectiveness of CBT on self-efficacy regarding to gender and grades was not significant. Further, the mutual interactions of group-gender-grades in relation to the effectiveness of CBT on self-efficacy were not significant. As a conclusion, the findings demonstrate the efficacy of CBT in enhancing the self-efficacy among high school students.

Narang and Saini (2013) conducted a study, “Metacognition and Academic Performance of Rural Adolescents”. The present study was undertaken to study the impact of metacognition on academic performance of rural adolescents (13-16 years). The study was carried out in rural schools of block-I, Ludhiana District. The sample comprised of 240 rural adolescents equally distributed over four grades (7th, 8th, 9th and 10th grade), two sexes and two socio-economic groups i.e. middle and low socio-economic group. Metacognitive skills of the subjects were assessed using a self-
structured Questionnaire adapted from Metacognition Inventory and Metacognitive Awareness Inventory. To assess the academic performance of the subjects, the aggregate percentage of marks obtained by them in the last school examination was procured from the concerned teachers. Results revealed that the major proportion of subjects with high level of metacognition also performed above average in academics. Further, analysis depicted that both the components of metacognition viz. ‘Knowledge of Cognition’ and ‘Regulation of Cognition’ significantly contributed towards the academic performance of the adolescents.

Rani and Punita (2013) conducted a study, “Metacognition and Its Correlates: A Study”. The present study attempts to investigate correlates of metacognition of undergraduate students. The study explored the relationship of metacognition of undergraduate students with demographic variables like gender, place of living, academic achievement and parents’ education. The study was conducted on the sample of 313 undergraduate students of Aligarh District. The metacognitive inventory (MCI) developed by Dr. Punita Govil has been used as a measure of metacognition of students. ‘t’ test and analysis of variance have been employed to analyze the data. The findings of the study reveal that gender has no significant impact on the metacognition of undergraduate students on the other hand the metacognitive level of urban students differs significantly from their rural counterparts. The high and low achieving undergraduate students differ significantly on their metacognitive level. Moreover, fathers’ educational qualification found to have no significant impact on metacognition of the students under study while mothers’ education has significant impact on it. This study suggests learners to understand and regulate their own thinking process to resolve the real life complexities. Further the present study also recommends some strategies for parents and teachers to facilitate learning among students at college level.

Sindhwani and Sharma (2013) conducted a study, “Metacognitive Learning Skills.” They pointed out that to become self-directed learners, students must learn to assess the demands of the task, evaluate their own knowledge and skills, plan their approach, monitor their progress and adjust their strategies as needed. Students must be able to accurately reflect on what they do and don't know and how they would
approach solving new organisation problems. Studies have shown that once a child is able to come up with his own way of organising items for study, he will achieve far greater results on tests (in reading, writing, math, science, bilingual education, test prediction, etc.). It is therefore imperative that effective study skills, with metacognition as the goal, be taught and monitored to children so that they may become more facile with finding unique problem-solving strategies in future. Unfortunately, these metacognitive skills tend to fall outside the content area of most courses and consequently they are often neglected in instruction.

2.3 OVERVIEW

In India, metacognition is in its infant stage, only few researchers have started doing research in this field. Since it has become increasingly clear that metacognitive awareness and skills are a central part of many academic tasks, a critical question for educators is how we foster the development of metacognition in students. What follows is a description of successful interventions, many of which were designed to improve comprehension and comprehension monitoring, but the principles underlying these interventions can and have been extended to other learning contexts. In sum, metacognition is important in learning. Students with good metacognition demonstrate good academic performance compared to students with poor metacognition. Students with poor metacognition may benefit from metacognitive training to improve their metacognition and performance. A second important variable in this study is problem solving ability. Problem solving is a complex behavior. Regardless of how much experience or knowledge a problem-solver has, each new problem situation is in some ways unique, requiring creative application of strategies for posing, solving and resolving the problem at hand. The third important variable in this study is self-esteem. Self-esteem gives you the courage to try new things and the power to believe in yourself. It lets you respect yourself, even when you make mistakes. And when you respect yourself, adults and other kids usually respect you, too.

Thus, it is evident the number of researches on adolescent students, in relation to variables like metacognition, problem solving ability and self-esteem is meager.
Therefore the investigator undertook this study on metacognition among adolescent students in relation to their problem solving ability and self-esteem. The present survey of related literature has been definitely useful in designing the study and interpretation of the results which appear in the following chapters. The investigator has made a humble attempt to fill up the research gap by undertaking the present study.