REVIEW OF RELATED LITERATURE

3.1 Studies on learning styles.
3.2 Studies on Meta cognitive Strategies
3.3 Studies on Self Questioning
3.4 Studies on Graphic Organizer
3.5 Studies on Problem Solving
Introduction

As theoretical review of the related literature provides theoretical foundations of the problem, same way the review of related literature provides practical foundations of the problem. A Survey of related literature is necessary for proper planning, execution and developing right concepts of the problem and solutions. This essential ingredient in the research process involves systematic identification and analysis of documents containing information related to the research problem. Moreover, researcher gets practical guidance about the methodological aspects of his or her study.

Mertens (2010) reports that review of literature establishes historical perspective on the intended research, provides a vision of the need for additional research and enables the researcher to develop a conceptual framework for the research. It can also be used as a substantive and methodological rationalization of the study and it provides guiding hypotheses, suggestive methods of investigation and comparative data for interpretative purposes. Best and Kahn (2007) believe “A summary of the writing of recognized authorities and of previous research provides evidence that the researcher is familiar with what is already known and what is still unknown and untested”.

In the present chapter, studies in close proximity to the present study that have been done in India and abroad were discussed and reviewed. The emerging findings have also been reported systematically. After reviewing the studies and literature, researcher classified them under the following areas of concern.

3.1 Studies on learning styles.
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3.2 Studies on Meta cognitive Strategies
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The abstracts of related researches are presented here in chronological order.

3.1 Studies on Learning Styles

Learning style is a student’s consistent way of responding to and using stimuli in the context of learning. Literature basically indicates that there is wide acceptance of the concept of learning style. For the purpose of the study, the investigator trace out a considerable literature exists in the application of learning style research in the field of Education. An attempt has been put here to bring some of these studies which are in close proximity with the present study.

Verma and Sharma (1987) studied Academic Achievement in relation to learning Styles of Adolescents. The objectives of the study were 1) to compare academic achievement of adolescent students possessing independent and dependent learning styles and 2) to analyze the effects of avoidant and participate learning Styles on academic achievement. They observed that the group of dependent learning style is significantly better than the group of independent learning style students so far achievement is concerned. This study also reveals that participant learning style group appears to be superior to avoidant learning style group with regard to achievement.

Verma and Tiku (1990) studied effects of Socio-economic status and General Intelligence on Learning Styles of High School
Students. They aimed to study the effect of socio-economic status on independent, dependent, participant, avoidance, collaborative and competitive learning styles of high school students. The results indicate that avoidance learning style is not influenced by change in the socio-economic status of the subjects. But variation in intelligence definitely affects the avoidance learning style. According to them, the interaction effect of socio-economic status and intelligence was not significant on any of the learning styles of high school students.

Malohotra (1993) studied the learning outcomes among Adult learners in the Union Territory of Chandigarh as related to goal orientation, persistence and Learning styles. Questionnaire and test developed by researcher were used for the data collection. The research was survey type in nature. They found that the goal of reading and writing had a positive effect on the learning outcomes of the learners. At the same time, the difference in learning styles used did not make any significant difference in the learning outcomes of the adult learners.

Dunn and Dunn’s (1993) learning style model is based on the theory that most individuals can learn from instructional environments, resources and approaches respond to diverse learning style strengths. In addition to this teachers can learn to use learning styles as a cornerstone of their instruction and students can learn to capitalize on their learning style strengths when they concentrate on new and difficult information.

Lemire & David (1998) through their research describes the psychometric issues associated with three different learning styles models (Visual, Auditory, and Kinesthetic) and the instruments
designed to assess these models. They also present some backgrounds to the learning styles idea along with suggestions for utilizing this information with developmental students.

Kopsovich (2001) in his study investigated the Correlation between learning styles of students and their Mathematics scores in the Texas Assessment of Academic Skills Test. The data were collected from 500 fifth grade students attending a North Texas Intermediate School. The learning style inventory by Dunn, and Price were used for data collection. The Pearson Product Moment Correlation Coefficient and the point-biserial correlation technique analyzed the data. The outcome of the study points out that the learning style preferences of all students in the area of persistence significantly influenced their mathematics achievement scores.

Shrivastava (2002) in his study briefly reviewed the learning styles of secondary school students with scientific attitude and their achievement in science. He found that the most popular learning styles of the students’ are accommodative learning style and second popular is convergent learning styles.

Farks (2003) measured the Effect of Traditional verses learning styles Instructional method on middle school students. He found that the advantages of learning style instructional resources had a practically and statistically significant influence on seventh grade students’ achievement, attitudes, empathy and transfer of knowledge.

Malathi & Malini (2006) conducted a study to find out the learning styles of higher secondary students of Tamil Nadu. Barbara A Soloman and Richard M Felder’s Learning style Inventory was used in this study to collect data. The collected data were analyzed using 't' test. The
findings revealed that there is high correlation between learning style and achievement, which implies that higher the achievement scores, the better was the learning style among higher secondary students.

Sheryl & Wetzel (2007) conducted a study to compare the sensory learning modes and adaptive study strategies in students attending Florida State University during the spring 2007. They were analyzed for a preferred sensory learning mode, number and variety of study methods, a match between sensory learning mode and sensory preference within the study habits, and passive versus deep learning processes. The students were found to demonstrate a sensory learning mode preference, but did not report using study habits that matched this sensory mode. Most of the students were found to employ too few study methods to allow for the development of true study strategies, were found to use memorization as primary study method, and to utilize passive learning rather than deep learning processes.

Sunila, T (2007) conducted a study on the effectiveness of cooperative learning on learning styles and academic performances in Mathematics learning at upper primary level. Learning style inventory, Participant observation, Student evaluation proforma were used as tools for the study. The study reveals that learning styles of the students have an impact on academic achievement in Mathematics. The study also found that Jigsaw pattern is very effective for the conceptualization of Mathematics in a collaborative atmosphere at upper primary level.

Penger and Tekavecic (2009) conducted a study to explore the learning styles of students enrolled in the Economics of Education
course at the FELU (University of Ljubljana, Faculty of Economics). Both descriptive and exploratory perspectives are included in this study. The findings outline that for the educators in higher education, the challenge is to provide meta-cognitive support for students enabling them to reflect not just on what they learn but also how and why.

Gohel (2009) explored the effect of learners’ learning style based instructional strategy on science achievement of secondary school students. He found out the impact of varied instructional strategies in accordance with their learning styles namely, visual, auditory and kinesthetic.

Jeral and Kim (2010) examine the influence of visual, auditory and kinesthetic learning opportunities on students. In the beginning of the study, students took a preferred learning style survey which classified their preferred learning style as visual, auditory and kinesthetic or a mixture of two or more styles. During the course of the study, students read four short stories and one novella, after the completion of each story, students were given a choice of projects to demonstrate their mastery of the material. The results of the study suggested that students benefit from being able to choose activities to demonstrate their learning. The overall implication is that classroom teachers need to be aware of their students’ learning styles and should tailor their instruction according to the needs of their specific learners whenever possible.

Martin (2010) conducted a descriptive phenomenological study explored qualitatively the lived experiences of freshman nursing students who were taught with teaching strategies that were different
from the strategies to which they were accustomed. Further the study explored whether or not the teacher’s teaching strategies complemented the learning styles of the learners. The sample consisted of one nursing educator and 12 student participants comprised of a mixed group of males and females enrolled in a freshman nursing course. A semi-structured interview and the Kolb’s Learning Style Inventory Version 3.1 (2005) gathered data from the student participants. Data were also obtained from a classroom observation by the researcher. Study results found that the participants identified a strong sense of acquiring new learning strategies that helped them to be successful in the nursing course. The study suggested that the teaching styles should be effectively complemented to students’ preferred learning styles and the teacher needs to identify the students’ preferred learning styles. The study further supported the use of a learning style inventory to determine the students’ learning styles to assist teachers in the planning and delivering of content to diverse learners. The results of the study may be beneficial to nursing educators and nursing administrators who develop nursing curriculum.

Preston (2011) explored the learning styles in nursing students of Walden University. The aim was to identify the dominant learning style and to examine whether an association existed between the dominant learning styles and demographics of participants. The research question examined the learning style of nursing students and the association between student age, gender and racial-ethnic identity. Results show that there was a statistical association between learning style and gender, however there was no statistical association between learning style and age groups.
Mehrdad & Ahghar (2012) conducted a study which aims at investigating whether difference in the brain dominance (left/right) is reflected in the learning style and therefore learning strategy differences between left handed and right handed EFL students. Torrance’s Right/Left Brain Dominance test, Oxford’s Strategy Inventory for language learning and VAK learning style indicator were adopted for this study. Although the results of the data analysis showed no significant difference in brain dominance between right-handers and left hander’s, the differences between the groups on certain aspects of learning styles as well as learning strategies were found to be statistically significant suggesting a rather different cognitive processing in left handed learners than right handed counterparts and bringing to light the need for the educators, teachers, and syllabus designers to give the issue due attention.

A close review and analysis of these studies throws light into the fact that learning styles do exist in individuals at varied levels just as how intelligence differs from individual to individual. It has also been observed that learning style of an individual has a direct influence on his academic performance. It is therefore essential that teachers should provide appropriate learning experience to cater to the learning style of the students and thus empower them. These studies have enabled the investigator to develop proper understanding about learning patterns of individuals and device appropriate strategies for the study.

3.2 Studies on Meta cognitive Strategies

The need to develop Meta cognitive strategies has been widely accepted. Meta cognition is regarded as a concept concerned with
what people generally think about their thinking and memory process. Educational psychologists have long promoted the importance of Meta cognition for regulating and supporting student learning. But often the modes practiced to turn up the goals are far from satisfactory.

The next few sections of the review are set apart to understand the impact of Meta cognitive strategies and the need to give such practices in classrooms in order to make the learners independent and self directed.

Piper (1992) conducted a study in increasing reading comprehension levels of average ability students. Five Meta cognitive strategies were employed to improve understanding of the adopted text book. It was concluded that instruction in the five Meta cognitive strategies improved the target groups reading comprehension abilities.

Harden (1997) examined the relationship between Meta cognition and the use of cognitive and Meta cognitive Strategies, and the involvement of students with attention problems participating in academic tasks in the language arts content area. The relationship between meta cognition and the attribution components of learning and achievement, along with the combined effect of these components on the performance of nine students was investigated. Results indicated that students became more Meta cognitively aware of their reading strategies and showed a significant increase in reading comprehension achievement level. Students were able to use the strategies effectively in the areas of reading comprehension, creative writing and writing for research purposes.

Cattell (1999) examined the effects of strategically teaching Meta cognitive skills to high, medium, and low achieving fourth grade
students and how it influenced their ability to comprehend grade level tests. Results indicated that strategic teaching of Meta cognitive skills influenced students’ ability to comprehend grade level tests.

Goos (2002) et al investigated the Meta cognitive activities of students in solving mathematical problems in Australia using a longitudinal naturalistic study. The findings showed that transitive discussion of Meta cognitive new ideas and assessment appears to be a significant factor in successful collaborative problem solving.

Karamarski & Mevarwch (2002) compared co-operative meta-cognitive instruction on solving authentic Mathematical problems with non-meta cognitive instruction in Israel. The findings suggested that cooperative Meta cognitive instructional students were performed better than the co-operative instructional students for both authentic and standard tasks.

Rasekh & Ranjbary (2003) shed light on the issue of strategy training. They investigated the effect of Meta cognitive strategy training with explicit strategy instruction on the development of lexical knowledge of EFL students. The training model used was based on the framework for direct language learning strategies instruction proposed by Chamot and O’Malley (1994). The results of the study showed that explicit Meta cognitive strategy training has a significant positive effect on the vocabulary learning of EFL students.

Maleki (2005) studied the effects of teaching cognitive and Meta cognitive strategies in increasing the learning and retention of different school texts mainly English, Physics and Social Studies in the first year of high school. Semi experimental and the expanded plan in non-equivalent control group design were used for this study.
The results showed that the instruction of cognitive and meta cognitive strategies was effective on the subject of Social Studies in almost all instances and led to an increase in the academic performance of students in both learning and retention. The instruction of cognitive strategies in the subject of Physics was more effective than the instruction of meta cognitive strategies. The instruction of these strategies did not have a significant effect on the subject of English language. The study concluded that teaching cognitive and Meta cognitive strategies to students have a significant effect in increasing the level of learning and retention of subjects. Therefore teachers should aim at teaching these strategies to all students in general and to the weaker ones in particular.

Philip & Hua (2006) conducted a study on co-regulation of strategy through the implementation of a Meta cognitive Strategy Instruction (MSI) for academic reading. It includes explicit direct explanation of learning strategies such as planning, monitoring and evaluation. The study found that both the High proficient (Hp) and Low proficient (LP) Learners benefited reasonably well from the experience of the MSI Sessions. The learners reported on how the strategies helped to facilitate their reading process. The key issue revealed in this study is that the MSI sessions have managed to at least prepare if not transform the learners into becoming Meta cognitively sophisticated readers.

Efklides (2006) conducted a study which highlights the importance of learning of one of the facets of meta cognition, namely meta cognitive experiences (ME) that comprise feelings, judgements or estimates and online task specific knowledge. The emphasis is on the affective character of ME, which has received little attention in the
past. Because of their nature, ME can trigger either rapid, nonconscious control decisions or conscious analytic ones. Evidence is presented regarding the relations of ME with affect and cognition, and the implications of the lack of accuracy of ME for the self-regulation of learning. Particular emphasis is given on judgments of learning, feeling of difficulty and feeling of confidence. The challenges for future research on Meta cognition are underscored.

Cao & Nietfeld (2007) examined college students’ awareness of difficulties in learning class content and selection of study strategies to address the perceived challenges in their study titled as ‘College students’ Meta cognitive Awareness of Difficulties in learning the class content does not Automatically lead to adjustment of Study Strategies’. The study reveals that student’s awareness of different kind of difficulties in learning the class content did not lead to adjustment of study strategies. Suggestions for promoting students abilities to self-regulate the learning process were discussed in the study.

Young and Fry (2008) studied the relationship between Meta cognitive awareness and academic achievement among college students. Correlations were found between Meta cognitive awareness and cumulative GPA as well as end of course grades. The study found that scores on the Meta cognitive Awareness Inventory significantly differ between graduate and undergraduate students.

Steinbach & Conant Judith (2008) conducted a quasi-experimental study to determine the impact of explicit meta cognitive strategy instruction on college students’ writing. This study involved the teaching of five explicit Meta cognitive strategy lessons to students in college
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Freshman English writing classes. After six week treatment, the scores were analyzed to see if there was a significant difference in writing of students who receive explicit instruction in Meta cognitive strategy use as compared to those who did not receive this instruction. The results of a Repeated Measures ANOVA indicated that the treatment did not have a significant effect upon the improvement of student writings.

Rahman et al (2008) used a meta cognitive framework in their study for analyzing strategies students used while assessing and studying hypertext materials online. The focus of the analysis lies in the three processes in Meta cognitive strategies namely planning, monitoring and evaluation. Results of the study showed that the use of Meta cognitive strategies is very minimal. It is concluded that students are lack of skills to synthesis and structure the information they studied during on line learning activities. These results suggest that students need to be equipped with online learning skills to help them learn effectively in hypermedia learning environment.

Zohar & David (2008) conducted a study on explicit teaching of meta-strategic knowledge in authentic classroom situations. The present study focuses on the control of thinking strategy. The findings showed dramatic developments in students’ strategic and Meta-strategic thinking following instruction. Findings showed that explicit teaching of Meta cognitive strategic knowledge had a strong effect on low achieving students.

Cubukcu (2008) determines the effectiveness of systematic direct instruction of multiple Meta cognitive strategies designed to assist teacher trainees in the English Department in comprehending
text. In addition, the investigation is also designed to determine the impact of the Meta cognitive strategies on vocabulary development.

Qzsoy & Ataman (2009) investigated the effect of using meta cognitive strategy training on Mathematical problem solving achievement. Mathematical problem solving Achievement test and Turkish version of Meta cognitive skills and knowledge Assessment (MSA-TR) were used in the study. The results indicated that students in the Meta cognitive treatment group significantly improved in both mathematical problem solving achievement and Meta cognitive skills.

Raja (2009) attempted to focus on the learning strategies taught by the teachers and used by the students of third, fourth and fifth standard language learners in immersion settings. This study observed the strategies, which were used and taught to the schoolchildren. The strategies taught by the teachers and adopted by the students were equated with the strategies listed by Oxford (1990). The efficiency of the strategies used was estimated.

Ronzano & Stephe (2010) in their study investigated the effectiveness of Meta cognitive strategies for improving reading comprehension on secondary students. A total of 312 students in 10th grade regular, pre-AP, and EL English classes responded to questions taken from the California STAR test and reported the meta cognitive strategies they used in responding to the questions. The teachers were interviewed about the Meta cognitive strategies for reading comprehension they taught. The students who used meta cognitive strategies scored higher in reading comprehension although the number of strategies used was not significantly related to scores. Teachers reported noticing that their AVID students, who were not
identified as a special population but used Meta cognitive strategies independently more often, appeared to use more Meta cognitive strategies in the study.

Kelly & Ho (2010) examine the role of Meta cognitive strategies in critical thinking. Ten university students with comparable cognitive ability, thinking disposition and academic achievement with different levels of critical thinking performance participated in the study. They were tested on six thinking tasks using think aloud procedures. Results showed that good critical thinkers engaged in more Meta cognitive activities, especially high level planning and high level evaluating strategies. The introduction of Meta cognitive strategies to critical thinking and implications for instructional practice were discussed.

White bread & Coltman (2010) conducted a study on aspects of pedagogy supporting Meta cognition and self regulation in mathematical learning of young children. The children were engaged in Mathematical activities designed by practitioners to facilitate Meta cognitive processes. Meta cognitive ‘events’ were identified and the children’s behaviors were analyzed for indicators of Meta cognitive thinking. At the same time, the pedagogical context of the activities, including interventions by adult practitioners was analyzed in relation to the Meta cognitive opportunities afforded. Findings were that, the young children did indeed show evidence through their talk, and their non-verbal actions, of emergent Meta cognitive processes, and that the nature and frequency of these processes were influenced by pedagogical aspects of the Mathematical activities.

Zabrucky (2010) conducted a study on Meta cognition in Taiwan students’ Calibration of comprehension and performance. The role of
Meta cognition on student’s performance was investigated. He concluded that students were able to predict comprehension and test performance at better than chance levels and were more accurate at post diction than prediction.

Coskun (2010) investigated the effect of Meta cognitive listening strategy training on the listening performance of group of beginner preparatory school students at a university in Turkey. From this experimental study, it was revealed that students who received Meta cognitive strategy instruction did better in listening test conducted at the end of the training. The implication of this study is that Meta cognitive strategy training should be incorporated into the regular listening teaching program to help students become more effective listeners.

Dul (2011) examined the effect of Meta cognitive strategies on achievement and retention in developing writing. The study was conducted on 77 freshman students enrolled in English language Teaching Department at Selcuk University. A pre test post test design has been adopted to find out the differences between the experimental and the control group. In data collection, the students were given writing assessment tests as pre test, post test and retention test. The results of the research statistically proved the contribution of Meta cognitive strategies to achievement and retention in writing.

A fourfold literature review on Meta cognition was conducted by Lai (2011) to explore the ways in which Meta cognition has been defined by researchers and investigate how Meta cognition develops in young children. Ways for facilitating Meta cognitive skills and assessing the Meta cognition are also reviewed by the investigator.
Alka, A. (2011) conducted a study on ‘Developing a meta cognition integrated multimedia science learning package for students at secondary level’. Meta cognitive awareness of secondary school students and meta cognitive teaching competency of their teachers were found out. The study revealed that meta cognition integrated multimedia science package was beneficial to the learners in enhancing achievement in Chemistry, meta cognitive ability, self efficacy, scientific creativity and social skills.

Rahimi & Katal (2012) investigated meta cognitive listening strategies awareness among Iraman University and high school students learning English as a foreign language. To achieve this goal, 122 university students and 116 high school students filled in the Meta cognitive Awareness Listening Questionnaire (MALQ) with five subparts including problem solving, planning and evaluation, translation, person knowledge and directed attention. The result of the data analysis revealed that university and high school students were different with regard to their Meta cognitive listening strategies awareness in general and in person knowledge and mental translation components.

Ahari et al. (2012) investigated the effect of meta cognitive strategy training through the use of explicit strategy instruction on the development of lexical knowledge of EFL learners. To reach the goal of the study, two homogeneous groups of English language learners at pre university level were selected, based on the result of a vocabulary pre-test. Only the experimental group received Meta cognitive strategy training during the course of the semester. Through the analysis of the obtained data, it was found that there were significant differences between control and experimental groups of the dependent
variable, lexical performance. The study reports that there is an empirical piece of evidence to support the language teachers who use Meta cognitive strategy training.

Vrieling et al (2012) conducted an intervention study focused on the relationships between student teachers’ self regulated learning (SRL) opportunities, their use of meta cognitive learning strategies and their motivation for learning. Results indicate that student teachers’ use of Meta cognitive learning strategies increases significantly in learning environments with increased SRL opportunities. Minor significant positive correlations were found between the Meta cognitive and motivational constructs measured. In general, the level of SRL opportunities turns out to be a moderate predictor of student teachers’ use of Meta cognitive learning strategies and motivation for learning, both important constructs for their academic career.

Chan (2012) examined co-regulation of learning on computer supported collaborative learning environments extending research on self regulated learning in computer based environments. The discussion employs a socio-cognitive perspective focusing on social and collective views of learning to examine how students co-regulate and collaborate in computer-supported inquiry. Future research directions on the theoretical nature of collective regulation and social Meta cognition in building models of co-regulated learning are discussed in this article. The study concluded that training cognitive and meta cognitive strategies to students has a significant effect in increasing the level of learning and retention of subjects, therefore, teachers should aim at training these strategies to all students in general and the weaker ones in particular.
The afore mentioned studies reveal the significant role of Meta cognition among the learners. Though several studies have exploited the benefits of Meta cognitive strategies in improving the learning conditions, no studies have focused on interlinking these strategies into the natural instructional classroom practices towards facilitating the self-directed approach in learning. This fact had urged the investigator to explore the effect of Meta cognitive classroom practices in the language learning classroom towards heightening the academic outcome and uplifting their language skills.

3.3 Studies related to Graphic Organizer

Graphic organizers are powerful and excellent instructional tools which help to instill Meta cognition among the learners. These pictorial representations allow students to brainstorm ideas and organize them into manageable and comprehensible chunks. They are perceived by students to be enjoyable, low stress, high interest and creative. These visual tools are relatively easy to implement and a rewarding element in the instructional practitioners’ repertoire of skills with regard to curriculum transaction. In this context, the investigator has made an effort to trace out some of the research reports in close proximity with this phenomena and the need to equip the learners in the use of such classroom practices.

Tompkins (1989) examined the effects of an eight week implementation of the Graphic post organizer, a spatial learning strategy, upon student achievement in American history in a secondary school. The study also analyzed the relationship between the degree of strategy implementation and student achievement, the time needed for strategy training and strategy effects upon student
comprehension of the text. A quasi experimental design was utilized in the absence of random assignment of subjects to treatment conditions. Multiple regression analysis was used to evaluate the relationship between strategy implementation and student achievement. The study concluded that the use of graphic organizers enable to increase student comprehension of a text and increase students’ concept knowledge base needed for strategy implementation as a review technique. In addition, student motivational and self-regulation training would appear to be warranted.

Olgin (1990) investigated the use of the graphic semantic organizer and the outline as Meta cognitive study strategies to improve the reading comprehension of fifth grade students in the content area of social studies. The study was designed to investigate both the learning process and to evaluate the effectiveness of the learned strategies. The sample consisted of 40 fifth grade students enrolled in a public school on Long Island. The students were divided into two treatment groups, a graphic semantic organizer and an outlining group. The learning process was analyzed using student and teacher interviews. The learning outcomes were evaluated using pre and posttest essays based on the curriculum being studied. The study reveals that both the semantic organizer and the outline had a significant effect on student performance both as pre writing strategies and in posttest essay completion. The study also indicated that both the strategies significantly improved the students’ performance on the post test essay.

Moyo (2004) reported a study of how secondary African American students use a graphic organizer to assist in Mathematical meaning making. The mathematical behavior of eight high school
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students was studied using a survey, transcripts from video and audio tapes, and semi structured interviews as they participated in problem solving sessions. The results of the study suggest that the use of graphical representations is essential to making meaning and that tools are needed to ensure that developing representations becomes a normative practice in Mathematics classrooms.

Samawi (2006) in his research study explored the effect of concept mapping as a Meta cognitive strategy on the critical thinking skills and dispositions of junior and senior live Baccalaureate nursing students. The findings reveal that the select strategy triggers critical thinking which guides the students to engage in meaningful learning and there was no relationship between critical thinking scores and disposition scores.

Jiang and Grabe (2007) conducted a study which argues that graphic organizers directly represents the discourse structures of a text, provide stronger evidence for the effectiveness of the technique, and these versions of the graphic organizers should be adopted in comprehension instruction. The authors propose a number of generic forms of graphic representations that apply to regularly recurring text structures, and recommend further research on the impact of G.O’s with learners of English as a second or foreign language as well as research that involves more extended instructional time.

Howard (2007) explored the factors that can encourage the use of research based practices (RBP) in classrooms by examining factors that support the implementation and sustainability of Graphic Organizers (G.Os) as an instructional strategy in inclusive classrooms with students with and without specific learning disabilities.(SLD).
Teachers who participated had received professional development about a set of strategies entitled the ‘Make Sense Strategies’ by facilitators provided by the Alabama State Department of Education. The use of G.Os has been touted as an instructional strategy to enable teachers to increase skills and knowledge for students with and without disabilities. The study explores those factors that support G.Os instruction in inclusive classrooms through a case study of teachers who were perceived to be high level implementers. The findings of this study were consistent with the research literature that identified and described factors that support the implementation and sustainability of RBPs. In addition, the findings indicated that classroom teachers do require supports to be in place in order to move RBPs from the point of initial awareness to classroom implementation.

Farmer and Frances (2008) conducted a study combines seven Cs of graphic organizer—connect, clarify, consider, collect, converse, conclude and cite—in a graphic organizer format. The purpose of this study was to determine the use of seven Cs graphic organizers on nonfiction reading comprehension and in other content areas. Participants were members of an inclusive seventh grade reading class in a large urban school in the western portion of the United States. The results of this study demonstrated that from pre test to post test reading comprehension scores increased for each student.

Klugh (2008) conducted a study which focuses on using ‘story web’ graphic organizers in a ninth grade social studies classroom in rural Pennsylvania. This study examines how well students use the graphic organizers on in-class assignments and analyses student assessment data to determine if graphic organizers improve student achievement.
Esmat (2009) focused his research on teaching students to organize their writing better by using the step up to writing approach. The students were introduced to a graphic organizer which they used throughout the inquiry. The students then were taught to use a writing check list to help them organize and improve their writing skills. The intervention was implemented with the whole class, but focused on four focus students. The intervention lasted a period of six weeks and incorporated a variety of writing activities to practice the tools being taught in the inquiry. The comparisons of pre and post intervention data indicate that the use of the graphic organizer and writing checklist positively increased students’ scores. Using the checklist gave students the ability to work with one another towards creating a sense of responsibility.

Hoffmann and Fisher (2010) examined the impact of teaching both graphic organizer and Meta cognitive monitoring strategies on the comprehension of 5th grade students reading expository science text. The effectiveness of teaching both graphic organizer and Meta cognitive monitoring strategies was compared with instruction in either graphic organizer or Meta cognitive monitoring strategies. Students in the graphic organizer plus Meta cognitive monitoring condition showed a significant increase in test scores on a standardized test of reading comprehension.

Cully (2010) examined the use of graphic organizers in secondary mathematics classrooms to solve high level mathematics problems. A Non –Equivalent Group Design (NEGD) was used to investigate the effectiveness of using a graphic organizer to guide students with disabilities and students at risk for failure in mathematics to solve linear equations and inequalities. Effect was
documented through repeated measures of a test of linear equations and inequalities and a social validity scale. Results indicate that the intervention was effective across all groups. Those students with disabilities who were instructed with the graphic organizer associated with the lowest cognitive demand saw the greatest relative percent of change from pre test to post test conditions as compared to students with disabilities in other each of the other two study conditions.

Fealy and Marie (2010) explored the explicit instruction of graphic organizer to support students’ understandings of informational text. An additional purpose was to investigate students’ perceptions of using graphic organizers as a comprehension strategy. Student work samples including student reflective journals and think aloud protocols were collected and analyzed. The major findings of the present study were that students seem to find graphic organizers useful, that they are able to independently use them, and that they learn new concepts about informational text as a result of using graphic organizers. They pointed to graphic organizers as providing instructional strategies that assisted them in becoming diligent and purposeful readers. This research adds to the body of growing evidence showing the instructional benefits of graphic organizers as a means to scaffold and support students’ understandings of informational text. This study extends the promising findings about the use of graphic organizers from middle schools and high schools to the elementary level.

Diebold (2011) evaluated the effectiveness of explicit direct instruction of Meta cognitive strategies using thinking maps. The foundation of this study was based on the constructivist learning theory proposed by Vygotsky. A quasi experimental pre test post test control group design was used to compare the achievement of 58
students organized into 4 READ 180 programme classes from 3 elementary schools. The findings revealed no significant differences between the control and the intervention groups. The findings did indicate that male students tended to have greater improvements in SRI (Scholastic Reading Inventory) scores than females. The result did not support the implementation of thinking maps to improve comprehension for at risk 4th grade students.

Suarez (2011) conducted a study that sought to identify which graphic organizers and higher order thinking skills would aid in students test scores in a district impacted by poverty and a high level of second language learners. The foundation of this study was predicated on cognitive theory, constructivism and the use of graphic organizers. The method used in this study was a 3 round Delphi method, a qualitative approach to understanding which graphic organizers best enhance critical thinking skills during nonfiction reading. The results of the study reveals consensus on 12 graphic organizers deemed most effective for direct instruction of higher order thinking skills. The data gathered from participating teachers’ responses regarding their use of graphic organizers, were used to create a teachers’ resource guide showing how to integrate Meta cognitive strategies into graphic organizers for comprehension of informational text. This resource guide can promote social change by enhancing students’ critical thinking skills and academic achievement, leading to improved motivation and a greater likelihood of becoming lifelong learners.

Solomon (2012) examined the effectiveness of graphic organizers in writing a summary. Summarizing is a skill elementary students struggle to master as they often find it difficult to make the distinction between information that is relevant and information that is not
relevant. In the present study, after reading a nonfiction passage, students completed a graphic organizer and then composed a summary. The data collection methods included a pre and post writing assessment, a 4 point Likert scale survey and an open ended questionnaire. The results of the data revealed that graphic organizers as they were implemented in this study assisted only a few students in improving their ability to compose a cohesive summary.

Snyder (2012) conducted a study which aims to investigate the effects of graphic organizers, level of text structure complexity and content familiarity on second grade students’ comprehension, recall and sensitivity to cause/effect text structure. A mixed factorial post test only design was utilized with two between subject factors (graphic organizers and level of cause/effect structure complexity) and one within subjects’ factor (content familiarity). Students were randomly assigned to either a graphic organizer condition or a control condition. A mixed factorial analysis of variance (ANOVA) was conducted to analyze the data. The results may inform efforts toward improving second graders’ text structure sensitivity and expository text comprehension through the use of graphic organizers.

The review of the studies in this sphere demonstrates that G.O provides a framework for strengthening the students’ ability to recall, comprehend and visualize their thinking. It also reveals the fact that they are adaptable for all ages and across all areas of the curriculum. G.O’s have a number of attributes that enhance students’ thinking skills. All of the research studies points out that true learning take place through the implementation of G.Os which helps to articulate the ideas and probe the thinking process effectively.
3.4 Studies related to Self Questioning

Self Questioning practices can help to transform a teacher centered classroom into a student centered, inquiry oriented community of learners. It is the ongoing process of asking questions before, during and after reading that are used by a reader to understand a text and it helps to spark curiosity that focuses learner’s attention on investigation, understanding and connection to the material they learned. Research shows that self questioning strategy can enhance comprehension and it increases learners’ meta cognition to monitor their understanding during the learning process. In this scenario, the investigator attempted to collect and analyze a few studies in close contiguity with classroom practices based on Self Questioning.

Wong (1985) conducted a review on the studies in self questioning designed to improve students’ prose processing in the context of theoretical issues and instructional implications that stem from three theoretical perspectives: the active processing perspective, meta cognitive theory and schema theory. The review indicates that the effect of self questioning training on students’ prose processing is successful. Moreover, it indicates the need to consider the issue of constraints in self questioning like content knowledge and Meta cognitive deficiencies. Subsequently, methodological problems underlying instructional failures in self questioning research are examined and the potential directions of future research were discussed.

Masuda (1992) investigated the effects on comprehension, self monitoring and retention of science expository prose by at risk
college students using a self-questioning reading strategy. The subjects were 56 Educational Opportunity Programme students enrolled in four sections of a college reading and study skills course. Using a quasi-experimental approach, the four sections were randomly assigned to the self-questioning experimental group or the read-re read control group. The intervention consisted of two weeks of pre testing, three weeks of training/practice with a chemistry paper, and two weeks of application with a biology chapter. Monitoring was measured by comparing self-reported confidence about test performance and actual test performance. The results suggested that cognitive, meta-cognitive and motivational factors all be considered in conducting strategy training and that providing sufficient training and processing time and using appropriate reading level materials with model questions is necessary.

King (1992) designed a guided learner generated questioning strategy to prompt learners to elaborate on new material in an effort to facilitate their understanding of that material. In a series of study conducted in naturalistic settings, the relative effectiveness of this strategy was compared with that of several other learning and study strategies for high school and college students learning regular course content presented in classroom lectures. Findings from these studies indicate that the guided questioning strategy facilitated learning by prompting students to generate specific thought-provoking questions pertaining to the material to be learned, and those questions in turn elicited relevant explanations.

Charmello (1993) studied the effect of a meta-cognitive strategy—self-questioning—on the improvement of reading comprehension. It
indicates that the self questioning practice has made a positive but not a significant difference in improving reading comprehension.

Donnelly (1999) explored self questioning as a reading comprehension strategy from the perspective of the fifth grade classroom teacher. A questionnaire was designed and distributed to a sample of fifth grade teachers selected from public schools in the eastern portion of the Commonwealth of Pennsylvania. The questionnaire probed teachers’ reported beliefs about self questioning as a reading comprehension strategy (I BELIEVE), teachers’ instructional practices of this strategy (I DO), and teachers’ awareness of their students use of self questioning (I KNOW). Multivariate correlation techniques were used to investigate how well the composite teacher variables predicted student responses to strategy use questions on the most recent Pennsylvania system of school assessment instrument. This study suggests that preparation in self questioning instructional techniques should receive greater emphasis in teacher pre certification programmes and in service offerings.

Hsu (2001) examined classroom questioning within the input-output theoretical framework to gain a better understanding of how teacher and student questions operate as pedagogical and learning tools for second language acquisition. Two teachers and 27 adult ESL learners in two intact oral communication classes within a college level intensive English Institute participated in this study. Four focal subjects from each class (eight focal subjects in total) were selected for further investigation. The qualitative analysis of the date was conducted using the constant comparative method. Teachers’ probing questions served as triggers for extended learner output. In problem solving situations, teacher questions served as verbal scaffolds promoting learner language performance,
cognitive functioning and self regulation. The study reported that teachers’ and students’ questioning is contributed to students’ on-line second language acquisition and additional research is needed to investigate whether classroom questioning has a lasting effect on second language acquisition.

Berkeley et al. (2005) investigated the effectiveness of self questioning strategy for improving student reading comprehension of grade level social studies text material. They employed a randomized experimental design for this study. Results indicated that students in the experimental strategy group performed better than the students in a typical practice group on both multiple choice and open ended comprehension tests of the social studies content. Implications for practice and future research were discussed.

Franke, et al (2009) examined the classrooms of three teachers who had engaged in algebraic reasoning CGI (Cognitively guided instruction ) professional development. They detail teachers’ questions and how they relate to students’ making explicit their complete and correct explanations. This study provides evidence about how teachers’ questions can support students to be more explicit and detailed in their explanations. It also revealed that teachers’ questions can position the student thinking in relation to the mathematics in varied ways which support student understanding. Finally the study showed that learning the details about teachers’ questioning practices and students’ responses required hearing what students said in relation to teacher questions, which has methodological implications for future research.

Shang and Chien (2010) explored the effectiveness of self questioning strategy on EFL learners’ reading comprehension. Both
quantitative and qualitative research methods were used including t-test, ANOVA and semi structured techniques to explore its effect. Results of this study demonstrate that students’ reading comprehension is enhanced significantly by self questioning strategy training, especially for low level students and students have positive attitudes towards enjoying self questioning strategy in their future reading activities. Pedagogical implications for EFL educators to recognize the directions of instructional practices for enhancing reading comprehension were presented.

Heng et al (2010) examined the effects of self questioning techniques on problem solving and Meta cognition for ill structured work place problems. The independent variable was the strategy training in self questioning techniques structuring around the IDEAL model as a cognitive heuristics adaptation to resolve novel situations. The dependent variable Meta cognition was made up of two constructs: knowledge about cognition and regulation of cognition. These were measured by using the Meta cognitive Awareness Inventory (MAI) while overall problem solving performance was determined by assessing the participants’ reasoning and the resulting consequences of their decision in the pre and post test. The results revealed that the intervention had significant positive effects on the novices’ reasoning performances, outcome performance and overall problem solving performance. In addition, the level of correlation between reasoning performance and outcome performance was significantly positive.

Lee (2010) conducted a study which provides teachers with blended questioning supports to enhance teachers’ questioning skills in pre-kindergarten science activities. The effects of teacher supports
were examined by two aspects: teachers’ questioning behaviors and
students’ language use in their responses to teachers’ questions. Twenty five pre–k teachers and their students participated in the study and were assigned into two groups: the treatment group received blended teacher supports and the comparison group did not receive the supports. The results shows that the web based questioning specific supports were found to be the most influential predictor to teachers’ enhancement of their open ended questioning. The study also reveals that the web based questioning and increased teachers’ frequency of open ended questions which in turn increases students’ use of complex sentences in their responses to teachers’ questions.

Pate (2011) used a randomized post test only control group experimental design to determine the effects of regulatory self questioning on secondary level career and technical education students’ electrical circuit theory test scores. The use of regulatory self questioning may positively benefit teachers who teach principles of Ohm’s law. This study should be replicated to determine the effects of regulatory self questioning with other secondary level students.

The attempts made to document some literature pertaining to the area of self questioning highlight the progressive merit of this classroom practice.

3.5 Studies related to problem solving

Successful intelligence involves the conscious direction of a set of mental processes to reach towards a thoughtful solution to a problem. The Meta cognitive prompts intentionally embedded in the problem solving strengthen learners’ higher order thinking abilities and raise their overall academic performance. Designing the classroom
based on the Meta cognitive experience enable the students to apply specific techniques and create new ideas with regard to the process of ‘learning to learn’. The Meta cognitive prompts also help the learners to engender and encourage appropriate mechanisms towards solving a particular problem. This section attempted to review some select studies with regard to the particular classroom practice, Problem Solving towards creating expertise in this practical, analytical and creative ability.

Flavell, (1976) Lin, (2001), and Mevarech &Kramarski (2003) studied the effect of meta cognition on problem solving in the school context. It was found that Meta cognition could improve the achievement of students regardless of their individual differences of participants.

Montague (1984) investigated the effects of cognitive and Meta cognitive strategy instruction on the mathematical problem solving of six middle school students with learning disabilities. All subjects eventually received both cognitive and Meta cognitive strategy instruction. Generally subjects improved their mathematical problem solving as measured by performance on one-two and three step word problems. Discussion focused on effectiveness of treatment acquisition and application of strategic knowledge, error pattern analysis and the need to tailor instruction to the learner’s individual characteristics.

West (1992) strongly vouched for including problem solving as a teaching strategy as it influences the thinking faculty of individuals to a remarkable extent, much more than the information one reads or is been told about.
Ross (1994) evaluated a method of instruction that promotes problem solving skills. Skills needed to solve problems are taught in schools but in isolated ‘chunks’ rather than being co-ordinate or integrated in an explicit problem solving approach. An adaptation of the framework of induction proposed by cognitive scientists was chosen as a theoretical base for the research. It identifies three main components of problem solving: collecting information, analyzing information and forming conclusions. These components were connected with declarative, procedural and conditional knowledge. They were used to structure the questions for the data collection which consisted of four interviews, daily learning logs and observations in each classroom. Results showed that after being taught in the problem solving environment, student explanations to declarative and procedural knowledge questions were better structured. In addition, there was a significant increase in their application or conditional knowledge to real life situations. The results show that Holland’s framework demonstrates the integration of diversity and fragmentation of skills being recommended in curriculum guidelines and resource books.

Ponnusamy (2006) investigated the impact of Meta cognition and problem solving strategies among low achievers in History. The research was conducted using a quasi experimental design with pre and post tests. The results reveals that the group which received meta cognitive and problem solving strategies performed better than the other groups in objective, subjective and essay tests. The study reported that higher meta cognitive awareness used more meta cognitive strategies during problem solving and higher meta cognitive knowledge could answer more higher level cognitive questions. The
study showed that Meta cognition and problem solving strategies can have a significant impact on academic achievement, Meta cognitive awareness and Meta cognitive knowledge.

Havenga (2008) investigated students’ knowledge, skills and strategies during problem solving in Object Oriented Programming. The objective of this study was to identify cognitive, Meta cognitive and problem solving knowledge, skills and strategies used by successful and unsuccessful programmers in Object Oriented Programming (OOP). A mixed research design was used, where both qualitative and quantitative methods were applied to analyze participants’ data. The findings suggest that successful programmers applied significantly more cognitive, Meta cognitive and problem solving knowledge, skills and strategies, also using a greater variety, than the unsuccessful programmes. Some experiences of teaching practices are also outlined as application of the findings of the study.

Cunningham (2009) explored the benefits of using ill-structured problems to develop Meta cognitive skills. The participants in the session will learn techniques for developing Meta cognitive skills by engaging them in solving ill-structured problems similar to those they will likely encounter in their professional life. Small teams are tasked to construct and defend reasonable solutions to an ill-structured problem. This interactive session examines how ill structured problems may help students learn to apply Meta cognitive strategies in the classroom. It also examined the benefits and challenges of teaching appropriate critical thinking and reasoning skills.

Price & Mitchell (2009) conducted an exploratory study aimed to measure perceived cognitive style, meta cognitive monitoring and
epistemic cognition according to Kitchener’s (1983) hierarchical model of cognitive processing as an indicator for problem solving confidence. This study argues these cognitive indicators may be used as a diagnostic foundation for improving ill structured problem solving capacity for adult professionals who develop software or use software systems to solve ill structured problems. The analysis determined that measured scores for the perceived assimilator (Kolb, 1984) cognitive style and Meta cognitive monitoring were moderately significant predictors of problem solving confidence as evidenced by a regression model that explained 20.5% of the expected variance.

Assefa (2010) tried to look into the patterns of physics problem solving strategies among third year physics students of Addis Ababa University as mediated by meta cognitive skills. Both close ended and open ended questionnaires were used for data collection. The close ended questionnaire was adapted from ‘higher order thinking skills questionnaire’ and the questions probing problem solving and meta cognitive skills were clustered around Larkin and Reif’s model of four steps physics problem solving. The study showed that strong knowledge base contributes towards problem solving skills and also practice and drill is important in developing Meta cognitive problem solving skills.

Downing (2010) measured Meta cognition of first year undergraduates from Hong Kong University by using the learning and study strategies inventory (LASSI) and it explored the differences in Meta cognitive development between each group of students between the beginning and end of their first fifteen months in each programme. Despite significantly weaker entry scores on the LASSI, the mean final scores, taken after 15 months and three semesters of study in the
different curriculum environments demonstrate dramatic improvements in Meta cognition for the PBL group of undergraduates. The paper argues that, in addition to the formal learning context, everyday challenges emerging from the additional new social contexts through problem based curricula provide fertile environments for the development of Meta cognition.

Gilies et al (2011) conducted a study titled as ‘Promoting problem solving and reasoning during cooperative inquiry science.’ This paper reported on a study that was conducted on the effects of training students in specific strategic and meta cognitive questioning strategies on the development of reasoning, problem solving and learning during cooperative inquiry based science activities. The study was conducted in 18 sixth grade classrooms and involved 35 groups of students in certain conditions. The results show that the students in all conditions demonstrated more helping discourses or discourses known to mediate learning than any other of the discourse categories. This outcome is encouraging because it is the helping discourses where students provide explanations, elaborations and reasons that promote follow up learning.

Delvecchio (2011) investigated how purposeful Meta cognitive instruction affected students’ use of Meta cognitive skills and their abilities to solve complex Chemistry problems. A quasi experimental intervention was implemented, using the pilot study as a control. A Meta cognitive framework that outlined Meta cognitive skills specific to problem solving in Chemistry formed the foundation for the intervention. Pre and post test self report questionnaires measuring students’ use of Meta cognitive skills (MCAI) and the problem solving tasks (PSTs) were used to measure the impact of the
intervention. Data about students’ meta cognitive and problem solving processes were also collected for the study group from: (a) think aloud pair problem solving (TAPPS) protocols (b) an exit interview with the classroom teacher (c) the students’ lab reports for two design labs, and (d) a survey of students’ use of meta cognitive framework. One way repeated measure ANOVA revealed that the post test PST scores were significantly higher than the pre test scores, and the groups differed significantly from each other with the study group scoring higher on both scores. While the statistical analysis revealed few differences, the teachers’ exit interview, TAPPS protocols, pre and post test lab reports, and student survey of Meta cognitive framework indicated that the intervention supported students’ abilities to solve complex Chemistry problems and use Meta cognitive skills associated with planning, monitoring and evaluation.

Bulu & Pedersen (2012) investigated how students with different prior knowledge and Meta cognitive skills benefited from continuous and faded domain-general and domain-specific scaffolds. Students’ scores on a multiple choice pre test, inventory of Meta cognitive self-regulation and solution forms were analyzed. Results indicated that while students with lower regulation of cognition and objectivity benefited more from the domain-general scaffolds than the domain specific ones, students with lower prior knowledge, knowledge of cognition and problem representation took advantage of both domain general and domain specific conditions. Results of the study also suggested that scaffolds did not substantially benefits the students with higher prior knowledge and higher Meta cognitive skills.
Review of Related Literature

These studies reveal that anchoring learning activities to a problematic task motivates learners for active involvement and enables them to highly participate in discussions towards reconstructing ideas systematically.

The methodological approach adopted, the analysis and interpretation done, findings and conclusions derived are outlined in the succeeding chapters.

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