2.0 INTRODUCTION

Research in any field implies a step ahead in the exploration of the unknown concepts. The unknown is always in the darkness, an investigator to be able to take this step should be properly prepared for it. One such preparation is the collection of appropriate knowledge of what has already been done in a particular field. A step towards unknown can only be taken after a thorough review of the related literature and researches conducted in that area. Any research without such a review of related literature is likely to be a building without any foundation. The review of related literature provides a clear picture of the study to be taken as a pre-requisite to the proper planning of the problem and conducting the research. The review of the past investigations in a particular field serves as a guide to the investigator as it helps him to avoid duplication of the work already done in that area. The knowledge that what has already been done in the area of researches regarding the methods used for data gathering and the results of their analysis, keeps the investigator systematic in his own endeavour.

According to John W. Best, “Practically all human knowledge can be found in books and libraries. Unlike other animals that must start a new with each generation, man builds upon the accumulated and recorded knowledge of the past. His constant adding to the vast store of knowledge makes possible progress in all area of human endeavour.” ¹

According to Borg, “The literature in any field forms the foundation upon which all future work will be built. If we fail to build the foundation of knowledge

provided by the review of literature our work is likely to be shallow and naive and will often duplicate work that has already been done better by someone else.”\(^2\)

According to C.V. Good, “The survey of related literature may provide guiding hypothesis suggestive methods of investigation and comprehensive data for interpretive purpose.”\(^3\)

The concept of Meta-cognition is in its infant stage in the field of Psychological testing. In developing country like India, researches regarding Meta-cognition are very few in numbers. 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. Review of research studies related to Meta-cognitive Skills, Academic Achievement and Emotional Intelligence of secondary school students, which have been taken up in the recent past are being listed below:

2.1 STUDIES CONDUCTED ABROAD

Corsale and Ornstein (1980) conducted a study on meta-cognitive skills. 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 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

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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.

**Salomon, Globerson and Guterman (1989)** in their study found that 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 meta-cognitive 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.

**Weiss (1990)** conducted a study on “learning to think, thinking to learn; improving college students ‗thinking through pair problem-solving” the main objectives of the study were (i) to evaluate a well know approach to thinking skills, that is, the Whimbey and Lochhead pair problem-solving technique under typical classroom conditions; and (ii) to identify students who benefited the most from this technique, using individual – difference variable level of meta-cognitive behaviors, self-efficacy and test anxiety. The sample of the study consisted of students of pre and post on self-report measure designed to assess motivational factors and use of learning strategies and scores of selected courses examination. The main finding of the study revealed that the pair problem-solving technique has some positive effects when implemented under typical college=classroom conditions. The technique most benefits students with at least moderate levels of meta-cognitive behaviors or self-efficacy.

**Einah (1990)** conducted a study on Meta-cognition in learning-disabled gifted students. The samples of the study were 48 boys from both elementary and high school grade levels. The collected data were treated with the help of multivariate analysis of covariate. The main finding for the study revealed that there was also a
main effect for grade, with the subjects at the high school level performing better on the depend variables that the subjects in the elementary grade level.

**McLain, Gridley, & McIntosh (1991)** had evaluated meta-cognitive 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 meta-cognition in reading. Thomas (2003) had developed the meta-cognition orientation learning environment scale-Science, for the students of age group of 14 years to 17 years. Subscales of the MOLES-S were 1) Meta-cognitive 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 meta-cognitive 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 Meta-cognitive 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 Meta-cognitive Reading Awareness (IRA). However it was not clear from their results whether the IRA was a reliable or valid way of measuring meta-cognition 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 Woodcock 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 meta-cognition 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 meta-cognition 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 meta-cognition in reading for both research and classroom use.

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.

Otero, Campanario and Hopkins (1992) studied the relationship between academic achievement and meta-cognitive comprehension monitoring ability of Spanish secondary school students. The main objective of the study was to measure the Meta-cognitive Comprehension Monitoring Ability (CMA) to determine whether this ability was related to academic achievement, as measured by marks (GPA) in several high schools courses in Spanish. The sample of the study consisted of 102 students, out of which 55 were boys and 47 were girls of XII class and 116 students out of which 58 were boys and 58 were girls of X class from secondary education of Spanish. This total sample comprised 218 students. The main finding of the study revealed that CMA found to be significantly related to GPA, although the correlations were not high and decreased with class level. CMA was highly related with class level.

Lijeron (1993) conducted a study on “Reciprocal teachings of meta-cognitive strategies strengthen reading comprehension of high school students in Spanish: a descriptive case study” the main objectives for the study were asking questions about segments of authentic text, summarizing paragraphs, predicating upcoming information and clarifying unclear text. The sample of the study comprised 24 class sessions from high school students who were studying in Spanish. The main finding of the study revealed that the students habited little awareness for meta-cognitive strategies of reading. They related mostly on translation of vocabulary when reading in Spanish.

Schraw et al. (1994) conducted a study, “Assessing Meta-cognitive Awareness”. The purpose of the present research was to generate and test an easily administered meta-cognitive 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 meta-cognition, 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 meta-cognitive performance. The purpose of the experiment 2 was to validate the MAI using empirically derived measures of meta-cognitive knowledge, test performance and meta-cognitive 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. The major findings of the study were: (i) Both experiments strongly supported the two component model of meta-cognition. 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 meta-cognition; (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 meta-cognitive awareness and performance.

Berardi-Coletta, Buyer, Dominowski and Rellinger (1995) found that college students given process-oriented (meta-cognitive) 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 meta-cognitive 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 meta-cognition in successful problem solving.

Mathew and Bhgle (1995) studied the factors influencing efficient problem solving among engineering students. The tools used for data collection were Essence
Personality Inventory – Q and Problem – Solving Inventory by Heppner and Peterson. The major finding of the study revealed that the types of specialization, confidence in problem – solving, low neuroticism and left-verbal cerebral dominance promoted efficient problem – solving.

Cozza (1996) conducted a study on concept mapping through Logs and metacognitive reflection during third graders’ scientific problem solving. The main objective of the study was to investigate third graders’ meta-cognitive and science problem-solving processes for the purpose of formulating an instructional meta-cognitive model from the data. The main findings of the study revealed that all areas of cognitive-meta-cognitive behaviors were activated. Children explored, monitoring there progress and gave suggestions to others. Learners recorded logs on maps. Moving from everyday concepts to scientific thinking. Throughout the process, the participants self-questioned, monitored and self-reflected.

Wolters (1996) conducted a study on “Issues in self-regulated learning: meta-cognitive, conditional knowledge and the regulation of motivation.” The main objective of the study was to identify and describe a range of strategies that students might use to regulate their academic motivation, and to relate this regulation to cognitive strategy use and achievement. The sample of the study revealed that the students’ regulation of intrinsic motivation assessed using both methodologies was positively related to the use to some cognitive regulatory strategies, ut not to course grade.

O’Neil and Abedi (1996) made an assessment, “Reliability and Validity of a State Meta-cognitive Inventory: Potential for Alternative Assessment”. The main objective of the study was to establish reliability and validity of a state Meta-cognitive inventory. In this study meta-cognition 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 Meta-cognitive inventory. There were total 39 items in a scale. The state Meta-cognitive inventory consisted of four subscales of meta-cognition was administered to a group of 219 community college students along with 20 item math test. Item means, item remainder correlations, factor loadings, commonalties 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. 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 Meta-cognition would lead to better academic performance. Since the reliability of the inventory is marginal for the 8th graders, the current state meta-cognitive inventory is not recommended for 8th graders or younger students. This inventory is useful for the 12th graders and older students only.

Yu (1996) observed the cognitive strategy use the motivation in underachieving students. The main objective of the study was identified as underachieving or learning disabled and comparison of students achieving at grade level. The sample of the study comprised 68 middle and high school students. The main finding of the study revealed that the importance of cognitive and motivational variables in models of students’ leaning suggest a need to reconsider the construct of under-achievement.

Kramarski and Mevarech (1997) studied the cognitive-meta-cognitive training within a problem-solving based Logo environment with the objectives: (i) to compare achievement outcomes of students who learned to construct graphs with a problem-solving bases Logo environment that was either embedded with or with no metacognitive training; and (ii) to examine the differences in students’ cognitive-
meta-cognitive behaviors under different conditions. The sample of the study was 68 students from four computer classes. The main finding of the study revealed that no significant differences were found between groups prior to the beginning of the study on all pre-treatment measures; at the end of the study, the students who were exposed to the meta-cognitive treatment tended to construct graphs better than their counterparts who were not exposed to such treatment. The meta-cognitive groups were able to reflect on their learning than their counterparts who were not exposed to such training.

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 meta-cognitive 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, “Meta-cognitive 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 meta-cognitive Awareness Inventory (Schraw & Dennison, 1994) by investigating its usefulness in the context of course learning and (b) to investigate the relationship between meta-cognitive 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. Meta-cognitive Awareness was measured by Meta-cognitive 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 & MSLQ have likert type scales. 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 meta-cognition and motivation factors in course performance. Meta-cognition 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. Meta-cognitive 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’ meta-cognitive 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 meta-cognitively 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 meta-cognition), 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 meta-cognitive “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’ meta-cognition 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' meta-cognition 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-meta-cognitive regarding their learning processes. Despite some students possessing meta-cognitive knowledge.

**Kouider and Carla (2002)** conducted a study to assess Students' Meta-cognitive Awareness of Reading strategies. The main objective of the research was to develop and validate a new self-report instrument, the meta-cognitive awareness of reading strategies inventory to assess adolescent and adult readers' meta-cognitive 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 Meta-cognition and its relationship with reading comprehension, achievement and aptitude. The main purpose of the study was to construct an assessment tool for meta-cognition for Turkish regular and gifted preadolescents. 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 meta-cognition scores and the achievement in the Turkish, Science and Mathematics courses.

**Cetinkaya & Erktin (2002)** had also developed meta-cognition inventory for the sixth graders. Subscales of the inventory were Evaluation, Self-checking, Awareness & Cognitive Strategies. Ahmet TOSUN & Metehen IRAK (2008) had translated a Meta-cognition 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 meta-cognitive abilities in mathematics, for the pupils of grade 4 to 6. According to them components of meta-cognition 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 meta-cognition scores and the achievement in the Turkish, Science and Mathematics courses.

**Mokhatari & Reichard (2002)** had developed an inventory to assess student's meta-cognitive 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 meta-cognition. Experiment 1 presented two versions of a self-report inventory, the Jr. MAI, appropriate for assessing meta-cognition in children in grades 3-9. Factor analyses are interpreted that illustrate how the items measure components of meta-cognition. Experiment 2 further addressed properties of the two versions and compared the instrument to other inventories, teacher ratings of children's meta-cognition 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’ Meta-cognitive Abilities in Mathematics”. The major objective of the study was to develop an inventory for the measurement of young pupils' Meta-cognitive ability in mathematics and the examination of its construct validity. 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 meta-cognition: knowledge of cognition and regulation of cognition.

**Moran (2004)** conducted a study on self-monitoring of attention versus self-monitoring of performance with second-grade journal writing: A comparison of two techniques. The main objective of the study was to see the comparative effectiveness of self-monitoring of performance and self-monitoring of attention in the area of journal writing. The sample of the study comprised of 8 class II students with writing problem. The main findings of the study revealed that 6 to 8 students spent more time on writing during the SMP condition than the SMA condition. Writing quality was improved over baseline during the SMA condition for 7 out of 8 students. During the SMP condition, 5 out of 8 students improved their writing quality over baseline. No carry over effect was noted.

**Owen (2004)** made a comparison of mathematical problem-solving errors between third grade students with learning disabilities and peers without disabilities. The main objectives of the study were (i) what mathematical errors do students with learning disabilities (SWLD) make? (ii) how do the errors of SWLD compare to those same-grade peers without disabilities who were low (LA), average age(AA), and high-achieving (HA) in mathematics and received the same instructional treatment for solving mathematics word problems of SWLD? The sample of the story was 152 students, out of which 38 SWLD, 38 LA, 38 AA and 38 HA. The findings of the study revealed that the terms of errors types, more errors were made by SWLD in the translation of word problems than in computation on all four measures. Computational errors and errors of unknown origin were small in comparison to the number of translation errors. The low number of computation errors suggests that errors made by SWLD while problem solving are not primarily caused by computational deficiencies.

**Veenman and Beishuizen (2004)** conducted a study, “Intellectual and meta-cognitive 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 meta-cognitive 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. Meta-cognition was scored from.

Fawcett and Garton (2005) studied the effect of peer collaboration on children’s problem-solving ability with the main objective to find out the effect of collaborative learning on children’s problem-solving ability and whether differences in knowledge status or the use of explanatory language were contributing factors. The sample of the study consisted of 100 students belonging to high socio-economic areas in the age group of 6 to 7 years. The main finding of the study revealed that the children who collaborated collectively obtained a significantly higher number of correct sorts than children who worked individually.

Perels, Gurtler and Schmitz (2005) observed the impact of Training of self-regulatory and problem-solving competence with the main objectives: (i) the problem-solving training expected strong effects only for such self-regulation variables which are connected with problem-solving; and (ii) for the combined training the expected effects are for self-regulation variables as well as for variables of the problem-solving test. The sample of the study was drawn from three grammar schools having 249 students of both the sexes between the age-group of 13 to 14 years. The tools of the study were a self-regulatory questionnaire and the problem-solving test. The main finding of the study revealed that it is possible to enhance self-regulatory components. For the self-regulatory competencies, the improvement can be optimized by the combination of self-regulation competencies, the improvement can be optimized by the combination of self-regulation and problem-solving strategies (companioned training). For the training of self-regulation and problem-solving strategies (combined training). For the training of problem-solving skills, this effect was not explicitly, because all types of training led to significant effects regaining the problem-solving measure.
Marcel, Veenman and Anke (2005) conducted a study, “The relation between intellectual and Meta-cognitive skills in early adolescence”. The first objective of this study was establishing to what extent Meta-cognitive skill is associated with intelligence. As a second objective, the impact of hints on the execution of Meta-cognitive 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 Meta-cognitive hints and three including these hints. Meta-cognitive 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 Meta-cognitive cueing triggers a higher level of meta-cognitive activities that are explicitly addressed by such cues, as well as other meta-cognitive activities that implicitly prosper by cueing. Moreover, meta-cognitive cueing yielded better learning outcomes. With regard to the relation between intelligence and Meta-cognitive skillfulness, results clearly reflect that meta-cognitive skills have their own virtue in learning, partly independent of intellectual ability, even for young adolescents who are in an early stage of meta-cognitive skill development.

Marcantonio, Ana, Giovanni and Judy (2006) conducted a study, “Meta-cognition as a mediator of the effect of test anxiety on a surface approach to studying. This study investigated the role of meta-cognition 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. The results of structural equation modeling supported the meditational hypothesis and suggested that the mediation is complete. Findings suggest that meta-cognition 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 meta-cognitive 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 meta-cognition 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 Meta-cognition Questionnaire-30 for the Turkish Population and its Relationship to Anxiety and obsessive compulsive symptoms”. The purpose of the study was to translate Meta-cognition Questionnaire into Turkish sample, thereby bringing into use a questionnaire that assesses meta-cognition 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 into English and latest version of the questionnaire was consequently formed. Meta-cognitive 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) 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 = 72,431, k = 344) examines the construct validity and predictive validity of 10 study skill constructs for college students. They 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' Meta-cognition, 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' meta-cognition, self-efficacy and constructivist science-learning processes. A review of the range of literature related to meta-cognition, 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 meta-cognition, 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 Meta-cognition Learning Inventory-Science (SEMLI-S) consisting of 30 items and 5 subscales. 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 discriminate validity for each of the subscales indicated that, while there is some overlap between the dimensions, they each measure distinct aspects of Meta-cognitive 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 Meta-cognitive self-assessment strategy on Chemistry Students self-efficacy and achievement”. This study examined the effect of instruction in meta-cognitive self assessment strategy on senior secondary school students’ Chemistry self-efficacy and achievement. The study also explored the interaction effect of instruction in meta-cognitive self assessment strategy and gender in their Chemistry self-efficacy and achievement. The results suggested that instruction in the meta-cognitive 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 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 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)** investigated the effect of emotional intelligence skills and meta-cognitive capabilities on student's mathematical problem solving. The main purpose of this study is to investigate of the relationship between emotional intelligence and meta-cognitive capabilities with the ability of mathematical problem solving in the students. The results showed that, there is a significant relationship between the general scores of meta-cognitive 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 meta-cognitive 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 meta-cognition and emotional intelligence contribute significantly to the prediction of problem-solving ability. However, meta-cognition 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 meta-cognitive capabilities and emotional intelligence skills at all educational levels.

**Catherine M. Aurah (2013)** conducted a study, “The Effects of Self-efficacy Beliefs and Meta-cognition on Academic Performance: A Mixed Method Study”. 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 meta-cognition in form of meta-cognitive 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 meta-cognitive prompting experience provides a rich environment for the development of meta-cognitive strategies that can promote problem solving skills among high school students.

**Harandi et al. (2013)** conducted a study, “The Effect of Meta-cognitive Strategy Training on Social Skills and Problem-Solving Performance”. The purpose of this study was to assess the effect of Meta-cognitive strategy training on Problem-solving Performance and social skills in high school girls. Data was 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 Meta-cognitive treatment group significantly improved in both social skills and problem-solving performance.

**Shoaakazemi, Javid, Keramati & Tazekand (2013)** investigated the relationship between happiness, meta-cognitive Skills and academic achievement of students at state universities in Tehran. Data indicated significantly positive relation between 3 variable (p≤0.05) in which happiness could predict academic achievement & problem-solving, self-regulation of Students and moreover, keep them away from depression and other mental and physical disorders.

### 2.2 STUDIES CONDUCTED IN INDIA

**Maqsud (1997)** investigated the effects of meta-cognitive skills and nonverbal ability on academic achievement of high school pupils. Maqsud found that meta-cognitive ability tends to associate positively with academic attainment of high school pupils.

**Baskaran (1991)** conducted a study on achievement motivation, attitude towards problem-solving and achievement in mathematics of standards X students in Devakottai District. The main objectives of the study were: (i) to find out the level for students’ achievement motivation, attitude towards problem solving and achievement in mathematics; and (ii) to find out significant relationship, if any, between
achievement motivation and attitude towards problem-solving, achievement motivation and achievement in mathematics. The sample of the study was 200 students, out of which 100 were boys and 100 were girls, from five urban and five rural schools. The tools used were Achievement Motivation Inventory and Attitude Scale. The collected data was treated with the help of ‘t’ and correlation. The main findings of the study revealed that: (i) there was significant relationship between achievement motivation and (a) achievement in mathematics, (b) attitude towards mathematics problem-solving; (ii) urban and rural students did not differ in their (a) achievement-motivation and (b) attitude towards mathematics; and (iii) Government and aided school students did not differ in their attitude towards mathematics and achievement motivation.

Jain (1991) conducted a study on child-rearing practices, adolescence, cognitive ability and achievement. Its main objective was to investigate how different types of parental rearing contribute to the adolescents’ cognitive ability and their academic achievement. The sample of the study consisted of 108 adolescents and their mothers from Lucknow city. The sampled adolescents were from both the sexes who were studying in classes VIII, IX and X, belonging to the age-group 13-15 years. The main findings of the study revealed that: (i) parental responsiveness was the only factor, which was positively and significantly related with the academic achievement; and (ii) restrictiveness was found to be negatively and significantly related with the scores on the object assembly only.

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.
Shrivastava (1992) conducted a study on cognitive style in relation to educational interest, learning style and academic achievement. The main objective of the investigation was to study the relationship between cognitive style, educational interest, learning style and academic achievement. The sample of the study comprised of 600 students studying in class X from higher secondary school of Raipur city. The tools used were group Embedded figure Test by Oltaman, Educational interest record by Kulshresth, Hindi Adapation of Inventory of learning process (ILP) by Schmeek and Ramnaihahand and Marks of Final Examinations of class X. The collected data were treated with the help of mean, s.d., ‘t’ ratio and two-way ANOVA. The major findings of the study revealed that: (i) students showing high and low interest in agriculture, commerce, humanities, home science and technology did not show any significant difference in their FD-I cognitive style; (ii) students displaying methodical study, fact retention and elaborative processing learning style did not show any significant difference in their FD-I cognitive style; and (iii) more students achieving high in literature, mathematics, science, social science and overall achievement displayed FD-I cognitive style than those achieving low.

Kumar and Susmu (1996) conducted a study on meta-cognition and achievement through cooperative learning with the main objective to study the effectiveness of cooperative learning based approach in terms of academic achievement in mathematics and meta-cognition of general students as compared with the conventional approach of teaching-learning. The sample of the study comprised 60 students of class V, categorized in two groups that is, control and experimental groups. Tools used for collection of data were Learning Awareness Questionnaire and Achievement Test. The collected data were treated with help of mean, S.D. ‘t’ test and ANOVA. The major findings of the study revealed that (i) there was significant difference between the experimental and control group’s scores at pre-test and post-test stages; and (ii) there was positive interaction between the groups for the performance of the students. Mean to the achievement scores of control group and experimental groups at pre-test stage were not significantly different.
Sharma (1997) conducted a study on self-regulation based on personality type a learning styles of college students with attention deficit hyperactivity disorder. The main objective of the study was to identify the difference in personality types and learning styles and discern their relationship to the learning strategies utilized by students with Attention Deficit hyperactivity Disorder (ADHD). The sample of the study were 16 students from all four institutions with the new England Region and each student was administered a personality indicator and a learning strategies Inventory. The main finding of the study showed a strong indication that only 5% of the ADHD population goes on to completes a post-secondary education.

Kumar (1998) conducted a study on interaction of approaches to studying and cognitive style on achievement in biological science with the main objective to study whether achievement in secondary school biology varies with different levels of approaches to studying and cognitive style of the students; the sample of the study was 700 secondary school students from a district of Kerala. Tools used were science Studying Approach Inventory (SSAI) by Pillai, Group Embedded Figure Test by Oltman and Achievement test Test in biology by Kumar. The collected data were treated with the help of mean, median, SD, ‘t’ test and two-way ANOVA. The major findings of the study revealed that: (i) there was significant effect of only deep/surface approach on achievement in secondary school biology; (ii) there was no significant effect of organized/disorganized method of study on achievement in biology , and (iii)the deep approach and surface approach group of students differed significantly in their mean achievement in secondary school biology and high mean achievement score in biology was seen to be associated with the deep approach of students.

Lakshmikanth (1998) studied the psycho-social of social problem-solving skills among pre-adolescents with the main objectives : (i) to identify the existing social problems among pre-adolescents and the strategies used in solving them; (ii) to study the variables related to social problem-solving skills; and (iii) to evaluate the effect of psychological intervention bases on social problem-solving skills training in enhancing social adjustment of children and related variables. The sample of the study was 340 students belonging to five English medium co-educational schools of
Bangalore city studying in VI to VII grades. The tools used for data collection were Information Schedule, Pre-Adolescents Adjustment Scale, State Trait Anxiety Inventory and Social Problem-Solving Skills Questionnaire. The collected data were treated with the help of mean, median, S.D., correlation and ANOVA. The major findings of study revealed that: (i) a significant positive correlation was found between school marks and all the sub-tests of moral development with the components of SPSS; (ii) girls showed greater appreciation of their behavioral conduct and greater responsibility on moral development scale, whereas boys were more anxious and they could foresee the negative consequences of situations; and (iii) the younger group showed better school adjustment and were more appreciative of their social competence, physical appearance and behavioral conduct on self-concept as compared to the older group.

Sangwan and chiikara (2000) conducted a study on cognitive abilities of pre school children with the main objective to assess cognitive abilities of pre-school children of Mewat Zonal of Haryana State. The sample of the study was 600 students of both the sexes of age group between 3 to 6 years. The sample was drawn from Faridabad area, that is, from Manger and Suraj Kund. The tool used for data collection was Cognitive Test by Sangwan and Chhikara(1996). The collected data were treated with the help of correlation. the major finding of the study pinpointed that perception, classification and spatial relations of 3 to 6 years’ old children increased with age among pre-school learners and there were no sex and locale difference in all the age groups.

Ponnusamy (2003) conducted a study, “The Impact of Meta-cognition and Problem Solving Strategies Among Low-Achievers In History”. The present study investigates the impact of meta-cognitive strategies among lower achievers in secondary schools. The aim of the research was to investigate whether meta-cognitive strategies have an impact on teaching and learning. The results revealed that the group which received meta-cognitive and problem solving strategies out-performed the other two groups in objective, subjective and essay tests, reported higher meta-cognitive awareness, used more meta-cognitive strategies during problem solving,
attained higher meta-cognitive 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 meta-cognitive and problem solving strategies can have a significant impact on academic achievement, meta-cognitive awareness and meta-cognitive knowledge. Also, the ability to use and reflect on meta-cognitive 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 Meta-cognitive Orientation of Science Classroom Learning Environments”. 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) Meta-cognitive 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, “Meta-cognitive Strategies of Reading among ESL Learners in Aligarh Muslim University”. This study identified meta-cognitive 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.

Anderson (2011) conducted a study, “Relationship of Self-efficacy, meta-cognition and performance” to examine the relationships among self-efficacy, meta-cognition and performance. Regression analysis showed that the relationship between self-efficacy and performance was not mediated by meta-cognition. However, another analysis showed that the relationship between meta-cognition and performance was fully mediated by self-efficacy. This suggests that students with effective meta-cognitive 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 meta-cognitive strategies and skills. A popular area of investigation for education researchers tends to be the relationship between learning variables such as goals, self-efficacy, meta-cognition, learning styles and techniques and test anxiety, as these variables influence learning and performance. The purpose of this study was to assess the relationship between self-efficacy and meta-cognition 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 meta-cognitive 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 meta-cognition and self-efficacy, followed by details on research methodology and will conclude with results and discussion.

Kapadia and Garg (2013) conducted a study, “Meta-cognition in Relation to Learning Environment as Perceived by Students of Different School Types”. The study aimed at ascertaining correlation between meta-cognition 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 meta-cognition and they also perceived their learning environment more favourably than SSC or ICSE students. A significant, direct, positive correlation was found between total meta-cognition 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 meta-cognition for SSC and ICSE students. However task orientation predicted only substask monitoring and evaluation components of meta-cognition for CBSE students. The study highlights the need for a conducive learning environment for supporting students’ meta-cognition.

**Jayapraba and Kanmani (2013)** conducted a study, “Meta-cognitive awareness in science classroom of higher secondary students.” According to them, meta-cognition 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 meta-cognitive awareness in science class room. 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 Dennision(1994) was used to measure meta-cognitive awareness in three groups. Results revealed that students in cooperative learning received higher meta-cognitive awareness compared to other groups. The researchers recommend that cooperative learning be adopted regularly in classroom to enhance meta-cognitive 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 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, “Meta-cognition and Academic Performance of Rural Adolescents”. The present study was undertaken to study the impact of meta-cognition 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. Meta-cognitive skills of the subjects were assessed using a self-structured Questionnaire adapted from Meta-cognition Inventory and Meta-cognitive 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 meta-cognition also performed above average in academics. Further, analysis depicted that both the components of meta-cognition viz. ‘Knowledge of Cognition’ and ‘Regulation of Cognition’ significantly contributed towards the academic performance of the adolescents.

Rani and Punita (2013) conducted a study, “Meta-cognition and Its Correlates: A Study”. The present study attempts to investigate correlates of meta-cognition of undergraduate students. The study explored the relationship of meta-cognition of undergraduate students with demographic variables like gender, place of living, academic achievement and parents’ education. The findings of the study reveal that gender has no significant impact on the meta-cognition of undergraduate students on the other hand the meta-cognitive level of urban students differs significantly from their rural counterparts. The high and low achieving undergraduate students differ significantly on their meta-cognitive level. Moreover, fathers’ educational
qualification found to have no significant impact on meta-cognition 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, “Meta-cognitive 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 meta-cognition 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 meta-cognitive skills tend to fall outside the content area of most courses and consequently they are often neglected in instruction.

### 2.3 OVERVIEW

In India, meta-cognition is in its infant stage, only few researchers have started doing research in this field. Since it has become increasingly clear that meta-cognitive awareness and skills are a central part of many academic tasks, a critical question for educators is how we foster the development of meta-cognition 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, meta-cognition is important in learning. Students with good meta-cognition demonstrate good academic performance compared to students with poor meta-cognition. Students with poor meta-cognition may benefit from meta-cognitive training to improve their meta-cognition and performance. Thus, it is
evident the number of researches on adolescent students, in relation to variables like meta-cognition, emotional intelligence and academic achievement is meager. Therefore the investigator undertook this study on meta-cognition among secondary school students in relation to their emotional intelligence and academic achievement. 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.