CHAPTER – II

REVIEW OF RELATED LITERATURE

2.1 INTRODUCTION

This chapter discusses about the review of related literature and researches carried out in the area. Literatures from various sources were reviewed to study the research trends in the area. The reviewed literature and researches are categorized into i) Studies on Active Learning, ii) Studies on Critical Thinking, iii) Studies on Thinking Styles and iv) Synthesis of Review.

2.2 STUDIES ON ACTIVE LEARNING

The review revealed that literature of Active learning is rich and robust and has been expanding for the past two decades. Educationalists worldwide accept the fact that student learn more when they are active. Active Learning Strategies have become engaged in the process a preferred way to change the passive traditional teacher-centered classrooms into active, student centered ones (Bogart, 2009). Numerous researches have been undertaken to explore the nature, status and impact these strategies have brought about in the instructional field. Many experts agree that students learn best when they take an active role in the educational process, discussing, take on active role in the educational process, discussing what they read, practicing what they learn and applying concepts and ideas.

Active learning pedagogies represent a model of teaching that highlights minimal for lecturing direct transmission of factual knowledge, multiple small group activities that engage students in discovery learning or problem solving.
Nelson (1994) examined the relationship between collaborative learning and some major theoretical and empirical approaches for fostering Critical Thinking and suggested three frameworks for combining collaborative learning and Critical Thinking – use of mental models, creation of discourse communities, and creation of disciplinary discourse communities.

Modell (1996) conceived active learning environment as one in which students engage in the process of building and testing their own mental modes from information they are acquiring.

Cantrell, Fusaro and Dougherty (2000) compare the effectiveness of two types of journal writing on learning social studies in four seventh-grade classrooms. Both journal formats incorporate reading comprehension strategies with journal writing. One format required students to structure their journal responses according to the steps involved in the K-W-L comprehension strategy format. The other journal format required students to summarize what they had read. Groups were pre- and post-tested in to compare the effectiveness of each type of journal format. A quasi-experimental design was used with results analyzed with an analysis of variance. Results indicate that the K-W-L groups learned more content material to a statistically significant degree than did the Summary groups.

Sivan et al. (2000) reported that beyond increasing the students’ success, Active learning helped students to create a sense of curiosity, to improve ability to apply knowledge, to develop independent learning skills and prepared them to for future career.
Sivan et al. (2000) studied the effect of active learning on the quality of student learning. The results showed that active learning made valuable contribution to the development of independent learning skills and ability to apply knowledge. It also helped to create interest in the curriculum and to prepare students for their future careers.

Oliveira and Oliveira (2006) pointed out that through active learning techniques and modeling by the teacher, students shed their traditional roles as passive receptors and learn and practice how to apprehend knowledge and skills and use them meaningfully.

Akinoglu and Tandogan (2007) found that problem based active learning has positively affected students academic achievement and their attitude towards science course. It was found that application of Problem based learning active learning model affected students’ conceptual development positively and kept their misconceptions at the lowest.

Csape (2007) observes that Active learning provided opportunities for interaction and involved through controlled activities and instructional interventions.

Miri, Benchaim and Zoller (2007) conducted a longitudinal case-study aimed at examining whether purposely teaching for the promotion of higher order thinking skills enhances students’ critical thinking (CT), within the framework of science education and found that the experimental group showed a statistically significant improvement on Critical Thinking skills components and disposition towards Critical Thinking subscales, such as truth-seeking, open-mindedness, self-confidence, and maturity, when compared with the control groups. The findings
suggest that if teachers purposely and persistently practice higher order thinking strategies for example, dealing in class with real-world problems, encouraging open-ended class discussions, and fostering inquiry-oriented experiments, there is a good chance for a consequent development of Critical Thinking capabilities.

Taraban, Box, Myrs, Pollar and Craig (2007) studied the effect of Active learning experiences on Achievement, attitudes and behaviour of high school students. The study revealed that Active learning based laboratory activities can lead to increased use of students centred instructional practices as well as enhanced content knowledge and process learning outcomes for the students.

Thangarasathi and Viola (2007) studied the effectiveness of cooperative learning approach in learning Mathematics and found that cooperative learning methods were more effective in improving students’ achievement in Mathematics.

Şükran Tok (2008) studied the effects of the note-taking and KWL strategy on the attitude and Academic achievement and found that note taking and KWL strategies in the 5th grade Science and Technology courses can be effective for increasing the academic achievement and concluded that KWL and note taking strategy are not effective for developing positive attitudes towards the science and technology course. Thus, according to the results of the study: The methods, activities and strategies which can support students’ note taking skills and KWL strategy should be integrated into the fifth grade Science and Technology Curricula. Note taking strategy and KWL strategies should be taught to prospective teachers in educational sciences courses as well as in in-service teacher training programmes.
Aydede and Matryar (2009) noticed that Active learning approach in science course affected the cognitive level of students achievement meaningfully. Their study also revealed that students had positive opinions for active learning approach.

Donohue and Richards (2009) concluded that active learning proposed to be a good set of pedagogies that is a good fit with preferred and working styles of the millennial and the students of science in particular.

Karamustafaoglu (2009) studied the physics teachers’ opinion about student centred activities applicable in physical teaching and learning context. The finding of the study indicated that although teachers were aware of student centred physical instruction they were still not using techniques widely.

Manimaran and Anandan (2009) pointed out that they studied the opinion of primary teachers towards activity based learning. The study revealed that most of the primary school teachers have a positive opinion towards activity based learning.

Anitha (2010) conducted a critical study on the learner active practices in secondary schools of Kerala and suggested that teachers should adopt active learning techniques to enable the learners to actively imbibe the concepts rather than making passive recipients of knowledge by helping them to develop dynamic and self regulated in learning. She also observed that pupils should be prompted to practice active, self regulatory learning habits that include analyzing, structuring and memorising through intentional sequential methods.

Aruna (2010) conducted an experimental study to ascertain the extent to which concept mapping helped the secondary school students to improve
achievement in science. The study revealed that the experimental group improved in the ability to understand the concepts well and retained them. She suggested that concept mapping can be effectively used as a revision and retention tool.

Guvenc (2010) investigated the effects of cooperative learning and learning journals on teacher candidate students’ self-regulated learning using quasi pre-test/post-test experimental design with control group. Both groups were taught by cooperative learning. The experimental group wrote their reflection in learning journals. The research has discerned that there is a difference between experimental and control groups. The experimental groups’ students have been affected more positively on self-efficacy for learning and performance, elaboration, organization, Critical Thinking and metacognitive control strategy dimensions of self-regulated learning.

Kaul (2010) studied the effect of learning together techniques of cooperative learning methods on student achievement in mathematics and observed that the method is more effective than the traditional methods in improving the mathematics achievement of students of class VII.

Majoka, Dad and Mahmood (2010) noted that the higher level of engagement in the learning process was effective for increasing academic achievement in Mathematics and for retaining the learnt material.

Pai (2010) studied the effects of participatory learning techniques on attitude towards and achievement in Educational statistics of B.Ed. students and the study revealed that participatory learning techniques were undoubtedly better than traditional methods in respect of not only increasing the achievement of the students but also in developing favourable attitudes towards it.
Pushpanjali and Satyaprakash (2010) conducted a study in which they found that cooperative learning strategies were superior to conventional methods in significantly promoting the achievement motivation and reducing the anxiety in students.

Andrews, Leonard, Calgrove and Kalinowski (2011) investigated the relationship between active learning and student learning in the subject area. They found no association between student learning gains and the use of active-learning instruction. Although active learning has the potential to substantially improve student learning, this research suggests that active learning, as used by typical college biology instructors, is not associated with greater learning gains. They contend that most instructors lack the rich and nuanced understanding of teaching and learning that science education researchers have developed. They caution that active learning as designed and implemented by typical college biology instructors may superficially resemble active learning used by education researchers, but lacks the constructivist elements necessary for improving learning.

Barnett and Francis (2011) conducted a study to determine if quizzes containing higher order thinking questions are related to Critical Thinking and test performance when utilised in conjunction with an immersion approach to instruction and effort-based grading. Quizzes contained factual multiple-choice questions, factual essay questions or essay items requiring higher order thinking. Critical Thinking was measured with a pre-test–post-test design and the Watson–Glaser Critical Thinking Appraisal (Short Form). Classroom learning was assessed via multiple-choice and essay tests. Critical Thinking increased equally across all
sections. The section receiving higher order thinking quizzes performed significantly better than the other two sections on both the multiple-choice and essay portions of the classroom tests.

Campisi and Finn (2011) investigated the influence of active, collaborative-based research project in undergraduate Research Methods course for first-year sports medicine students. The results of the study indicated that on incorporating a participatory, collaborative, and active learning component to this course allowed students to grasp relevant theories and principles, acquire competency in research methodology techniques, develop interpersonal and professional skills, and improve their attitude regarding science and the research process. The results suggest participation in a research project can be an effective way to enhance student learning and attitudes regarding the course.

Carvalho and West (2011) conducted an experimental study to determine if offering voluntary active learning exercises would improve student understanding and application of the materials covered. Students in both experimental and control groups were taught by traditional methods and students in the experimental group had the option to voluntary participate in two additional active learning exercises: 1) a small group discussion, 2) a free response question, where students anonymously responded to one short essay question after the laboratory exercise. In these formative assessments, students received feedback about their present state of learning from the discussion with their peers and also from the instructor comments regarding perceived misconceptions. As a result of the participation in these activities, students in the experimental group had a better overall performance.
Khaurey and Bowers (2011) pointed out that Active Learning Strategies transform learning from a private unexamined want to a public, shared process within the classroom community.

Kumar and Behera (2011) studied the effectiveness of Activity based Learning for developing the competency of reading comprehension and found that the pair work and group work stimulated the learners to actively involve in the program and it helped the students to achieve competencies in reading comprehension within a period of two weeks.

Manoj and Devanathan (2011) studied the effectiveness of problem based learning strategies on science process skills in relation with the scientific attitude of secondary school students and found that problem based learning significantly enhanced the process skills in biological sciences and process skills and scientific attitude were positively correlated. They also found that problem based learning had a bearing on improving the scientific attitude of secondary school students.

Sesin and Tarhan (2011) conducted a study aimed to investigate the effectiveness of active-learning implementation on high-school students’ understanding of “acids and bases” on 45 high-school students from two different classes, which were randomly assigned to the experimental (n = 21) and control groups (n = 25), in a high school in Turkey. A one-way analysis of variance (ANOVA) was conducted to compare the pre-test scores for groups and no significant difference was found between experimental and control groups in terms of mean scores. The experimental group was taught using an active-learning curriculum developed by the authors and the control group was taught
using traditional course content based on teacher-centered instruction. Based on the achievement test and individual interview results, it was found that high-school students in the experimental group had fewer misconceptions and understood the concepts more meaningfully than students in control group. The study revealed that active-learning implementation is more effective at improving students’ learning achievement and preventing misconceptions.

Sheieh, Chang and Lui (2011) conducted a quasi experimental investigation on students learning general physics, focusing on differences between genders and among various achievement levels. The results indicated that the learning gain achieved by the experimental group was 11% higher than that achieved by the control group in the first semester, though the margin decreased to 1% in the second semester. In the situation of the low achievement level, there was no difference found in the learning gain achieved by the two groups in the second semester. The qualitative data revealed that student academic performances were disclosed to be associated with the following factors: the instructors’ teaching styles and instructional skills, the students’ prior knowledge, their study habits, and the cohort atmosphere. That is, implementation of the innovative tool alone might not be sufficient to significantly improve student performance. Nonetheless, the interactive, collaborative instructional approach seemed to appeal to females more than it did to males, disclosing the potential of TEAL in narrowing the learning gap between genders.

Tatar and Oktay (2011) examined the effectiveness of PBL on candidate science teachers’ understanding of the first law of thermodynamics and their science process skills. This study also examined their opinions about PBL. A
one group pre-test–post-test experimental study was conducted on the sample consisting of 48 third-grade university students from the Department of Science Education in one of the public universities in Turkey. The results of the study indicated that the PBL approach has a positive effect on the students’ learning abilities and science process skills. The students thought that the PBL environment supports effective and permanent learning, and self-learning planning skills. On the other hand, some students think that the limited time and unfamiliarity of the approach impede learning. From this study it was concluded that the PBL is an active learning approach supporting students in the process of learning.

Deepa and Sadananthan (2012) studied the attitude of secondary school teachers towards cooperative learning strategies and found that majority of the secondary school teachers showed a favourable attitude towards cooperative learning.

Ebrahim (2012) studied the effect of Cooperative Learning Strategies on Elementary Students’ Science Achievement and Social Skills in Kuwait and found that the cooperative learning strategies have significantly more positive effects on both students’ achievement and social skills than teacher-centered strategies. These results provide an evidential base to inform policy decisions and encourage and persuade teachers to implement cooperative learning methods.

Gardner and Bellard (2012) studied the effect of organizing Active learning Experiences in Biology instruction among undergraduate students. The results of the study revealed that Active Learning Strategies can increase student learning, yet few biology instructors use all identified Active Learning Strategies. They
have presented a framework for organizing Active Learning Strategies in undergraduate biology classes, and also provided clear implications for designing instruction.

Madhuri, Kantamreddi and Prakash (2012) studied the effectiveness of inquiry-based active learning pedagogical approach in promoting higher order thinking skills in chemistry.

Maskiewicz, Griscom and Welch (2012) studied the effect of Targeted active-learning activities on students’ ways of reasoning. From the findings of the study they concluded that using targeted in-class active learning activities had a beneficial effect on student learning regardless of major or class size. They argue that using diagnostic questions to identify effective learning activities is a valuable strategy for promoting learning, and gains from lecture-only classes were minimal.

Minhas, Ghosh and Swanzy (2012) studied the effects of Passive and Active Learning on Student Preference and Performance in an Undergraduate Basic Science Course and found that by the end of the study, student preference for peer-led seminars increased, and examination scores significantly increased. A majority of students (68.8%) preferred a method that contained peer-led seminars and instructor-led lectures. These results may indicate that integration of active and passive learning into undergraduate courses may have greater benefit in terms of student preference and performance than either method alone.

Shaljan (2012) investigated the effects of inquiry-based science instruction on science achievement and interest in science of 5,120 adolescents from 85 schools in Qatar. Results of study revealed the substantial positive effects of
science teaching and learning with a focus on model or applications and interactive science teaching and learning on science achievement and interest in science. In contrast, science teaching and learning using student investigations and hands-on activities had substantial negative effects on science achievement in the context of other variables.

Sheih (2012) studied the Impact of Technology-Enabled Active Learning (TEAL) on Student Learning and Teachers’ Teaching in a High School Context. The results of this quasi experimental study revealed that the benefits that the participants gained from exposure to the innovative instruction appear in various aspects in addition to the students’ test results. Having higher interest in attending physics classes and being more active in participating in extracurricular science activities on the part of the students, and being more enthusiastic and confident in helping students strengthen their physics concepts on the part of the teacher, are among the non-test score gains. The students’ achievements and positive responses to the teacher’s instruction seem to have motivated dedication and confidence. It is also found that teachers’ teaching beliefs and desire to change greatly affected their classroom practices and technology integration.

2.3 STUDIES ON CRITICAL THINKING

Torres and Cano (1995) studied the relationship between learning styles and Critical Thinking and find that the Critical Thinking of students are influenced by their learning styles. 9% of the variance in the students’ Critical Thinking was uniquely accounted for by the learning styles after controlling the personal characteristics.
Adrit (1999) summarised the teaching strategies that develop Critical Thinking as classroom assessment techniques, cooperative learning strategies, case study, discussion method, using questions, using written assignment dialogues (written and spontaneous group dialogues) and ambiguity (disputations situations instead of clear information).

Rudd, Baker and Hoover (2000) examined the presence or absence of relationship between student learning styles and student Critical Thinking dispositions. The results of the study revealed that only 17% of the sample considered for the study possessed high disposition towards Critical Thinking and there was no significant difference between field dependent and field independent learners. The results indicate that Critical Thinking dispositions are independent of students learning styles.

Kaewkongka (2001) studied the differences of sixth graders’ Critical Thinking as taught by group investigation model and traditional learning methods. The purpose of this experimental research with randomized control group pre-test post-test design was to describe the difference between the sixth graders’ Critical Thinking as taught by group investigation model and another group as taught by traditional method on a sample of 25 students in experimental and other 25 in control groups. The results of the research reveal that Critical Thinking ability of experimental group was significantly higher than the control group, indicating that group investigation model was effective in enhancing the Critical Thinking abilities of the students.

Collier, Guenther and Veerman (2002) conducted an action research project seeking to develop students’ Critical Thinking skills by implementing a
variety of instructional strategies. Targeted for this study were students in early childhood special education program, one kindergarten class, and one eighth grade science class. The deficit in Critical Thinking and problem-solving skills was documented through teacher observation checklists, student journals, and surveys of teachers, parents, and students. Analysis of probable causes revealed that students were not challenged to use Critical Thinking skills in the classroom on a consistent basis. Several instructional strategies were used in an 11-week intervention to boost students’ Critical Thinking skills, including environmental enhancements, graphic organizers, journaling, problem-based learning, technology, and questioning techniques. Teachers guided students in a variety of developmentally appropriate activities to assist individual, small, and whole groups in problem-solving activities and in acquiring concepts and skills. Post-intervention data revealed definite improvements in student Critical Thinking skills for most students in the early childhood, kindergarten, and eighth-grade classes.

Clark (2003) pointed out that Critical Thinking can be facilitated by collaborative working environment that encourage the personal dispositions, valuing open mindedness, value for fairmindedness, respecting evidence and reason, respecting clarity and procession and tolerating ambiguity. Critical Thinking can be facilitated by collaborative working environment that encourages the cognitive skills, asking questions, examining evidences, defining problems, analyzing assumptions and biases and considering the point of view.

Gellin (2003) concluded that college students who engaged in activities such as interacting with faculty and peers, living our campus and participating in
college clubs or organizations increased their measured Critical Thinking skills by 0.14 Standard as compared to other college students.

Walker (2003) argue that numerous instructional methods exist to promote thought and active learning in classroom including case studies, discussion methods, written exercises questioning techniques and debates. Although not appropriate for all subject matters and classes, these learning strategies can be used and adapted to facilitate Critical Thinking and active participation.

Wheeler and Collins (2003) conducted a quasi-experimental study that used a pretest-posttest design with a control group to evaluate the effectiveness of concept mapping in developing Critical Thinking skills in baccalaureate nursing students. A convenience sample (n = 76) was randomly assigned to experimental (n = 44) and control (n = 32) groups. The experimental group was taught to use concept mapping of patient information to prepare for clinical experiences. The control group was taught to use traditional nursing care plans. Critical Thinking skills were measured with the California Critical Thinking Skills Test, which yielded six scores: an overall score and five subscales (analysis, evaluation, inference, deductive reasoning, and inductive reasoning). A significant difference was found between the mean pretest and posttest scores and each subscale. Post hoc tests found differences between groups to be insignificant, while various differences within a group were significant. Experimental group scores improved significantly on the overall score and the analysis and evaluation subscales, while control-group scores improved significantly only on the evaluation subscale and declined significantly on the inference subscale. The findings suggest that concept mapping is effective in helping students develop Critical Thinking skills. Clayton
(2006) also had a similar finding. He pointed out that that review of the current state of the science with regard to concept mapping demonstrates that this teaching-learning method assists nurse educators to prepare graduates to think critically in the complex health care environment.

Wilke (2003) investigated the effect of active-learning strategies on college students’ achievement, motivation, and self-efficacy in a human physiology course for non-majors. The findings of the study indicated that there were no significant differences in motivation. Attitude surveys indicated that students in both the treatment and control groups demonstrated a positive attitude toward active learning, believed it helped (or would help) them to learn the material, and would choose an active learning course in the future.

Hoffman and Elvin (2004) examined the relation between Critical Thinking and confidence in decision making for new graduated nurses. On contrary to prior studies that have found either no relationship or positive correlation between Critical Thinking and confidence in decision making, the study found a negative correlation between the two variables.

Hofrecter (2005) observed that after a semester long intervention students did not improve in Critical Thinking dispositions, but improved in overall Critical Thinking skills especially in analysis, self regulation and evaluation. Critical Thinking skills scores positively correlated with disposition scores.

Mimbs (2005) studied teacher leaders’ perceptions of their success in modeling and teaching Critical Thinking through problem based perspectives and examined their perceived challenges in implementing their approach. This study aimed to enhance teacher’s use of critical-thinking, problem-based curricular
approach in family and consumer sciences (FCS). Their perceptions of their
success in using the techniques, and the ongoing challenges were discussed and
found that 1) teachers’ need a solid understanding of the Critical Thinking,
problem-solving approach and the value it has for themselves and their students;
2) teachers must learn to think critically and model and practice the techniques
consistently with students; and 3) support and continued professional development
for current and future teachers in the Critical Thinking, problem solving approach
is needed.

Ricketts and Rudd (2005) conducted a correlational study to identify the
specific Critical Thinking skills of selected youth leaders. From the conceptual
model of Critical Thinking skills development, the following sets of variables
were related to Critical Thinking skills: Grade point average (GPA), leadership
training score, and the Critical Thinking disposition of innovativeness explained
12% of the variance in combined Critical Thinking skill; GPA, gender, age, and
innovativeness explained 13% of the variance in the specific sub-skill of Analysis;
and GPA and the Innovativeness disposition explained nine percent of the
variance in the specific sub-skill of Inference. The findings of the study indicated
that positive but low relationship between Critical Thinking skills and
innovativeness and engagement component of Critical Thinking dispositions and
high or low, but negative relationship was fond between Critical Thinking skills
and maturity component of Critical Thinking dispositions.

Terezine, Parcarella and Nora (2005) have cited three kinds of teacher
influenced classroom interactions positively influenced Critical Thinking. (I) The
extend to which the faculty member encouraged, praised or used students ideas
(II) the extend and cognitive level of student participation in the class and (III) the amount of interaction among students in a course.

Yoder and Hochevar (2005) tested the hypothesis that students in psychology of women classes would perform better on materials covered by multiple-choice exams when they presented these materials with active learning versus lecture, autonomous readings, and video presentations alone. Across three classes, they coded exam items according to how the instructor presented relevant materials and recorded classwide performance. Both between and within classes, students’ performances were better on items testing materials covered with active learning techniques compared to other formats. These data provide empirical support for the efficacy of active learning techniques.

Klimoveiena, Urboviene and Raminta (2006) revealed that relationship between cooperative learning and Critical Thinking. They found that the student who mastered the skills of cooperative learning mastered the skills of Critical Thinking as well. They also found that Critical Thinking and creative thinking are interrelated and complementary aspects of thinking and it is important to pay attention to the development of both creative thinking and Critical Thinking in order to improve Critical Thinking.

Tiwari, Lai, So and Yuen (2006) conducted a study to compare the effects of problem-based learning (PBL) and lecturing approaches on the development of students’ Critical Thinking of undergraduate nursing students at a university in Hong Kong. The results of the study indicated that there were significant differences in the development of students’ Critical Thinking dispositions between those who undertook the PBL and lecture courses, respectively. It was concluded
that PBL was effective in developing the Critical Thinking dispositions of the students.

Yesildere and Turnukla (2006) conducted a study to determine the effect of project-based learning on the disposition of Critical Thinking in teacher candidates of primary mathematics. Project-based learning was implemented with 73 teacher candidates in the last year of their initial teacher education. The California Critical Thinking Disposition Inventory was used for deciding whether there was a difference in the teacher candidates’ Critical Thinking dispositions before and after the project-based learning. Additionally, a semi-structured interview was held with the teacher candidates. The differences pertaining to participant Critical Thinking were established according to their perceptions. A significant difference was found between the Critical Thinking disposition level of teacher candidates of elementary mathematics before and after their involvement in project based learning. Teacher candidates stated that the period of project-based learning had positive influences on their ways of thinking and their skill development. The study revealed that significant difference between Critical Thinking dispositions level of teacher candidates of elementary Mathematics before and after their involvement in project based learning. The project based learning had positive influence on their ways of thinking and their skill development.

Burris and Garton (2007) studied the effect of instructional strategy on Critical Thinking and context learning using problem based learning in secondary classroom. The purpose of the study was to determine the effect of problem-based learning (PBL) on Critical Thinking ability and content knowledge among selected secondary agriculture students in Missouri. The study employed a quasi-
experimental, non-equivalent comparison group design. The treatment consisted of two instructional strategies: problem-based learning and supervised study. The target population was identified as secondary agriculture students in Missouri. Twelve secondary agriculture teachers were selected based on criteria established by the researcher. Intact classrooms were randomly assigned to a level of the treatment. The resulting sample (n = 140) consisted of 77 students in the problem-based learning treatment group and 63 students in the supervised study treatment group. Analysis of covariance indicated a treatment effect on Critical Thinking ability and content knowledge and observed that problem based learning and supervised study affected Critical Thinking ability and content knowledge positively.

Carss (2007) conducted a research aimed to describe the effects of Think-Pair-Share strategies, used during Guided Reading lessons, on reading achievement. The study took place in a Year 6 classroom with two intervention groups, each containing six children. One group was reading above their chronological age and the other below. Control groups reading at these levels were also used. Three variations of Think-Pair-Share were utilised during the eight week intervention period; Predict-Pair-Share, Image-Pair-Share and Summarise-Pair-Share, and the research centred on the effects of the intervention on reading comprehension. A quasi-experimental design was employed using a pre-test, post-test format and a mix of quantitative and qualitative measures to ascertain the effects. The results confirmed the positive effects of the strategy on reading achievement, especially for those students reading above their chronological age, although an extended period of intervention may have had more significant effects
on those reading below. Positive effects on aspects of oral language use, thinking, metacognitive awareness, and the development of reading comprehension strategies were noted with both of the intervention groups. Results have significance for those concerned with implementing effective literacy practice. They demonstrate the versatility of the Think-Pair-Share strategy as a tool to foster conversation.

Mazer, Hunt and Kuznekoff (2007) conducted an experimental study to assess a Critical Thinking instructional model in the Basic communication course. Experimental group participants received enhanced instruction using various Active Learning Strategies, activities, and assignments and the results of the study revealed that the new instructional model containing enhanced instruction in Critical Thinking has generated substantive improvement overtime in students Critical Thinking skills.

Tan, Sharan and Lee (2007) conducted an experiment in 7 eighth-grade (ages 13-14 years) classes in Singapore, the authors evaluated the effects of the group investigation method of cooperative learning versus the effects of the traditional whole-class method of instruction on students’ academic achievement and on their motivation to learn. The authors also investigated students’ perceptions of group investigation. Students in group investigation and in whole-class instruction advanced to the same extent over the course of the experiment. Neither method was more effective academically than the other method. As expected, the high-achieving students had significantly higher academic achievement than did the low-achieving students. The group investigation method did not have differential effects on the two groups of high and low achievers.
Group investigation affected high achievers’ motivation to learn on the Criteria subscale only.

Abrami, et al. (2008) studied the instructional interventions affecting the Critical Thinking skills and dispositions and found that training in Critical Thinking works. In regard to the question of how to plan a curriculum in such a way that students are successfully developing their Critical Thinking skills. This was an important finding for the design of courses. They found that developing CT skills separately and then applying them to course content explicitly works best. When instructors received special advanced training in preparation for teaching CT skills, the impacts of the interventions were greatest. As important as the development of CT skills is, educators must take steps to make CT objectives explicit in courses and to integrate them into both pre-service and in-service training and faculty development.

Blue, Taylor and Rice (2008) studied the effect of full cycle assessment over a three year period to assess the student development. They used full cycle assessment over a three-year period to assess students’ development and to modify the course teaching and assignments with the goal of increasing student development of Critical Thinking skills. Data were obtained from student writing throughout the semester during each offering. Modest, but significant, overall gains of 0.7 on a 4-point scale are reported between early and midterm assignments in the course using a seven trait assessment rubric. Key factors that contribute to the increase in Critical Thinking skills are identified including peer review, scaffolded assignments, and the use of a grading rubric for each assignment. The findings of the study revealed that peer review, scaffolded
assignments and the use of grading rubric contributed to the increase of Critical Thinking skills among undergraduate students.

Hayes and Devitt (2008) studied the effect of classroom discussion with student led feedback on the development of Critical Thinking skills and found that utilization of small group for discussion was effective tool for developing Critical Thinking in all students CDSF strategy was particularly successful in development of Critical Thinking skills among students.

Rashid and Hashim, R.A. (2008) examined the Critical Thinking ability of Malaysian undergraduates and its relationship to their language proficiency. Results indicated that the Critical Thinking ability of the undergraduates was much lower than that of their American counterparts. Nevertheless, significant correlations were found between their Critical Thinking ability and English language proficiency as measured by two national level tests.

Saurino (2008) found that concept journaling increases Critical Thinking disposition and problem solving skills in Adult education.

Sezer, Renan (2008) compared the effects of integrating Critical Thinking skills into a teacher preparation course in mathematics by examining a control and an experimental group. Results indicate that emphasis on Critical Thinking, even in one course content, can have positive effects on students’ attitudes.

Simpson and Courtney (2008) conducted the study on implementation and evaluation of Critical Thinking strategies to enhance Critical Thinking skills in Middle East Nurses and found that strategies like questioning, debate, role play and found that small group activities improved the Critical Thinking skills of the sample.
Bataineh and Alazzi (2009) conducted a study on social studies teacher’s perceptions of teaching Critical Thinking skills in classroom. This research study was conducted in Jordan, where secondary school social studies teachers were interviewed regarding their perspectives of teaching Critical Thinking skills in their classrooms and guidelines, textbook and teacher manuals were analyzed qualitatively. The study results indicated that Jordanian secondary school social studies teachers are not familiar with the definition and teaching strategies of Critical Thinking; the Jordan Ministry of Education Guidelines did not require teachers to teach Critical Thinking. In addition, teacher manuals for the state-required textbooks providing only detailed content information, with only minor references to teaching Critical Thinking. Previous research, conducted by the author on middle and high school students in Jordanian public schools, supports the finding that students do not acquire Critical Thinking skills from their public school education in Jordan. The study results indicated that Jordanian secondary social studies teachers are not familiar with the definition and teaching strategies of Critical Thinking. This supports the finding that students do not acquire Critical Thinking skills from public school education in Jordan.

Brickman, Gormally, Armstrong and Hallar (2009) conducted a study which demonstrated greater improvements in students’ science literacy and research skills using inquiry lab instruction. They also found that inquiry students gained self-confidence in scientific abilities, but traditional students’ gain was greater – likely indicating that the traditional curriculum promoted over-confidence. Inquiry lab students valued more authentic science exposure but
acknowledged that experiencing the complexity and frustrations faced by practicing scientists was challenging.

Goyak (2009) studied that effect of cooperative learning techniques integrated into traditional lecture on perceived classroom environment and Critical Thinking skills of preservice teachers. This study analyzed the effects of cooperative learning techniques versus lecture techniques on the following aspects of a higher education classroom: (a) the perception of a student’s learning environment and (b) a student’s Critical Thinking skills among preservice teachers. Results revealed significantly higher means in the cooperative learning group in four of the eight constructs within the Classroom Environment inventory. Results within the WGCTA-FS disclosed no significant differences between the means of the two groups. The outcomes of this study suggest that cooperative learning techniques have no merit and profit in the undergraduate classroom. Thus influence of co-operative learning techniques did not have measurable effect on Critical Thinking skills of population sample for this specific study.

Kokmaz and Karakus (2009) studied the impact of Blended learning models on student attitude towards geography course and their Critical Thinking dispositions and skills. An experimental pattern with pretest-posttest control group was used in the study. The study group consists of a total of 57 students. The experiment group was subject to hybrid learning through the Geography web page, while the traditional learning model was used for the control group. The data were collected through literature review, the Geography Attitude Scale, and the California Critical Thinking Disposition Inventory with Cronbach Alpha values of
0.92 and 0.88, respectively. The data were then subjected to percentage, arithmetic mean, t-test, ANOVA, Scheffe and Pearson correlation tests and the results were interpreted (p<0.05). The study indicated that Blended learning model contributed more to student attitudes toward geography course when compared to the traditional learning model, blended learning model contributed more to student critical dispositions and levels when compared to the traditional learning model; and there was a positive correlation between student attitudes toward geography course and their Critical Thinking dispositions and levels.

Kyoungna (2009) investigated the effect of incorporating Active Learning Strategies such as small-group learning with authentic tasks, scaffolding, and individual reports, which were employed to enhance students’ learning and Critical Thinking in a large undergraduate, general science education class. Results indicate that the Active Learning Strategies had a positive significant effect on undergraduate students’ learning of geoscience concepts, from pretest to posttest, as well as students’ Critical Thinking displayed in written reports, which suggests that the use of Active Learning Strategies in a large class were useful to enhance student learning. From the qualitative results regarding students’ perception, in general, the use of Active Learning Strategies reportedly had a positive effect on students’ engagement in the learning experience. The three Active Learning Strategies employed in the course were perceived as being supportive for student learning and Critical Thinking. Overall, students perceived positive impacts or values of the Active Learning Strategies on the following: (1) their active engagement in their learning, (2) receiving external support and
input from group discussion and scaffolding as well as for applying knowledge to real-life problems, and (3) individual writing opportunities.

Mulia (2009) conducted a study aimed to find out whether there was any significance difference between the students who taught by using think-pair-share strategy and those who were taught by using conventional technique. From the results of this research it was concluded experimental group was better than control group. Based on the results above, it could be concluded that the use of Think-pair-share strategy was effective to improve reading descriptive text for Junior High School students.

Tumkaya, Aylek and Aldag (2009) studies the relation between Critical Thinking disposition and perceived problem solving skills among the university students and they results of the study indicated that letter disposition towards CT was associated with greater problem solving skills. The recommended that increasing activities that develop Critical Thinking and Problem Solving skills and integrating these activities to their instructional program could help students in development of these skills.

Tung and Chung (2009) investigated the efficacy of developing Critical Thinking through literature reading. A few strategies are incorporated into the course design: reading comprehension pop quizzes, learning log, group presentations, guided in-class discussion with Socratic questioning skills and individual essay-question reports. Students took the pretest and posttest California Critical individual interview with the teacher. The findings of the study were 1) literature reading helped those who scored low in the pretest improve their overall Critical Thinking skills, particularly those in analysis; 2) students’ English
proficiency did not relate to their performance in both the pretest and posttest; 3) Students found guided in-class discussion more effective than other student-directed activities in developing Critical Thinking.

Yang and Chung (2009) examine the effect of cultivating Critical Thinking skills within civic education to maximize its potential. This investigation aims on how teaching Critical Thinking in civic education affects the Critical Thinking skills and dispositions of the junior high school students. During the 10-week experiment, the experimental group was taught using Critical Thinking instruction while the control group was not taught using any Critical Thinking programme. The statistical analysis showed that the experimental group significantly outperformed the control group on scales of CT skills and CT dispositions. The student surveys indicated that the CT programme fostered their active listening and respect for different ideas, and moreover they learned to tolerate divergent and to examine their ideas for possible bias. The programme boosted their learning interest and sense of accomplishment, and nurtured their teamwork and communication skills. Furthermore, a few students experienced improvements in their speaking skills and courage as their confidence and ability to express themselves improved.

Aizikovitsh and Amit (2010) studied whether it was possible to improve students Critical Thinking dispositions through teaching a course in probability. The tenth-grade students were taught with the purpose of encouraging Critical Thinking dispositions such as open-mindedness, truth-seeking, self-confidence and maturity. The teacher encouraged class discussion and planned investigative lessons. The students completed a pre and post CCTDI test. A minor improvement
was detected, but they believe that these initial results are the first step in showing that it is possible to train students’ Critical Thinking dispositions. The findings of the research suggest that when teachers consistently and explicitly emphasize specific Critical Thinking skills students are more likely to succeed in developing them.

Beachboard and Beachboard (2010) conducted a study entitled ‘Critical Thinking pedagogy and student perceptions of university contributors to their academic development and the empirical evidences provided by the study indicate that the extra efforts faculty exert to engage their students in Higher order thinking activities make a difference in students’ critical life skills, improved academic development, job preparation and improved grades.

Bensley, Crowe, Bernhardt, Buckner and Allman (2010) gave Seven Guidelines for direct infusion approach in helping students acquire basic CT skills Teaching and Assessing Critical Thinking – Motivate the students to think critically, Clearly state the CT goals and objectives for the class, Find opportunities to infuse CT that fit content and skill requirements of the course, Use guided practice, explicitly modeling and scaffolding CT, Align assessment with practice of specific CT skills, Provide feedback and encourage students to reflect on it and Reflect on feedback and assessment results to improve CT instruction.

Coker (2010) examined the effects of participation in a 1-week, experiential, hands-on learning program on the Critical Thinking and clinical reasoning skills of occupational therapy (OT) students. A quasi-experimental, nonrandomized pre- and post-test design was used with a sample of 25 students. The finding of the study supported the use of hands-on learning to develop clinical
reasoning and Critical Thinking skills in healthcare students, who face ever more diverse patient populations upon entry-level practice.

Helsdingen, Bosch, Gog and Merrienboer (2010) studied the effects of Critical Thinking instruction on training and transfer of complex decision-making skills in which the participants conducted scenario-based exercises in both simplified and high-fidelity training environments. In both studies, half of the participants received instruction in Critical Thinking. The other half conducted the same exercises but without Critical Thinking instruction. After training, test scenarios were administered to both groups. The results of the study indicated that the Critical Thinking instruction enhanced decision outcomes during both training and the test and that Critical Thinking instruction benefited both decision outcomes and processes, specifically on the transfer to untrained problems. The results suggested that Critical Thinking instruction improves decision strategy and enhances understanding of the general principles of the domain.

Luetkehans and Reid (2010) conducted a quantitative assessment of an application of Halpern’s Teaching for Critical Thinking in a business class and found that the application of the intervention resulted in significant improvement in six of the seven parameters of the assessment. Based on the statistical result, they concluded that significant improvement occurred in the Critical Thinking skills of the participants. This was the first study that indicated statistically that Critical Thinking can be taught, learned, and transferred across domains.

Pokhrel (2010) studied the Critical Thinking practices in Mathematics classroom in Nepal and found that Critical Thinking perceptions and practices were found to be different in teachers and the teachers were using most of the
necessary conditions but they are not sufficient and these strategies have be
refined in order to address students CT appropriately.

Sulaiman, Abiddin and Hassan (2010) claimed that usage of thinking
fosters students intelligence. According to them students intelligence can be
fostered by encouraging students to engage in different types of thinking such as
Critical Thinking, Analytic thinking, Practical thinking, Creative thinking,
Convergent thinking, Divergent thinking, Lateral thinking and Vertical thinking.
They pointed out that engaging students in activities such as collaborative
learning, extensive writing assignments and having class discussions can
courage students to use Critical Thinking.

Lampert (2011) studied the effect of an after school enquiry based art
programme on Critical Thinking of urban elementary children and found that the
children’s Critical Thinking gain from the programme was substantial.

Maneval, Filburn, Deringer and Lum (2011) conducted a study designed to
determine if concept mapping is superior to traditional care planning as a teaching
method for practical nursing students. Specifically, the study evaluated the effects
of concept mapping as a teaching methodology on the development of Critical
Thinking skills. A control group consisting of students taught through the
traditional methodology was compared to two groups of students taught with
concept mapping. Results indicated that students who were taught the nursing
process using the traditional care planning method scored statistically significantly
better on the examination than students taught with the concept mapping method.

Muraya and Kimamo (2011) conducted a study which sought to determine
the effect of cooperative learning approach on mean achievement scores in
Biology of secondary school students. Solomon-four-non-equivalent-control-group design was used and the target population comprised 183 form two students in four secondary schools. Students were taught one Biology topic for five weeks and cooperative learning approach was used in experimental groups while the regular teaching method was used in control groups. Pre-test was administered before treatment and a post-test after treatment. A Biology Achievement Test was used to measure students’ achievement and it attained a reliability coefficient of 0.84 (N=59) at pilot testing. Data was analyzed using t-tests, ANOVA and ANCOVA. Cooperative learning approach resulted in significantly higher mean achievement scores compared to regular teaching method and gender had no significant influence on achievement.

Ok and Toy (2011) conducted a case study on reflections of prospective teachers towards a Critical Thinking based pedagogical course. In this study, a pedagogical course in a vocational teacher education program in Turkey was designed by integrating CT skill-based strategies/activities into the course content and CT skills were means leading to intended course objectives. The purpose of the study was to evaluate the importance of the course objectives, the attainment of the objectives, and the effectiveness of teaching learning strategies/activities from prospective teachers’ points of view. The results revealed that although the students mostly considered the course objectives important, they did not feel competent in the attainment of all objectives especially in those related to the main topic of Learning and those requiring higher order thinking skills. On the other hand, the students considered the course activities effective for learning and for
the development of thinking skills, especially, in interpreting, comparing, questioning, contrasting, and forming relationships.

Pandya (2011) conducted a study seeking to ascertain whether co-operative learning model is equally effective for students with mastery and performance goals. The study uses quasi-experimental and factorial design for conducting the experiment. The experiment was conducted on 153 students of standard IX studying in schools affiliated to the SSC Board and with English as the medium of instruction. It has used two tools, namely, achievement test in mathematics and learning goals inventory both developed by the researcher. The researcher has also developed an instructional programme for co-operative learning. The techniques used to test the hypotheses include the t-test, ANOVA and ANCOVA. The study found that the effect of the co-operative learning model on students’ academic achievement is maximum. Co-operative learning model was found to be more effective for students with mastery goals whereas the traditional lecture method.

Semerci (2011) studied the relationship between achievement focused motivation and Critical Thinking and found that sub dimensions of Achievement focused motivation and sub-components of Critical Thinking skills are positively correlated. Survey method has been used in the research. In this research, regression analysis has been done. The study sample included a total of 772 students in Turkey, attending the Faculties of Education. Results of Multiple regression analysis regarding the production of AFM demonstrate that Critical Thinking is a significant instrument of the prediction of AFM. He suggested that while teaching student how to gain AFM, prior importance should be given to Critical Thinking skills.
Szabo and Schwartz (2011) conducted a study whose results show that the use of online discussion forums as an instructional tool in face to face course improved the undergraduate pre service teacher’s Critical Thinking skills.

Villavicencio (2011) studied that relationship between Critical Thinking, Negative academic emotions and achievement. The study tested the control-value theory’s assumptions regarding the cognitive-motivational effects of emotions on achievement. Specifically, the link between Critical Thinking and achievement was examined among 220 engineering students. The Academic Emotions Questionnaire was used to assess how specific negative academic emotions mediated the effect of Critical Thinking on achievement. Results showed that Critical Thinking was positively associated with achievement, but negative emotions (anger, anxiety, shame, boredom, and hopelessness) were negatively correlated with achievement. Anxiety and hopelessness were found to completely mediate the relationship between Critical Thinking and academic achievement. The results suggested that when students engage in Critical Thinking, their cognitive resources are used appropriately for the task to be completed, making them less anxious and less hopeless, thereby increasing their achievement.

Yenice (2011) examined pre-service science teachers’ Critical Thinking dispositions and problem solving skills based on gender, grade level and graduated high school variables and also studied relationship between pre-service science teachers’ Critical Thinking dispositions and problem solving skills based on gender, grade level and graduated high school variables. According to the findings of this study, pre-service science teachers’ Critical Thinking disposition levels differ significantly based on gender and graduated high school while no significant
difference was found between pre-service teachers’ Critical Thinking disposition levels and grade levels. Another finding indicate no significant difference in pre-service teachers’ problem solving skills based on gender and grade level, but a significant difference was found in problem solving skills based on graduated high school type. According to regression analysis results, no significant relationship were found between pre-service science teachers’ Critical Thinking dispositions and problem solving skills based on gender and grade level variables. On the other hand, a significant difference was found in pre-service science teachers’ Critical Thinking dispositions and problem solving skills based on graduated high school type.

Forawi (2012) conducted a study aimed to assess and identify the science content objectives that require Critical Thinking abilities as perceived by pre-service teachers. Sample of 120 pre-service teachers participated in the study by examining science education standards of K-12 curriculum using the Critical Thinking Attribute Survey (CTAS) originally developed and validated by the authors. Results of the study identified those standards and activities of science curriculum that were thought to have Critical Thinking. The process-oriented standards, i.e. the inquiry, nature of science, technology and personal and society perspectives had the highest means than the content standard, life, physical and earth. Interviews, supported the statistical analyses that the science inquiry standard was seen to provide an open-ended, high cognitive skill require of students.

Huang, Chen, Yeh and Chung (2012) conducted a study aimed to evaluate the effects of a program of case studies, alone (CS) or combined with concept
maps (CSCM), on improving CT in clinical nurses. The experimental group participated in a 16-week CSCM program, whereas the control group participated in a CS program of equal duration. Data were collected before and after the program using the California Critical Thinking Skill Test (CCTST) and the California Critical Thinking Disposition Inventory (CCTDI). The results of the study indicated that there were significant differences between the two groups in the Critical Thinking skills of analysis, evaluation, inference, deduction, and induction. There was also an overall significant difference, and a significant difference in the specific disposition of open-mindedness. The CSCM resulted in greater improvements in all Critical Thinking skills as well as the overall and open-minded affective dispositions toward Critical Thinking, compared with the case studies alone. An obvious improvement in the CSCM participants was found in analytic skill and disposition.

Tuna (2012) interpret knowledge by actively participating in the process of learning. This study aimed to assess geography teachers' current knowledge, usage and evaluation of the most common active learning methods and techniques in Turkey. Data were gathered through a survey conducted at a vocational seminar organized by Ministry of National Education, with the participation of 90 geography teachers working in secondary schools throughout Turkey. Statistical analysis of the answers revealed that geography teachers’ average knowledge of active learning methods and techniques was at the level of “heard of, but could not explain”. The average usage rate of the techniques was 30%, and teachers’ average evaluation grade was at the “moderate” level.
2.4 STUDIES ON THINKING STYLES

Grigorenko and Sternberg (1997) investigated the role of Thinking Styles in academic performance. Participants were 199 gifted students enrolled in the Yale Summer School Program. Their abilities were evaluated by the Sternberg Triarchic Abilities Test; their academic performance was judged by independent raters blind to the conditions of the study; and their Thinking Styles were measured by two converging self-report questionnaires. The results of the study show that there are no differences in Thinking Styles between groups of students with different ability patterns, certain Thinking Styles contribute significantly to prediction of academic performance and the degree of this contribution is not affected by the type of instruction students are given. Students with particular Thinking Styles do better in some forms of evaluation than in others.

Zhiching and Richard (1997) studied the relation between Thinking Styles and academic achievement and found that there is a significant relation between Thinking Styles and achievement.

Cano Garcia and Hewitt (2000) conducted a study which showed that there is a significant relation between Thinking Styles and achievement.

Zhang (2000) investigated the relationship between Thinking Styles and personality types within the contexts of Sternberg’s theory of mental self-government and Holland’s theory of personality types. A total of 600 university students from Hong Kong responded to the Thinking Styles Inventory (TSI) and the Short-version Self-directed Search (SVSDS) that was specially designed for the study. A major finding of this study is that Thinking Styles and personality types overlap to a degree.
O’Hara and Sternberg (2001) conducted a study entitled effects of Instructions to Be Creative, Practical, or Analytical on Essay-Writing Performance and Their Interaction with Students’ Thinking Styles. From the findings of the study it was evident that consistent with goal-setting theory, specific-related instructions resulted in higher performance for each of the three performance ratings over no special instructions. In line with a person-situation fit model, people who prefer to play with their own ideas (i.e., those with a Legislative Thinking Style) showed higher creative performance, whereas people who prefer to analyze and evaluate ideas (i.e., those with a judicial Thinking Style) showed lower creative performance when not given any special instructions.

Zhang (2002) investigated the nature of Thinking Styles as described in the theory of mental self-government. Two-hundred-and-twelve US university students responded to the Thinking Styles Inventory and the Styles of Learning and Thinking. From the study it was evident that the more creativity-generating and more complex Thinking Styles are significantly related to a holistic mode of thinking, and that the more norm-conforming and more simplistic Thinking Styles are significantly related to an analytic mode of thinking. The results also showed that both Thinking Styles and modes of thinking contributed to students’ self-reported grade point averages beyond what was explained by their self-rated ability scores.

Zhang (2002) studied the relationship between Thinking Styles and the big five personality traits. One-hundred-and-fifty-four (mean age 20 years) second-year university students from Hong Kong participated in the study. Participants responded to the Thinking Styles Inventory based on Sternberg’s theory of mental
self-government and to the NEO Five-Factor Inventory (NEO-FFI, Costa and McCare, 1992). The revealed significant relationships were between particular Thinking Styles and certain personality traits.

Zhang and Sternberg (2002) conducted a study to validate further Sternberg’s theory of mental self-government in a cross-cultural setting and to investigate relationship between Thinking Styles and teachers’ characteristics. Research participants were one hundred ninety-three in-service teachers studying in the Bachelor of Education degree program and the Postgraduate Certificate in Education program at the University of Hong Kong from whom data was collected using the Chinese version of the Thinking Styles Questionnaire for Teachers (TSQT) that has its theoretical foundation in Sternberg’s theory of mental self-government. The results of the study showed that the TSQT is a reliable and valid inventory for assessing the Thinking Styles of primary and secondary school in-service teachers in Hong Kong. These teacher characteristics like gender, professional work experience outside school settings, the degree of enjoying adopting new teaching materials, a tendency for using group projects in assessing student achievement, perceived autonomy for determining their teaching contents, and their rating of the quality of their students were related to Thinking Styles as specified by the theory of mental self-government.

Zhang (2003) investigated whether Thinking Styles significantly contribute to Critical Thinking dispositions of the university students and the results from the study supported the prediction that Thinking Styles statistically contribute to individual differences in Critical Thinking dispositions.
Murphy (2004) explored the association between Thinking Styles and emotional intelligence. Participants ($N = 309$) completed Sternberg’s Thinking Styles Inventory (TSI) and the Schutte Self-Report Inventory (SSRI) for emotional intelligence. Statistical analysis of the scores of the participants on the two instruments indicated that there is an overlap between the TSI and the SSRI, and suggests that they measure similar constructs. The results show that Thinking Styles are significant predictors of emotional intelligence and that participants who have high emotional intelligence prefer more complex and creative Thinking Styles.

Weir (2004) studied the effect of active learning techniques including multiple choice questions short problems completed by individual students or small groups and group discussion used as interludes with lecture. The results of the study indicate that the active learning approaches adopted for the experimental class did have a positive impact on students performance. Students also indicated slightly positive attitude at the end of the course.

Gakhar (2006) and Domenich (2007) revealed that there was less or no relation between Thinking Styles and academic achievement.

Wei-Qiao (2006) investigated changes in Thinking Styles and the relationships between Thinking Styles and academic achievement in traditional and hypermedia instructional environments on a sample of 281 students. The results indicate that the use of particular Thinking Styles significantly increased or decreased in both instructional environments. However, the results only partially supported the hypotheses that the hypermedia instructional environment would positively contribute to the increased use of the more creativity-generating and
complex Thinking Styles. The results also suggest that personality and achievement motivation were significantly correlated with changes in particular Thinking Styles. Moreover, significant effects of gender and discipline differences on Thinking Style changes were found in the traditional instructional environment. Significant relationships between Thinking Styles and academic achievement were only found among the social science students in both instructional environments. Furthermore, it was found that the contributions of Thinking Styles to achievement sometimes went beyond those of personality and achievement motivation. The study does not support the view that a hypermedia learning environment is clearly better than a traditional environment in accommodating to students with different Thinking Styles and in improving academic achievement.

Zhang (2006) studied nature of the relationships of student–teacher style match (or mismatch) to students’ academic achievement. Participants were 135 (59 male and 76 female) students from three academic disciplines (mathematics, physics, and public administration) who responded to the Thinking Styles Inventory and rated their own abilities (analytical, creative, and practical). The academic achievement scores in two subject matters for each student were also used. The students’ subject matter teachers responded to the Thinking Styles in Teaching Inventory. The findings of the study indicate that the effects of style match/mismatch upon students’ achievement vary as a function of academic discipline and subject matter.

Zhang (2007) empirically studied whether or not intellectual styles make a difference to students’ academic achievement. The study revealed that, conservative intellectual styles predicted better achievement across the three
subjects among students in lower grade levels, whereas creative intellectual styles contributed to achievement in Chinese among students in higher grade levels. It is concluded that each of the two style constructs has a unique value in explaining individual differences in human performance.

Bell and Kozlouski (2008) comprehensively examined the cognitive, motivational and emotional processes underlying active learning approaches, their effects on learning and transfers and the core training design elements and individual differences that shape these processes. The results of the study indicate that exploratory learning has positive effect on adaptive transfer performance and interacted with cognitive ability.

Gafoor and Lavanya (2008) studied the relation between Thinking Styles and achievement of higher secondary students and found that certain Thinking Styles have significant influence on the Achievement in Physics of the students.

Kim (2009) studied high achieving students’ career decision making associated with Thinking Styles and to examine factors influencing career choices with a sample of 209 high school students. Students responded to the Thinking Style Inventory, and A Questionnaire Related to Career Choices and Students’ Sensitivity toward Environmental Forces. The findings of this study demonstrated that the effect of program on different Thinking Styles was significant and the effect of gender on different Thinking Styles was significant. Also, the findings showed that an external Thinking Style was a good predictor for choosing the social science area for future careers. However, students with a higher external Thinking Style chose computer and math areas 73% less than students with lower external Thinking Style. The study suggested the importance of taking Thinking
Styles into consideration for the career development of high-achieving adolescents.

Chen GH, Zhang (2010) investigated the relationship between Thinking Styles, as defined in Sternberg’s theory of mental self-government, and mental health was investigated. 583 university students in Guangzhou, P.R. China, were invited to fill out the Thinking Styles Inventory-Revised and the Symptom Checklist-90 on a voluntary basis. Results indicated that scores on six of Sternberg’s 13 Thinking Styles were significantly correlated with the Mental Health Index. The hierarchical style (one Type I style) negatively predicted the General Severity Index beyond sex and age, whereas the judicial, anarchic, and internal styles did so positively. The specific ways in which the Thinking Styles and mental health scales were related to one another supported Zhang and Sternberg’s (2006) claim that Thinking Styles are value-laden.

Moutsios-Rentzos and Simpson (2010) studied the relationship between studying university mathematics and the ‘Thinking Styles’ of both undergraduate and postgraduate mathematics students. The analysis revealed that the more experienced undergraduates and the postgraduates showed a stronger preference for originality and freedom in thinking, low degrees of structure, high levels of freedom and more complex information processing, combined with non prioritised thinking.

Zhang (2010) conducted a study to explore the predictive power of Thinking Styles for metacognition when self-rated abilities were taken into account. As a preliminary step, the study examined the psychometric properties of the Metacognitive Awareness Inventory (MAI). Four hundred and twenty-four
university students from mainland China responded to the MAI, the Thinking Styles Inventory – Revised II, and the Self-Rated Ability Scale. The results of the study suggested that three creativity generating styles (hierarchical, liberal and Legislative) and the executive style predicted metacognition beyond self rated abilities.

Zhang (2010) studied the relationship between Thinking Styles and identity development among Chinese students. Students from Shanghai responded to the Thinking Styles Inventory-Revised, based on Sternberg’s theory of mental self-government, and to the Erwin Identity Scale-III, grounded in Chickering’s theory of psychosocial development. Not only were Thinking Styles strongly associated with identity development, but also the former had predictive power for the latter.

Alipour, Akhondy and Aerab-sheybani (2011) studied the relationship between handedness and Thinking Styles in female and male university students. The Edinburgh handedness inventory and Sternberg-Wagner Thinking Styles inventory were used. Significant relationship was found between handedness and Legislative, judicial, executive, hierarchical, monarchical, oligarchic, global, local, liberal, and conservative Thinking Styles. Left-handed participants used Legislative, judicial, and hierarchical Thinking Styles more frequently. Right-handed individuals used executive and local Thinking Styles more. Thus it was evident from the study that there is a relationship between handedness and Thinking Styles.

Sumangala and Rinsa (2012) studied the interaction effect of Thinking Styles and deductive reasoning on problem solving ability in mathematics of
secondary school students and found that main effect of Legislative Thinking Styles and judicial Thinking Styles on problem solving ability in mathematics were not significant for the sample while the main effects of executive Thinking Styles and deductive reasoning on the problem solving ability were not significant. The interaction effect of each of these styles and deductive reasoning on problem solving ability was also not significant for the sample.

Turki (2012) conducted a study aimed to recognize The Thinking Styles in light of Sternberg’s theory, prevailing among the students of Tafila Technical University and its relationship with some Variables on a sample of (800) students (male and female) chosen in stratified, clustered and random method. The researcher used a list of methods for Sternberg and Wagner (1991) for the instrument of the study. The results indicated that the common Thinking Styles came mid in general, it also indicated that there are no statistically differences on level of ($\alpha = 0.05$) attributed to the variable of gender in all the styles except the Legislative and judicial style, the differences came to the favor of males. The differences of the executive style came to the favor of females.

2.5 SYNTHESIS OF REVIEW

The studies reviewed on the Active Learning Strategies revealed that the research in this field is in the emerging stages and has countless scope for extension. There were several studies on the topic from different parts of the world and most of the researches were aimed at studying the effectiveness of the strategies in increasing student learning. Some of them were focusing on the effect of these strategies in developing the students’ interest, attitudes, social skills, reasoning abilities and in preventing misconceptions and a few studies were aimed
at finding the influence of the Active Learning Strategies on the higher order thinking skills including Critical Thinking. The Active Learning Strategies that were found to be studied more by the researchers were Problem based learning, Technology enabled active learning, group discussion, collaborative learning etc. Not many studies were found on studying the effectiveness of innovative strategies like group investigation, Think-pair share, K-W-L, and reflective journaling.

The review of studies on Critical Thinking primarily indicated that Critical Thinking can be taught and learned. Many studies explored the relation between Critical Thinking and variables like achievement, intelligence, negative academic emotions, decision making, achievement focused motivation, problem solving skills, learning style etc. There were several attempts to find the correlation between Critical Thinking skills and Critical Thinking Dispositions. Many studies were aimed at investigating the effectiveness of course with instructional paradigm in improving the Critical Thinking Skills as well as dispositions of learners. The strategies like collaborative learning, problem based learning, Socratic seminars, Cooperative learning were found to produce significant improvement in Critical Thinking abilities.

The studies reviewed on Thinking Styles revealed that most of the studies were conducted on finding the relationship between factors like personality type, Achievement of the students, learning styles, mental health, career decision making, critical thinking, creative thinking etc and very few researches were found on studies on effect of different instructional environments on Thinking Styles.
The literature review indicated that there are a number of gaps existing in this area of research. From the review it was evident that most of the studies on these lines were conducted abroad, no such studies were found in reference to secondary level students in India and particularly in Kerala. Very few efforts to test the effectiveness of integrating strategies like group investigation, Think-Pair-share, KWL, concept mapping and journaling in teaching science and particularly physics at the Secondary level were found. No attempts at improving the Thinking Styles using interventional practices were found in the review even though the theory clearly states that Thinking Styles are modifiable and teachable. Moreover only very few studies on the development of Critical Thinking abilities of the secondary school students were found in the context of Kerala. So the investigator decided to attempt to reduce the gap by integrating Active Learning Strategies like group investigation, Think-Pair-share, KWL, concept mapping and one minute papers in teaching physics to students of class IX and to study its influence on their Critical Thinking, Thinking Styles and Achievement in Physics. The investigator also studied the relation between Critical Thinking, Thinking Styles and Achievement of the secondary school students.