CHAPTER II
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2.0 Introduction

The Review of related literature is an important pre-requisite to actual planning and execution of any research work. Every research project should be based on all of the relevant thinking and research that has preceded it. When completed it becomes part of the accumulated knowledge in the field and so contribute to the thinking and research that follows.

Review of the related literature, when done properly, serves a number of purposes. It allows the researcher to acquaint himself with current knowledge in the area in which he/she is going to conduct research and thereby select a suitable problem. It helps the researcher to define his/her problem, delimit the area, state the objectives and hypotheses of the study clearly and precisely. The review of related literature gives the researcher an understanding of the research methodology, which refers to the way the study is to be conducted. It helps the researcher to know about the tools and techniques, which proved to be useful in the previous studies. Moreover, it provides an insight into the data analysis procedures through which validity of results is to be established.
The present study is concerned with the development of critical thinking skills in relation to various psycho-contextual variables like intelligence, academic achievement, sex, socio-economic status, home-background, location and management of schools, and teaching strategies. The studies that were reviewed are presented under different heads in the following pages.

2.1 Experimental Studies in Critical Thinking

The main purpose of Ballew's (1965) study was to investigate the effects of discovery learning on achievement in mathematics and on critical thinking abilities of first year algebra students at the high school level. Two of the three classes available for the study were arbitrarily designated as experimental class A and experimental class B, the third class was designated as control class C. Throughout the experimental period of 18 weeks, the same teacher taught all the three classes. Class C was taught making use of expository method of teaching whereas the other two classes A and B were taught making use of discovery method. The findings are as follows:

1. There was no significant difference among the three classes in achievement.

2. Both of the classes exposed to discovery learning improved more in critical thinking scores than did the class that was taught by the expository approach.

Ruth (1970) studied the effectiveness of an instructional program in persuasive communications prepared by him for helping children
improve certain critical thinking skills. The sample included 4 grade VI classes of 110 subjects. The result of the study is that the instructional materials were found to be effective in improving the abilities of VI graders to detect propaganda and evaluate evidence. Although the analysis of variance also indicated statistically significant improvement in the skills of identifying an author's persuasive techniques and analyzing arguments, the amount of improvement was too small to have practical significance.

Nolan (1970) investigated the effect of two instructional inquiry strategies on critical thinking and achievement in social studies among 8th grade students. The strategies differed in the degree of teacher guidance through verbalization of key concepts and generalizations. The sample of 80 eighth grade students were divided into 40 student's of high ability group and 40 students of average ability group. As measured by Watson Glaser Critical Thinking Appraisal, the subjects significantly increased \((P<0.01)\) their critical thinking performance during the six week treatment period. There was no significant difference in performance between the subjects who were or were not familiar with the investigator's teaching. The other findings of the study are: (1) there was no significant difference in performance due to different instructional strategies, (2) Students designated as high ability performed significantly better than students designated as average ability.

Robert (1970) conducted a study with the objectives: (1) To evaluate a paper and pencil test constructed to measure critical thinking skills using physical science content. (2) To determine the comparative
effectiveness of Physical Science Study Committee (PSSC) and non PSSC physics program in developing critical skills. (3) To identify teacher-pupil verbal interaction behaviours that enhance the development of critical thinking skills. The sample for the study consisted of 1000 physics students from 27 high schools.

The Principal conclusions of the study were: (1) There was little evidence to support the belief that either the PSSC or the non-PSSC physics program was more effective in developing critical thinking skills. (2) An interaction between the physics curriculum and verbal classroom behaviour was found and this interaction was related to the development of critical thinking skills. (3) A linear relationship did not exist between the mean growth scores on each critical thinking test and the verbal behaviour of each class. (4) Comparisons between the verbal behaviours of the physics classes that gained the most and least in critical thinking skills indicated that the two groups did not differ significantly in the amount of time spent in those behaviours. (5) Significant differences in verbal behaviour were found between classes which were subjectively selected as being more effective and less effective in developing critical thinking skills.

In a study conducted by Kwak (1981) the effect of content treatment and questioning treatment on students achievement in the area of critical thinking in social studies was investigated. Ninety seven 9th Grade students were included in the study. There were 6 instructional treatment groups and one control group. For the treatment groups two levels of content treatment (Critical thinking versus non
critical thinking) and 3 levels of questioning treatment (higher cognitive questions, factual questions, and no questions) were provided.

It was concluded that the critical thinking treatment groups as well as the non-critical thinking treatment groups demonstrated significant improvement in social-studies achievement. Critical thinking treatment groups demonstrated significantly greater improvement on the critical thinking test than did the non-critical thinking treatment groups. No critical thinking treatment groups showed improvement in their critical-thinking test scores. The questions treated groups did not differ significantly from the no-questions treated groups in critical thinking as well as achievement.

The effects of transfer materials on the critical thinking abilities of Second Year Algebra students was studied by Knight (1981). Two hundred and ninety five 11th grade second year algebra students from 12 high schools formed the sample. Hundred and fifty seven students were taught the methods of critical thinking through transfer materials and 138 students were taught Algebra without transfer materials.

On the basis of the work carried out in this study the following conclusions were made:

1. Students in the transfer group and non-transfer group showed a significant increase in their ability to think critically.
2. There was no significant difference between the male students and female students in either the critical thinking or Algebra post tests.

3. There was a significant correlation between scores in the algebra achievement post test and scores on critical thinking post test for both the transfer and non-transfer groups.

4. There was a significant difference between the increase of student critical thinking scores for those students with teachers experienced in teaching critical thinking over those students with teachers not experienced in teaching critical thinking.

Hoehn (1982) in his study "An Examination of the Relationship between Critical Thinking Ability and Risk Taking in Group Discussion with Controls for Sex and Age" tested two hypothesis: (1) A discussion groups' critical thinking ability would have a relationship with the degree of risk that it assumed as a group with control for sex and age, (2) A discussion group with high critical thinkers would show a significantly greater shift to risk than would discussion groups with middle or low critical thinkers with controls for sex and age.

A oneway Analysis of Variance and Pearson Product moment correlation coefficient were computed Hypothesis No. 1 was rejected. Hypothesis No. 2 was confirmed at the 0.01 level of significance. A strong correlation was also found between critical thinking ability and shift to
risk at. These findings indicated that as the critical thinking ability increased so did the risky-shift.

Norton (1986) Studied the effect of an independent laboratory investigation on the critical thinking ability and scientific attitude of students in a general microbiology class. Eighty community college students enrolled in general microbiology class participated in the study. Following the treatment of three weeks, the students were given Watson-Glaser Critical Thinking Appraisal and the Scientific Attitude Inventory by Moore. The data were analyzed using Multivariate Analysis of Variance using the Wilkes Lamb test of significance. Multivariate F-ratio determined for interaction effects, treatment conditions, and replication effects were not significant.

Critical thinking skills training as a method for improving information processing in secondary school students was studied by Rosen (1986). Using a quasi-experimental design, 84 low achieving 9th grade students were given critical thinking instruction over a 25-weeks period. One control group consisted of 108 students who received no special instruction in critical thinking skills, but who did receive additional tutors and materials as a result of special state funding. A second control group consisted of 52 students who received neither additional funds, nor special instruction in critical thinking skills.

Results of the study indicated no significant effect of critical thinking skills training upon content learning as measured by the pre and post administration of a standardized tests. The student who
received 25 hours of instruction in critical thinking skills training did as well as the students who received special state funding for tutor and materials.

Gonzalez (1988) conducted a study to examine the perceptions of secondary level teachers about their teaching of critical thinking skills and the perceptions their students had of that instructions. Sixty secondary teachers and 1239 students were divided into control group and experimental group. The experimental group undergone a treatment of 2 one day workshop on critical thinking followed by 3 observation. Major finding of the study were: (1) teachers in the experimental group did not exhibit significant treatment effects; (2) students in the experimental group exhibited no significant treatment effects except that two items showed significance counter to expectations. Control group students perceived teachers as demonstrating behaviours which were more contributive to learning to think critically than did experimental group students.

Sidney (1989) Studied the effects of inquiry method in teaching science on critical thinking skills, achievement, and attitudes toward science for male and female Vth Grade students. The conclusions made from the study are: (a) the inquiry method of teaching science as implemented in this study, did not yield significant effects on critical thinking skills, science achievement, or attitude toward science; (b) a significant effect was not found when gender of the student was considered; and (c) there was no significant interaction between method of instruction and gender.
In conducting a study to examine the effect of critical thinking instruction on the reading comprehension ability of a group of under-prepared college students, Finnelly (1989) divided 85 college students into 6 groups of 14 students (3 experimental group and 3 control group). Experimental group received critical thinking instruction through Whimbey and Lockhead program and the control group was exposed to traditional reading comprehension instruction.

A comparison of the post-test scores on the McGraw Hill Reading Test between the experimental and control groups showed no significant difference. Overall, each group gained significantly in reading comprehension, and the total group gained significantly in reading comprehension. There was, however, no correlation between the gain scores in reading and the gain scores in critical thinking; meaning those who gained in critical thinking were not necessarily, those who gained in reading. Consequently there was no support to suggest that gain in reading comprehension could be attributed to critical thinking instruction.

Chennault (1989) conducted a study to determine if significant differences existed in the adjusted mean scores in critical thinking for a group of 5th and 6th grade gifted students who participated in critical thinking strategy curriculum and a group of 5th and 6th grade students who participated in traditional gifted classroom curriculum. The finding of the study revealed that the students with the critical thinking strategies curriculum had higher scores than the group with the traditional curriculum. No significant difference was noted in the
adjusted mean critical thinking scores for the two groups regarding length of participation time in the gifted program or for the interaction of type of curriculum and length of time in the gifted program.

Changes in student attitudes, achievement, and critical thinking skills due to two different types of participation in science teaching methods was measured by Mc Cune (1990). Hundred and forty-five VIth grade science students enrolled in four rural elementary schools participated in the study. The subjects were divided into experimental and control groups. The experimental group was instructed using an Integration of a Cognitive System with the Scientific Method (ICSSM) and the control group was instructed according to the method specified in teachers manual.

The findings indicated that critical thinking skills improved considerably with the instruction of the ICSSM model when compared with the instructional model for the control groups. No significant difference was found in attitudes and content achievement between the experimental and control groups. However, there were considerable gains made in these areas by participating students in the treatment group.

The effects on creative thinking and critical thinking skills from a curriculum approach which encourages the students to be kinesthetically and critically involved in activities was studied by Fischer (1990). The sample consisted of 107 Seventh Grade students. Analysis of the data revealed significant correlation in creative thinking and critical thinking. Treatment groups compared to control groups were
significantly higher in creative thinking skill development. Likewise, in development of critical thinking skills the treatment group compared to control groups were significantly higher. The data were also considered using three classifications: Full group, Not identified gifted and Identified gifted. When mean score difference of identified Gifted and not identified Gifted was compared, no significant difference was observed.

Reisenmy (1991) conducted a study to determine whether 4th and 5th Grade pupils who were trained in self directed critical thinking skills could retain and transfer those skills better than 28 control children from the same school district, who were given no practice in small group discussion or the thinking roles. It was concluded that the experimental children earned superior retention score on 3 variables when compared with control children. The variables included use of self directed thinking skills, amount of information used in solutions, and quality of answer. Experimental group children also scored better than control children did on two transfer problems.

In his study Goldberg (1991) evaluated the effect of an instructional program which incorporated the implicit teaching of a set of critical thinking competencies with the explicit teaching of a set of library research and writing skills on above average 8th Graders. The findings indicated that the experimental group did not perform significantly better than the control group in any of the critical thinking competencies measured by the Ennis-Weir Critical Thinking Essary Test. The finding also indicated that females generally out performed male on both the pretest and post test.
Schulkauser (1991) investigated how participating in literary discussion groups affected 4th grade students' critical thinking, reading comprehension, and attitude toward reading. Fourth grade students from two classrooms formed the experimental group and from other two classes formed the comparison group. The experimental group had literary discussion of trade book and group discussion whereas the comparison group studied self-selected materials followed by individual discussion.

Results indicated that participation in literary discussion groups did not significantly affect students' critical thinking performance, reading comprehension, or attitude toward reading. A qualitative analysis of questions revealed that all but one treatment group teacher asked predominantly lower level questions. Students were seldom asked to support their responses.

Jordon (1991) conducted a study to investigate the relationship among critical thinking, reading comprehension and meta-comprehension and to examine the effectiveness of meta-comprehension strategy training on the reading comprehension, critical thinking and reading awareness abilities of students in Grades 4, 5 and 6.

Findings indicated positive correlations among reading comprehension, critical thinking and meta-comprehension with the strongest correlations being between reading comprehension and critical thinking. Students in the experimental group received significantly higher scores than did those in the control group in the areas of
inferential comprehension and reading awareness. An analysis of scores by level of reading ability and by level of reading awareness indicated that students with higher levels performed significantly better in critical thinking, reading comprehension, and reading awareness.

Brown (1991), using a cognitive-developmental (CD) framework investigated interrelationship between cognitive style (CS), Critical Thinking (CT), and Moral Reasoning (MR) and determined which cognitive factors (CT assumption, credibility, deduction, induction, or CS) significantly predicted MR scores. Significant interactions of age, ethnicity, grade level sex and reading achievement (RA) with MR were determined. The findings are as follows:

1. Significant inter-correlations existed among all cognitive variables, except assumption and cognitive style.

2. Deduction and induction combined to predict 12.9% of MR variance.

3. No demographic factors significantly predicted MR variance.

4. Females' mean credibility and deduction scores were significantly higher than males;

5. No significant difference in MR were found by grade level, race, or sex.
Commeyras' (1992) study was to investigate whether reading instruction that emphasizes critical thinking would benefit learning disabled 5th grade students. Fourteen fifth grade students were divided into control group (n=7) and experimental group (n=7). Experimental group was given ten dialogical reading lesson and the control group took the usual classroom procedure.

Differences were found between the two groups on the post dialogical - thinking reading lessons. The instructional group was better at arriving at sound defensible evaluation of the reasons they had generated to support the two hypothesized conclusions. They also gave better final conclusions regarding the central issues than did the comparison group. There was no evidence of improvement on the paper and pencil tests of reading comprehension and critical thinking for either group. Comparing the students performance on paper and pencil tests with their performance in discussion settings revealed significantly differing views of competency.

The outcome related to intellectual development and critical thinking of an innovative freshman year curriculum after its first year of implementation at Rose-Hulman institute of technology was assessed by Rogers (1992). It was found that after the first year there was no significant difference on measures of intellectual development and critical thinking between the students in the experimental program and those in the comparison group who were in the traditional freshman curriculum.
The development of critical thinking skills in high school students was the objective of Susan's (1992) study. In her study she considered critical thinking as a function of teacher questions. Four average level high school classes were divided into two control group and two experimental group. Teachers in the experimental group were trained in how to ask critical thinking questions.

Results indicated that teacher questions were altered and more critical thinking questions were asked by teachers in treatment classes. There was a positive correlation between the number of critical thinking questions asked and the number of critical thinking responses given. No significant correlation was found between the level of participation of the students studied and the number of critical thinking questions asked. A positive correlation, was found between the number of critical thinking responses given and the number of positive teacher responses given. There was a significant increase in the Watson-Glaser scores for students in the treatment classes but no such increase was noted for students in control classes.

Kezar (1992) conducted a study with the following objectives:

1. To investigate the effectiveness of computer technology in developing critical thinking skills of teachers and middle school students.

2. To investigate the influence of years of experience and educational degrees of teachers upon teacher gain in critical thinking and students gain in critical thinking.
3. To examine the relationship between achievement test scores and critical thinking test scores.

The findings indicated that the computer group performed significantly better than the traditional group in critical thinking test and achievement test. There was a significant inverse relationship between years of teaching experience and student gain scores. Students of teachers with the fewest years of experience had the highest gain scores. For all students in the sample, the California Achievement test reading score was the best predictor of overall critical thinking gain scores.

The role of thinking frames in developing teachers' critical thinking skills and disposition was determined by Moreyra (1992). Forty seven elementary teachers were divided into (1) baseline group who were taught in traditional method (2) Experimental group who were taught the Richard Pauls remodelling and the thinking frames and a (3) comparison group who were taught Richard Pauls remodelling without thinking frames. Major findings of the study were as follows:

1. Teacher who were taught in the experimental group did not obtain statistically different scores on the Ennis Weir critical thinking essay test than the teachers taught in the comparison or baseline groups

2. Teachers across groups showed no-significant differences in how they perceived themselves as thinkers when measured by Edward's Self-concept as a Thinking Scale.
3. Teachers in the experimental group reached a higher level of reflectivity as assessed by Van Mannen's Levels of Reflectivity than teachers in the comparison and base-line groups. The study thus revealed that thinking frames seem to be a process for helping teachers become more critically reflective.

In a study conducted by Hudgins (1994) fifty middle-grade pupils participated in experiments on the effects of gravity, either as members of small groups who were taught skills of self-directed critical thinking (Experimental 1; E-1) or as members of a class taught by their regular teacher (Experimental 2; E-2). Sixteen other children served as controls (C). Studying neither the science nor the thinking skills. Experimental-1 and Experimental-2 pupils scored significantly higher on a test of relevant science content than did the control children, but their achievement was not different from each other. When E-1, E-2, and C children were individually given new science problems to solve, E-1 pupils outperformed E-2 pupils and C-pupils as predicted. Somewhat unexpectedly, E-2 children performed better on the new problems than did the uninstructed C-pupils.

Hendrix (1995) in his study of "Improving Critical Thinking and Reading Achievement of Community College Students" administered a treatment designed to develop critical thinking skills within a college reading course to an experimental group of community college students. A comparison group receiving the standard reading curriculum was contrasted with the experimental group on the dependent variables of critical thinking skill level and reading achievement. Other independent
variables of interest, included age, gender, race/ethnicity, study orientation, study habits, and students attitude, were also examined.

The treatment produced no significant differences between the two groups on critical thinking skill level. The treatment did produce statistically significant improvement in critical thinking skill level of the experimental group. Critical thinking skill level was significantly related to race/ethnicity in terms of pretest to post test improvement and age (older students out performed younger ones in terms of post test score and pre test to post test improvement).

In his study West (1995) created a micro-unit in argumentation theory to test in a wider variety of speech communication core and general education public speaking courses to determine its impact on critical thinking through a quasi-experimental design. Experimental group took instruction in argumentation theory and the control group did not have the same.

Statistically significant results were indicated for speech core treatment subjects on the "interpretation of data" sub-test, and for general education public speaking students on the argument sub-test of Watson-Glaser Critical Thinking Appraisal (WGCTA). No statistically significant results were obtained for the overall test or any other sub-tests, nor for effects of previous instruction.

Underwood (1995) took up a study to determine if the use of educational technology in vocational programs and applied academics
curriculum instructional delivery system increased students critical thinking skills. The sample consisted of 317 secondary students from vocational schools.

Significant gains were found for the educational technology treatment group on two of the four critical thinking skills sub-tests. No significant difference was found on two of the four critical thinking skills sub-tests or the total score. No difference was found in the personality type of the groups or in the critical thinking skills gains by personality type for the treatment group or control group. No significant difference was found between age groups in critical thinking skills achievement.

Smith (1996) conducted a study to reveal overall differences in achievement, process skills, critical thinking skills, and laboratory skills produced by the teaching of science as inquiry as compared to traditional methodology. Based on the overall effect size estimate for each of the outcome variables, it was found that teaching science as inquiry increased students' mastery of science content, improved critical thinking skills and laboratory skills all at a significantly higher level than was the case for students taught science by traditional approach. On the other hand process skills were not improved at the hypothesized level of significance.

To determine the potential uses of instructional Technology in improving critical thinking of Junior high school students enrolled in model technology program was the objective of Jacks (1996) study.
Seventh and 8th Grade students enrolled in a model technology program constituted the sample.

Findings revealed that within the first year of model technology program, statistically significant mean gain scores were obtained on all four sub-tests of the Cornell Critical Thinking Test as well as the total test. During the two-year period of participation in the model technology program, statistically significant mean gain scores were obtained on all four sub-tests of the Cornell Critical Thinking Test as well as on the total test. During the two-year period representing the second and third years of participation in the model technology program, statistically significant mean gain scores were realized on five of the nine sub-tests of the Ennis-Weir Critical Thinking Essay Test.

Langton (1996) conducted a study to determine the effects of non-gradedness and critical thinking on student achievement, reasoning ability, and attitude. Four classes in an urban elementary school were used as treatment and control classes. Two classes were non-graded and two were traditionally graded. One of the non-graded classes and one of the conventional classes used a formal critical thinking program. The two non-graded classes utilized co-operative learning, thematic reasons, team teaching, and individualized instruction compared with two traditionally graded classes which did not use above strategies.

Non-graded classes attained significantly better results in reading, reasoning skills, attitude, school enjoyment, class participation, and academic expectation than the traditionally graded control group. The
critical thinking program did not produce significant achievement in reading, maths, or reasoning achievement after 7 months of treatment. Interaction effects of the two treatments revealed that the class with the best overall results for academic achievement, reasoning, and attitude was the non-graded class with critical thinking.

Lierman (1997) compared the effectiveness of two instructional modalities: concept learning with lecture instruction and concept learning with guided practice approach on the development of critical thinking. The sample included 91 Junior nursing students. The finding revealed that the teaching method did not affect students critical thinking ability within a 16-week semester course as measured by the California Critical Thinking Skills Test.

Nathan (1997) conducted a study to investigate (1) whether there was improvement in critical thinking skills in two classes of nursing students over an academic year in their nursing education and (2) how learning styles affect students ability to think critically. The subjects completed the Watson-Glaser Critical Thinking Appraisal (WGCTA), Kolb's Learning Style Inventory (LSI), and a demographic questionnaire.

The results from the WGCTA revealed the two classes of nursing students did not increase in their ability to think critically over an academic year. There was no relationship between Grade Point Average and WGCTA even though the group demonstrated a numerical increase in GPA. For both classes there was no relationship between WGCTA, GPA
and learning style. Learning Style was believed to have an influence on student learning.

The relationship of cooperative learning strategy to critical thinking and achievement test score was studied by Asmani (1998). The sample consisted of 80 students in selected classes of remedial reading. The result of the study showed that there were significant differences between the groups in achievement scores according to the instruments used in the study. Cooperative learning was found to be an effective method of instruction to be used in remedial reading classes.

The study conducted by Rose (1998) examined the effectiveness of several methods of instruction of critical thinking skills for post secondary students with and without learning disabilities. Two instructional methods were used, one an enhanced version of the other. Three groups of students were involved. Two groups received explicit and embedded instruction of critical thinking skills as part of the curriculum of literature course. One of those groups was also instructed in the use of icons which were designed to enhance instruction as aids to processing or representative of analogous modes of thoughts. Inclusion of icons was based on the evidence of their effectiveness as found in a review of the literature. The third group was the control group.

The findings revealed that students who received explicit instruction improved their scores; however instruction enhanced by icons was not more effective than instruction without icons. Students with learning disabilities received consistently lower scores on the writing
samples. Qualitative data, which included instructors' journal and interviews with a subset of the sample, indicated that subjects were more focused on comprehending content than they were on acquiring critical thinking skills.

M Murithi (1998) investigated whether there were significant differences in the academic achievement of students who were taught by teachers who had received specialized critical thinking skills training and students who were taught by teachers who had not received such training. The sample for the study included 893 middle school students in grades 6 and 8. Hypothesis 1, which predicted no significant differences in the academic achievement of the experimental and control groups of sixth grade students, was rejected. Hypothesis 2, which predicted no significant differences in the academic achievement of experimental and control groups of eighth-grade students was accepted. Hypothesis 3, which predicted no significant main and interaction effects of grade, sex, race, and socio-economic status (SES) on the academic achievement of students, was partially rejected. Although the differences in the academic achievement of the two groups of students were not statistically significant at the 0.05 level of probability, test scores revealed some disparities between the two groups.

The effect of indirect and direct teaching strategies on critical thinking skills and self esteem of at-risk 10-13 year old boys in a physical education environment was investigated by Bonnettes (1998). In addition the effect of age (10-11 years Vs. 12-13 Years) On critical thinking skills and self esteem was also investigated. In the findings
both experimental and control groups critical thinking skills significantly improved over time. However, the experimental group showed a significantly larger increase. In addition, the older boys had significantly higher critical thinking scores than their younger counterparts. No significant effect for self-esteem was determined from the statistical analysis.

2.2 Studies on Critical Thinking in Relation to Psycho-Contextual Variables

Pillai & Nayar (1968) conducted a study with the objectives (1) To find out the extent to which critical thinking ability correlates with science achievement of students in secondary school, (2) To find out whether two extreme groups in critical thinking differ significantly in science achievement, (3) To find out two extreme groups in science achievement differ significantly with respect to critical thinking, (4) To find out if there is a significant difference in critical thinking of Government and private school students and (5) To study the extent to which each of the 4 components of critical thinking correlates with science achievement.

Four hundred and forty one (231 boys and 210 girls) Xth standard students from 13 high school situated in Trivandrum city and surrounding rural areas were included in the sample. The study concluded that the critical thinking as measured by an adapted version of WGCTA, correlated with the school science marks. The correlation was found to be highly significant for the total group and for the girls and significant for the boys. The difference of mean of the science marks
between the high group and low group in critical thinking was found to be highly significant in favour of high group. Similarly, the high group and the low group selected on the basis of science marks, differed in their mean scores on critical thinking and this difference was found to be highly significant. These findings indicated that high critical thinking ability is an important determinant of science achievement. No difference was evident in the critical thinking ability between students studying in the Government and the Private schools. Of the four components included in critical thinking test two components namely deduction and interpretation, were found to correlate significantly with science achievement.

Nayar (1969) conducted a study with the following objectives:

1. To analyze the score on six experimental variable (verbal reasoning, comprehension and interpretation, Numerical ability, problem solving, critical thinking and creative thinking) and the school science mark for the sample and sub sample (sex, rural and urban)

2. To find out correlations between each experimental variable and science achievement

3. To select from the experimental variables those variables which best predict science achievement.

The sample consisted of 441 secondary school students of Kerala. The findings of the study are as follows:
1. For the three experimental variables namely numerical ability, Problem solving and critical thinking, the two sexes differ significantly in their mean performance - Boys were superior to girls.

2. The correlation between science achievement and all experimental variables were positive and significant.

3. The correlation coefficients between scores on verbal reasoning and critical thinking and school science marks showed significant differences between boys and girls.

4. The inter-correlation of the six experimental variables were positive and significant.

Identifying significant variables in relation to the ability of secondary social studies students to think critically was the objective of Handfield's (1980) study. The sample for the study included 75 eleventh grade students. From the findings, it was concluded that there existed a composite evidence to support a significant inverse relationship between critical thinking ability and level of dogmatism. Furthermore, the ability to think critically was significantly related to intelligence. However, there was no composite evidence to support the contention of a significant relationship between one's degree of flexibility, socio-economic status, or sex and the ability to think critically.
Degree of relationship between stress and anxiety factors, and critical thinking ability was investigated by Jones (1980). The sample consisted of 75 students at a south western seminary. The findings revealed an extremely low correlation between life stress and critical thinking ability, state anxiety and critical thinking ability, and the combined effect of the independent variables with critical thinking ability.

The relationship between critical thinking skills and intellectual development was investigated by Brabeck (1981). The sample consisted of 392 students enrolled in private, catholic, New England Schools. The main findings of the study were; (1) Reflective judgement levels increased with education level even though critical thinking scores were held constant. (2) High critical thinking subjects out performed low critical thinking subjects on the Reflective judgement interview. (3) While low critical thinking subjects were homogeneously low in Reflective judgement levels, high critical thinking subjects had great variability of reflective judgement scores.

Kehler (1982) conducted a study with the purpose of finding out the effect of program for gifted high school students on critical thinking and the association of this variable to intelligence, sex, academic achievement, and teachers rating of behavioural characteristics. Significant gains in critical thinking were found irrespective of sex or particular school. Significant differences were found between High and Low critical thinkers and all areas of academic achievement and ability.
The researcher concluded that gifted students who participated in a special course of study made significant gains in critical thinking. There was relationship between academic achievement and ability and critical thinking; however little relationship exists between academic achievement, ability and teachers' rating of behavioural characteristics of the gifted.

Relationship between cognitive questioning preference levels of both teachers and students and student achievement in critical thinking was investigated by Song (1982). The sample for the study included 2 teachers, one who preferred higher level cognitive questioning and the other one who prefers lower level cognitive questioning. The students of these teachers in Grade 5 and 6 were also included in the study and they were divided into two groups: (1) higher cognitive preference group (n=30), (2) lower cognitive preference group (n=53).

The findings revealed that the students and teachers cognitive questioning preference levels were not related to the students' achievement in critical thinking. However, a match of cognitive questioning preference between teachers and students was significantly related to the students achievement levels in critical thinking.

Trimble (1986) explored the relationship between specific categories of teachers' verbal behaviour and student growth in a component of critical thinking in secondary social studies classes. The Technical Skill Observation Schedule (TSOS) was used to ascertain the frequency of specific teacher verbal behaviours. This instrument focussed on seven
classes of verbal behaviour. The seven moves encompass 51 discrete behaviour and are labeled as functional or dysfunctional. The five functional moves are structuring, conditional, wait-time, probing and reacting. The two dysfunctional moves were obstructing and inhibiting.

Two significant relationships were identified with regressed mean student gain scores. Teachers' mean frequency of structuring moves had a significant negative correlation, and teachers' mean and median frequency of inhibiting moves had a significant positive correlation. The author concluded that although critical thinking is a valued goal in the social studies, limited student growth in the aspect of conditional reasoning (component of critical thinking) occurred in the classes studied.

The relationship among critical thinking, dogmatism, self concept, and success on the Test of Adult Basic Education (TABE) was examined by Mayes (1986). One hundred and twenty volunteer adult basic education students from technical college formed as the sample for the study.

The major findings indicated that for males, females, and the total sample of adult basic education students, there was statistically significant relationship between critical thinking and TABE; for males, females, and the total sample of adult basic education students, critical thinking scores predicted success on TABE.
The goals of Anderson (1988) study were: (1) to extend and enrich the methodology of teaching social studies; (2) to expose students to techniques in applying critical thinking skills; (3) to create a program that would blend with, not eliminate, the social studies curriculum. The results of the program were positive. An analysis of the program revealed that students with the ability to apply thinking skills showed an improvement in their performance. More than 63 percent of the students met the criteria for success where the scores of a pretest-posttest questionnaires were compared. Teachers, department chairpersons, and principals rated the program as desirable and appropriate and recommended that it be expanded.

Jones (1989) studied the principles and instructional strategies for fostering critical thinking in adult learners. The sample included 79 extension home economists currently employed in Ohio. The findings of the study led to several conclusions. The majority of Extension Home Economists perceived the formulated principles of critical thinking to be important. However they do recognize that their teaching does not always foster the principles.

Many respondents indicated that they have never used several of the instructional strategies for fostering critical thinking. A large percentage of participants expressed interest in receiving information about training in, or practice with these instructional strategies. The finding indicate a significant relationship between degree of comforts in using each strategies and frequency of use.
The ability of Iowa agriculture students to use critical thinking skills was determined in Rollins' (1989) study. Six hundred sixty eight agriculture students from 18 Iowa secondary school served as the sample. Major findings of the study were: (1) critical thinking mean score of Iowa secondary agriculture students was lower than the mean scores measured in the two norm-referenced groups; and (2) two sub-tests of the Iowa tests of education development proved to be the two greatest predictors of levels of critical thinking.

The teachers' perceptions of and beliefs about their teaching and its relationship to promoting critical thinking was studied by Boikai (1990). Two hundred high school teachers were used as sample. He found that grade level of teaching was the only independent variable significantly related to professed use of critical thinking activities. XIIth grade teachers were the most positive about using these activities while 10th grade teachers reported the least preference for them. Teaching behaviours showed significant differences for both age and teaching experience. The teachers most positive about these behaviours were 36-40 years old and had 5 to 12 years teaching experience. The oldest teachers and those with the most experience were the least interested in applying this behaviour. In terms of teaching strategies, significant differences existed for teachers level of education and teaching experience. Teachers with the lowest level of education and those with 5-12 years of teaching experience showed the greatest interest in using these strategies. Teachers with bachelors and graduate degrees and those with the least experience were the least interested in these strategies.
Ircink (1990) conducted a study to determine whether selected demographic variables and the curricular model in baccalaureate programs had a relationship to critical thinking scores of senior Baccalaureate nursing students. The study conducted on 299 senior nursing students revealed no significant relationship between curricular models and critical thinking. No significant differences were noted among age, sex, years of experience or education and critical thinking scores. Grade Point Average appears to be positively associated with students critical thinking abilities.

The experience, activities, and materials that instructors in a selected public school system use for the purpose of teaching critical thinking in social studies classes were investigated by Thorpe (1990). Within the study seven questions are addressed. They centre upon how social studies teachers define critical thinking, skills believed to enhance critical thinking, components of critical thinking skills emphasized, activities used to stimulate or to develop critical thinking, the utilization of experiences outside the classroom to encourage critical thinking, the extent to which text books and other instructional material emphasize critical thinking, and how teachers test for evidence of critical thinking. Findings revealed that respondents in the present study did not appear to differ substantially with respect to methods, procedures, and techniques of teaching critical thinking from teachers in general, as described by the literature.

The relationship between critical thinking ability, achievement indicators, and personality variables of graduate educational
administration students was investigated by Smith (1990). Results indicated no differences by gender for achievement indicators, critical thinking scores, though significant score differences among students in the three program areas were found. Significant differences were found for males, but not for females, regarding personality variables and program of study. For males only, seven MMPI scales were found to account for significant variability in critical thinking scores. Grade Point Average was significantly related to program of study.

The perceived importance of teaching critical thinking in vocational agriculture students was determined in Ware's (1990) study. The questionnaire was mailed to 750 vocational agriculture students. Findings from the study suggested that teaching strategies be revamped to emphasize the development of knowledge, skill and critical thinking in vocational agriculture students.

Mc Garrity (1990) conducted a study on the relationships of academic achievement, program preparation, critical thinking ability and classroom performances of pre-service teachers in two selected universities in Georgia. Forty nine pre-service teachers participated in the study.

Stepwise regression analysis suggests that academic achievement, the type of preparation program, and perceptions of the quality of one's program were the significant predictors' of Teacher Performance Assessment Instrument (TPAI) scores. Pearson correlations also showed that pre-service teachers' earning higher on GPAs and rating higher the
quality of their preparation were more successful on their performance based assessments. The subjects' critical thinking scores or perception of critical thinking ability were not significantly related to the other variables and do not predict TPAI scores.

Bitner (1991) conducted a study to test the hypothesis that formal operational reasoning modes are predictors of critical thinking abilities and grades assigned by teachers in science and mathematics. Hundred and one rural students in grade 9 through 12 were included in the sample. It was concluded that the five formal operational reasoning modes (proportional reasoning, controlling variables, probabilistic reasoning, correlational reasoning, combinatorial reasoning) in the Group Assessment of Logical Thinking test were found to be significant predictor of critical thinking abilities and grade assigned by teachers in science and mathematics.

Identifying some of the important correlates of critical thinking, in terms of motivation, use of cognitive learning strategies, and classroom experience was the objective of Gracia's (1992) study. Participants (N=758) were college students attending three mid-western institutions. Twelve classrooms were sampled spanning three disciplines: biology, English and Social sciences. The Motivated Strategies for Learning Questionnaires (MSLQ) was administered to students at the beginning and at the end of the term. The result of the analysis lend further support for the positive relationship between "deep" processing (in this case critical thinking) and an intrinsic goal orientation. The relationship between critical thinking and a mastery orientation, however is tempered
by content domain. Intrinsic goal orientation is a significant, positive predictor of critical thinking for biology and social science students, but not for English students, at both the pretest and post test. Meta-cognitive self regulatory strategies were consistently positively related to critical thinking. In summary this study supported positive relationship between motivation, deep strategy use, and critical thinking.

To determine whether primary and secondary pupils in Singapore can reason and do philosophy, a study was undertaken by Lim (1992) to ascertain their reasoning skills. The study focussed the relationship between critical thinking as measured by the New Jersey Test of Reasoning (NJTR) specifically developed to evaluate the philosophy for children program (Lipman, 1983), and concrete and formal operational reasoning as measured by the Test of Formal Reasoning (TFR). The study was conducted on 160 primary grade, pupils from one school and 887 secondary students from three schools.

The four schools in which the data were collected were a good primary school (A), an average secondary school (B) and two good secondary schools (C and D). The classification of the Piagetian stages indicated that the average of the secondary students from school B appeared to be closer to the average of the students of the good primary school than to that of the good secondary schools. Ability level in terms of Piagetian classifications seemed to be pretty wide for that of the good and average secondary schools. Students at the lowest level of the Piagetian stage (the concrete level) were able to score a mean of 23.88, close to answering correctly half the number of items in the reasoning
scale of fifty items, showing that even the primary-level students can reason and be in a critical thinking program. The detailed Rasch analysis indicated that the sample generally found RR (recognizing relationships) items the easiest and DT (deductive thinking) items the most difficult. IT (inductive thinking items) appeared to be easier than E (evaluation) items, I (interpretation) items or A (analysis) items.

Onosko (1992) in his study "Exploring the Thinking of Thoughtful Teachers" compared outstanding teachers of thinking with their less successful colleagues based on their instructional goals, their perception of students, and their understanding of thinking. The sample consisted of 20 social studies teachers drawn from a pool of 48 teachers from 16 secondary schools. Ten teachers were outstanding and the other 10 teachers were less than outstanding. The findings indicated that compared to low scores, the higher scores (1) considered the development of students thinking as fundamental goal of instruction (2) found satisfaction in organizing activities associated with thinking (3) believe content coverage impedes students' thinking and were more willing to reduce coverage to pursue the goal of thinking, (4) manifested lengthier, more elaborate and more precise perspective on what thinking entails, in addition (6) identified a greater number of intellectual disposition and ability.

The main objective of Stewart's (1992) study was to find out the relationship between a person's level of moral development, critical thinking skills and self concept. Four hundred and thirty seven students from two colleges were included in the study. Although none of the
correlation were strong, statistically significant correlation were noted between moral development and critical thinking. There were also statistically significant correlation between aspects of self concept and moral development and aspects of self concept and aspect of critical thinking.

Yildirim (1994) investigated teachers theoretical orientation toward teaching thinking, using a survey questionnaire. The sample included 285 New York State Public School teachers, and the result showed that less than one fourth of the teachers presented a clear content or skill orientation views about the nature of thinking. The majority had mixed views about these two theories, indicating that neither orientation was predominant among teachers.

The relationship between cognitive development and critical thinking and the demographic variables: age, educational level, and educational background, of 140 baccalaureate junior and senior nursing students was studied by Gambino (1995). The data strongly suggest that cognitive development significantly co-varies with critical thinking. Descriptive univariate statistics were utilized to describe and summarize the findings of the demographic data. No significant differences were found between the educational levels.

The presence and nature of developmental or gender differences in critical thinking performance of elementary school students was determined by Foss (1995). Hundred and fifty eight, mid-western students in Grades 4,5 and 6 served as the sample for the study. The
result indicated statistically significant differences between grade levels on the critical thinking scale for children, and Raven's Progressive Matrices. Statistically significant gender differences were found on the Critical Thinking Test.

Tsai (1996) examined secondary school social studies teachers perspectives of teaching critical thinking in Taiwan. The result indicated that the social studies teachers were not familiar with critical thinking. Their definitions of critical thinking were considerably diverse, seven out of eleven teachers said that they did teach critical thinking skills. However, teachers in the study confirmed the findings of a previous study that students did not acquire critical thinking skills from Taiwanese schooling. Difficulties of teaching critical thinking related to students were mostly addressed. A considerable proportion of participants indicated that Taiwanese students had too much school work and with added academic pressure for students to be successful in school they felt critical teaching would be boring or not important, because it did not increase student test score. Consequently, no response or reaction from students was the main difficulty in teaching critical thinking mentioned by teachers.

Clocklin (1996) conducted a study to determine if a relationship existed between critical thinking skills and preferred learning styles of first year nursing students. 1997 students from four colleges in a rural geographic region were included in the sample.
This study showed that a significant relationship appeared to exist between critical thinking skills and preferred learning styles. Students categorized as divergers on the Kolb's Learning Style Inventory had lower mean composite scores on the Watson-Glaser Critical Thinking Appraisal (WGCTA) than did those categorized as assimilators, accommodators, or converges. Converges had the highest mean scores. Age also was related to critical thinking scores with students over the age of 40 years having higher mean composite scores on the WGCTA than those under 40 years of age.

The critical thinking abilities of beginning and advanced community college students from the disciplines of business, liberal arts, nursing and science was investigated by Mc Donough (1998). Sample consisted of 240 beginning and advanced students equally distributed among the disciplines. The significant findings of the study are as follows:

1. All beginning versus all advanced students differ significantly in their ability to think critically

2. All advanced students scored significantly higher than all beginning students on total critical thinking and all sub-test score,

3. Advanced students scored significantly higher on total critical thinking scores when compared to beginning students from the same discipline.
4. Beginning students do not differ significantly in their ability to think critically.

5. Advanced students differ significantly in their ability to think critically.

The relationship of moral judgement, critical thinking and gender among students was studied by Cargnel (1998). Hundred and eighty one students (96 females and 85 males) from a four year christian liberal arts college formed the sample. Results of this study found the subjects to be lower in levels of moral judgement compared to normative populations and to be similar to normative population in critical thinking competency. Although none of the correlations were strong, statistically significant correlations were noted between moral development and critical thinking. Statistically significant correlations were also found between class level. Moral judgement and critical thinking were not significant when investigating the variable of gender.

Coca (1998) studied the variation in development of critical thinking of higher secondary school students studying in different types of schools. The sample consisted of 536 Higher secondary students and 62 teachers. The major findings are as follows:

1. There was a significant positive correlation between academic achievement and critical thinking.

2. There was no significant different between boys and girls in their critical thinking ability.
3. There was no significant difference between rural-urban and Government-private school students in their critical thinking ability.

The development of critical thinking among the B.Ed. students in relation to academic achievement, Gender, subjects, level of education and teaching strategies was studied by Sheeba (1998). Hundred and sixty seven teacher trainees from two teacher training colleges were included in the sample. The major findings are as follows:

1. A very negligible percentage of subjects had a very high level of critical thinking.

2. There is a significant positive correlation between critical thinking and academic achievement.

3. There is no male-female and rural-urban difference in critical thinking ability.

4. Science students scored high on critical thinking test than arts and commerce students.

5. There is no significant correlation between educational level and critical thinking.

6. B.Ed. program helped the trainees in acquiring various critical thinking teaching strategies.
2.3 Implications for the Present Study

From the above discussed research studies it is clear that most of the researches on critical thinking were conducted abroad with the exception of a very few studies in India. In abroad a good deal of research had gone into the area of critical thinking. Conventional method of teaching different subjects at various levels were found to be less effective than various innovative teaching patterns like discovery learning, inquiry method, guided practice, meta-comprehension strategies in term of students gain in critical thinking. The art and science of improving critical thinking in the individual person is in its initial stages and much has not been accomplished. The studies cited above include various training programmes which had attempted to enhance critical thinking under different environmental conditions. Researchers have also studied the effect of classroom climate, questioning strategies, learning styles, instructional technology, co-operative learning and thinking frames on the development of critical thinking. However with regard to this variables no studies have so far been conducted in India. Though many researchers have identified several teaching skills and their contributions for effective learning specific to each subject, studies are yet to be conducted to identify the specific teaching behaviour/strategies which would contribute for the development of critical thinking in students. Therefore studies need to be conducted in India to find out whether secondary school teachers use suitable teaching strategies for developing critical thinking and to what extent use of these strategies contribute for enhancing the students’ level of critical thinking.

Several studies conducted abroad to examine underlying relationship between critical thinking and teacher factors considered teachers’ perception, knowledge of critical thinking, educational level, experience and attitude. The findings revealed that Teachers’ perceived
importance and use of critical thinking strategies varied with experience and educational level. Many teachers felt developing students' thinking as fundamental goal of education. Studies have also reported of teachers who are familiar with critical thinking and who do not teach for developing critical thinking. Studies to examine underlying relationship between critical thinking and teacher factors has not been reported in India. Therefore, studies need to be conducted in Indian context to find out whether secondary school teachers vary in the use of critical thinking strategies in relation to the subjects they teach, years of experience and types of schools in which they are employed.

Research on psycho-contextual factors and critical thinking broadly relates such factors as critical thinking and intelligence, critical thinking and life stress, critical thinking and self esteem and self concept. Development of critical thinking is also studied in relation to academic achievement, gender, age, socio-economic status, types of school. Considering the above variables only a very limited number of studies have so far been conducted in India and that too limited only to variables such as gender, intelligence, SES, and types of schools. Moreover, it needs to be mentioned here that except one Ph.D. Study, all other studies in India were conducted at M. Phil and M. Ed. Level. It clearly indicates that research in critical thinking is one of the most neglected area of research in our country.

Almost all the studies have reported significant correlation between critical thinking and academic achievement in various subjects but so far no such studies are conducted on secondary school students. All studies conducted abroad found positive correlation between critical thinking and intelligence. But studies are yet to be conducted on the possible relationship between critical thinking and non-verbal intelligence. In
India, no such studies are reported so far. With regard to critical thinking and socio-economic status studied have reported no significant correlation. But only two studies have been conducted so far which necessitates many more such studies in order to arrive at valid conclusion on the relationship between the two variables. Findings of studies on sex difference in critical thinking are not conclusive. Some studies have reported significant gender difference in favour of boys where as some have reported in favour of girls. There are also studies which have reported no significant gender difference in critical thinking. Hence there is a necessity of conducting more studies to confirm the findings of sex difference in critical thinking.

Both the studies conducted to find out the possible variation in critical thinking between government and private school students found no significant difference in critical thinking between students of the two types of schools. However, only two studies may not be considered sufficient to arrive at valid conclusions. Since, no researcher has yet studied the difference in critical thinking between rural and urban secondary school students, it is necessary to study whether rural urban variation in critical thinking exists among the secondary school students.

So far no researchers have studied critical thinking in relation to language spoken, religion and size/type of family. Also the possible effect of home environment on critical thinking has not yet been investigated by researchers in the Indian context.

With regard to all the above variables, most of the studies abroad have made use of samples of lower and middle schools and college students with a few studies using high school samples. Moreover, in Indian context one or two studies in each category may not be considered
sufficient to arrive at valid conclusions and that too except one Ph.D study, all other Indian studies reported above were conducted by M.Ed. and M.Phil students, where conclusions are not based on large scale representative sample. The review of these findings leads to fact that there is a necessity of conducting research studies in critical thinking with specific reference to secondary schools involving large scale representative samples.