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**DEVELOPMENT OF CRITICAL THINKING AMONG SECONDARY
SCHOOL STUDENTS IN RELATION TO SOME
PSYCHO-CONTEXTUAL VARIABLES**

**THESIS
SUBMITTED TO THE GOA UNIVERSITY
FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY IN EDUCATION**

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CERTIFICATE

This is to certify that the thesis entitled "Development of Critical Thinking Among Secondary School Students in Relation to Some Psycho-Contextual Variables" is a record of bonafide research work carried out by Shri. Paily M.U. under my guidance. To the best of my knowledge and belief, the results embodied in this thesis have not been submitted to this or any other University for the award of any degree or diploma.



(Gopal C. Pradhan)

DECLARATION

I Shri. Paily M.U., do hereby declare that the thesis being submitted by me is my own research work, on "Development of Critical Thinking Among Secondary School Students in Relation to Some Psycho-Contextual Variables", carried out under the guidance of Dr. G.C. Pradhan.

I do further declare that to the best of my knowledge and belief, the research work embodied in the present thesis is original and has not been submitted in part or full for any diploma or degree of this or any other university.

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CHAPTER I
INTRODUCTION

CHAPTER I

INTRODUCTION

1.1 Background of the Study

The goal of helping students to become effective thinkers is fundamental to any educational practice and is certainly not a new idea. John Dewey saw the development of an individual capable of reflective thinking as a prominent educational objective. The National Policy on Education - 1986 subsequently modified in 1992 has justifiably emphasised, "subject should be visualised as the vehicle to train the child to think, analyse, reason and articulate logically".

Scholars are of the opinion that thinking is not another educational option. Rather it is an indispensable part of it, because being able to think critically is a necessary condition for being educated, and educationists have come to realise that teaching for developing critical thinking is an essential function of School. But how far have we achieved this ? After independence, some great minds of our country have examined from time to time the state of education both at school and college levels, and valuable documents like University Education Commission (1948-49), Education Commission (1964-68), Secondary Education Commission (1952-53) and National Policy on Education (1968 & 1986) have suggested the various steps to be taken for the qualitative improvement of education at different levels. Policies on education have been formulated almost in each decade but what actually had happened (and is happening) in our classrooms between the teachers and students, remains practically the same. Virtually all

informed persons agree that schooling today does not foster the higher order thinking skills and abilities which represents the basic of the future.

1.1.1 The Present Scenario and the Future Needs

India, a developing nation, has invested huge amounts for the cause of educational establishment. But after five decades of independence varying gaps remain. Research on education documents serious deficiencies in students reasoning. Students and educators alike are confused about the intellectual standards. It is clear that schools neither successfully teach students to think critically nor realise, that they are not doing so. As a result, we find our students after schooling are poor thinkers and inadequate problem solvers. The same even continues into their college education and finally the career. Many of them merely possess lower-order skills of rote memorisation. Too many passed their classes by cramming fragmented bits of information.

Years of rote memorisation and passivity are poor foundation at any educational level. Through over-emphasis on examination, with recent stress on objective type only, the educational system has made the students passive consumer of facts and not the active producer of ideas. In consequence, the classroom instead of becoming centre of inquiry, has degenerated in to lesson hearing room. The classrooms are more concerned with students rote use of procedures than with their understanding of concepts and development of higher order thinking skills.

Students apathy and resistance to active and reasoned involvement in the classroom is a product of years of didactic instruction. The teacher presents the materials to be learned, and the students are

expected to absorb it. There is very little teacher student or student-student interaction. Except perhaps for an occasional question from a student requesting clarification, or an occasional question from the teacher testing comprehension. The teachers feel a greater obligation to cover subject matter through lecture than to generate thought provoking activities or assignments that may seriously reduce what they can cover or significantly add to their work load or both. Most teachers take this relatively traditional approach to instruction, relying heavily on classroom presentation, text books, and work book. While such techniques have helped many students attain basic levels of proficiency in each subject area, they have not been as successful in helping students achieve higher levels of performance. What is unfortunate about this traditional approach is that it allows little real students involvement beyond the actual recall level. Thinking is not only encouraged but frequently not allowed.

The old way of educating that was passable in a relatively stable world no longer works. Rote memorisation is useless when what is memorised today is obsolete tomorrow. It is certainly easier in the short run, to lecture students and test for their ability to restate the lecture. In the long run, the didactic counterfeit of education leaves our citizens grossly unprepared and unable to assume their responsibilities, now unavoidable to make rational judgement about significant national and global issues.

As we approach the end of the 20th century, drastic social, political, economic, and environmental changes around the globe demand citizens be trained to identify and analyse issues and problems not merely memorise facts and follow directions. Social demands for higher order thinking are increasing. There is an emphasis every where

in the need for a future work force capable of more sophisticated thinking than was generally required in the past. Such skills as independent analysis, flexible thinking and problem solving are now considered basic requirements for many jobs. In addition, in this information age which is characterised by the rapid expansion of knowledge and the emergence of increasingly sophisticated technologies, the ability to adopt quickly to change, along with the capacity and willingness to learn new skills on the job assumes greater importance.

The rapid increase of available knowledge has particular significance for education. Content teachers frequently lament their inability to cover all the materials in the content curriculum. The increased knowledge bases of many subjects quantitatively compound this task. It is clear that a different strategy is in order-one that emphasizes developing the lifelong learning and thinking skills necessary to acquire and process information within an ever-expanding field of knowledge.

It is time that we reverse the pervasive emphasis in education on lower rather than on higher order learning, on recall rather than on reasoning, on students merely "reproducing" rather than producing knowledge.

If the teachers and educators are to be successful in coping with the contemporary demands of the society, they cannot avoid focussing their major efforts in developing children who can think independently and critically .

1.1.2 Critical Thinking: A Historical Perspective

Philosophers, Psychologists and curriculum theorists have all

defined and analysed thinking skills. The perspectives of each discipline have resulted in somewhat different frameworks and terminologies, yet analysis of works that represent the major views of each field reveals substantial overlap.

Within the field of philosophy attempts to teach thinking and problem solving have been prevalent since the time of Aristotle and Plato. The concern of philosophers with the elements of critical thinking dates back to ancient times. If Dewey is the modern day founder of critical thinking movement then Plato and Aristotle are its ancient founders. Mann (1979) cited Plato's argument: "Arithmetic stirs up him who is by nature sleepy and dull, and makes him quick to learn, retentive, and shrewd. He makes progress quiet beyond his natural powers". Similar ideas were espoused by Sir Francis Bacon, who favoured the study of mathematics as a remedy to students lack of attention. In 1800's, many educators argued that the study of Latin would develop the mental discipline necessary to learn in any domain. Perhaps the oldest systematic account goes back to Aristotle. According to him the mind is composed of a number of separate powers or faculties, such as memory, judgement, reasoning and so on. These specific powers of the mind are thought to be capable of being developed and strengthened by suitable exercise much as the muscles of the body can be strengthened by a proper regimen of exercises. The whole educative process, then becomes a process of rigorous mental exercise. The ultimate outcome of a good education is a "trained mind".

If there is a modern day, founder of critical thinking movement, it is almost certainly John Dewey, who was simultaneously an educator, philosopher and psychologist. Dewey (1933) defined reflective thought as the "careful persistent examination of an action, proposal, or belief and

the analysis or use of knowledge in the light of grounds that justify it and its probable consequences". Smith (1953) also emphasized the judgemental aspect of critical thinking as "what a statement means and whether to accept or reject it". In his landmark paper, "A concept of Critical Thinking" Ennis (1962) elaborated on Smith's definition of critical thinking by delineating skills that called for the application of formal and informal logic. Ennis has since then considerably expanded his concept of critical thinking.

In more recent times philosophers such as Seigel (1980), Mcpeek (1984), Lipman (1988), Paul (1989) and Norris (1990) have devoted their attention to understanding the bases of critical thinking.

The emergence of psychology as a science, less than a century ago, was stimulated by developments in philosophy and by laboratory achievement in physiology and physics. Within the field of psychology, definition of higher-order thinking skills tend to place the reasoning skills proposed by philosophers within a broader framework.

Early in this century, uneasiness with the failure to address the thinking and reasoning potential of human beings was evident in the reaction to E.L. Thorndike's work. Thorndike as a theorist, did not ignore higher level process but he reduced them to connectionistic conceptions. Despite, the dominance of connectionism, interest in establishing a cognitive basis for a pedagogy that fosters thinking and reasoning in school learning has been continuously expressed by educators and psychologists at least since John Dewey.

In 1945 Max Wertheimer in his book on productive thinking described an insightful series of studies on problems solving in

mathematics and science. He distinguished productive thinking from "blind intuition", equated the former with grasping the essential structure of the problem. In the late 1950s and early 1960s, behaviouristic psychology and its expression in programmed instruction strongly influenced instructional theory. Modern theories that are now contributing to the teaching of reasoning and understanding were beginning to emerge.

Psychologists interested in the nature of critical thinking such as Piaget, Guilford, Feuerstein, Sternberg, have been particularly concerned with characterizing critical thinking as it is performed under the limitations of the person and environment. Piaget's stages of development, particularly the distinction between formal and operational thought, are often used to differentiate among problems requiring logical reasoning. Guilford (1956) structure of the Intellects Model (SOI) has provided a ready source of hypothesised abilities that could be used as primary tools in critical thinking. Landis and Michael (1981) employed factor analysis to determine a minimum number of necessary constructs from SOI model for understanding critical thinking. It is reported that within the conceptual framework provided by SOI model, cognition of semantic classes, relations, and system; evaluation of semantic units classes, relations and transformation; and convergent production of semantic transformation held most promises as possible valid explanatory components or sub-constructs of critical thinking.

More recently Sternberg (1985) in his triarchic theory of intelligence viewed thinking skills as a subset of intelligent functioning. He proposed a framework based on his triarchic theory of intelligence, that can encompass the various theories of critical thinking. He proposed that theories of critical thinking can and often do deal with one or more

aspects of critical thinking - its relation to the mind of the individual, its relation to the context in which it occurs, and its relation to the experience of the individual with various kinds of task and situations previously confronted that required critical thinking in greater or lesser degree.

In the educational tradition of theorizing are leading figures such as Bloom (1956) Gagne (1980), Perkins (1981) and Renzulli (1976), whose theorizing seems directly responsive to the skills needed by children in the classroom for problem solving, decision making, and concept learning. Bloom's (1956) famous taxonomy of cognitive skills and Gagne's (1965) well known hierarchy of learning skills have seen widespread application in classroom situations. These theorists have drawn heavily on classroom observation, text analysis, and process analysis of thinking in the classroom to guide their thinking about critical thinking. In general, thinking skills clusters proposed in curriculum projects (for example, Bruner, 1966; Taba, 1963; Suchman, 1965; Covington, 1968) are the reasoning skills identified by philosophers and psychologists.

Looking across these three disciplines; we see that the goal of teaching thinking and problem solving is not unique to the 1980's and 90's. Attempts to achieve this goal have been espoused for centuries and have stimulated a variety of suggestions.

1.1.3 Concept of Critical Thinking

If we are to foster and strengthen critical thinking in schools and colleges, we need a clear conception of what it is and what it can be. We need to know its defining features, its characteristic outcomes, and the underlying conditions that made it possible.

Both philosophers and psychologists have addressed this question. The psychologist are interested in the process involved in critical thinking. They offers insight into how thinking occurs. According to Sternberg (1985) psychological theories tend to be performance theories specifying what people actually do. Philosophy on the other hand are more concerned with outcomes or products and also the philosophy offers insight into what ought to be included in critical thinking instruction. According to Sternberg (1985), philosophical theories of critical thinking are competence theory specifying what people can do. It tells us how people might think under ideal circumstances.

Although theorists provide a variety of explanation of critical thinking they do not necessarily reject each others explanations. They feel that their particular explanation most usefully conveys the basic concept highlighting what they take to be its most crucial aspects but do not necessarily hold that others explanations are wrong or lacking in usefulness. Novices on the other hand, typically get caught up in the wordingness of definitions and do not probe into them to see to what extent their meanings are in fact compatible. The various proposed explanations when examined, are in fact much more similar than they are different. In what follows here, a close examination of various of various explanations of critical thinking is made.

According to Ennis (1985) "critical thinking is reflective and reasonable thinking that is focussed on deciding what to believe or do". In so defining, he considers it as a goal directed thinking in which critical thinker consciously and rationally thinks about his or her thinking with a view to applying it in other contexts. For Ennis then critical thinking is a practical activity concerned with making decision of what to believe or do. This decision making results from the interaction of a set of

dispositions toward critical thinking with a set of abilities for critical thinking. Ennis's 13 dispositions of critical thinkers are listed in Table 1.1.1

However, having dispositions to think critically is not enough. A person may have a disposition to take position and change it when evidence and reasons are sufficient to do so. But how can he exercise this disposition unless he is competent to seek the sufficient evidence and reasons. To be successful in seeking evidence and reason, the person require certain abilities.

Ennis classify these abilities under five main categories, which are themselves further subdivided. The categories are elementary clarify related abilities, advanced clarify related abilities, inference related abilities, abilities related to establishing a sound basis for inference and abilities involved in going about decision making in an orderly and useful way. Each of these categories contain a large number of abilities. The details of these abilities are given in the Table 1.1.1

TABLE 1.1.1
Critical Thinking Dispositions and Abilities

<p>WORKING DEFINITION: <i>Critical thinking</i> is focused on deciding what to believe or do.</p> <p>Critical thinking so defined involves both dispositions and abilities:</p> <p>DISPOSITIONS:</p> <ol style="list-style-type: none"> 1. Seek a clear statement of the thesis or question 2. Seek reasons 3. Try to be well-informed 4. Use credible sources and mention them 5. Take into account the total situation 6. Try to remain relevant to the main point 7. Keep in mind the original and/or basic concern 8. Look for alternatives 9. Be openminded <ol style="list-style-type: none"> a. Consider seriously other points of view than one's own ("dialogical thinking") b. Reason from premises with which one disagrees—without letting the disagreement interfere with one's reasoning ("suppositional thinking") c. Withhold judgment when the evidence and reasons are insufficient 10. Take a position (and change a position) when the evidence and reasons are sufficient to do so 11. Seek as much precision as the subject permits 12. Deal in an orderly manner with the parts of a complex whole 13. Be sensitive to the feelings, level of knowledge, and degree of sophistication of others <p>ABILITIES: (Classified under these categories: Elementary Clarification, Basic Support, Inference, Advanced Clarification, and Strategy and Tactics)</p> <p>Elementary Clarification</p> <ol style="list-style-type: none"> 1. Focusing on a question <ol style="list-style-type: none"> a. Identifying or formulating a question b. Identifying or formulating criteria for judging possible answers c. Keeping the situation in mind 2. Analyzing arguments <ol style="list-style-type: none"> a. Identifying conclusions b. Identifying stated reasons c. Identifying unstated reasons d. Seeing similarities and differences e. Identifying and handling irrelevant f. Seeing the structure of an argument g. Summarizing 3. Asking and answering questions of clarification and/or challenge, for example: <ol style="list-style-type: none"> a. Why? b. What is your main point? c. What do you mean by "_____?" d. What would be an example? e. What would not be an example (though close to being one)? f. How does that apply to this case (describe case, which might well appear to be a counterexample)? g. What difference does it make? h. What are the facts? i. Is this what you are saying: "_____?" j. Would you say some more about that? <p>Basic Support</p> <ol style="list-style-type: none"> 4. Judging the credibility of a source; criteria: <table style="width: 100%; border: none;"> <tbody> <tr> <td>a. Expertise</td> <td>e. Use of established procedures</td> </tr> <tr> <td>b. Lack of conflict of interest</td> <td>f. Known risk to reputation</td> </tr> <tr> <td>c. Agreement among sources</td> <td>g. Ability to give reasons</td> </tr> <tr> <td>d. Reputation</td> <td>h. Careful habits</td> </tr> </tbody> </table> 5. Observing and judging observation reports; criteria: <ol style="list-style-type: none"> a. Minimal incurring involved b. Short time interval between observation and report c. Report by observer, rather than someone else (i.e., not hearsay) d. Records are generally desirable. If report is based on a record, it is generally best that: <ol style="list-style-type: none"> 1) The record was close in time to the observation 2) The record was made by the observer 3) The record was made by the reporter 4) The statement was believed by the reporter, either because of a prior belief in its correctness or because of a belief that the observer was habitually correct e. Corroboration f. Possibility of corroboration g. Conditions of good access h. Competent employment of technology, if technology is useful i. Satisfaction by observer (and reporter, if a different person) of credibility criteria (#4 above) <p>Inference</p> <ol style="list-style-type: none"> 6. Deducing, and judging deductions <ol style="list-style-type: none"> a. Class logic—Euler circles b. Conditional logic c. Interpretation of statements <ol style="list-style-type: none"> 1) Double negation 2) Necessary and sufficient conditions 3) Other logical words: "only," "if and only if," "or," "some," "unless," "not," "not both," etc. 	a. Expertise	e. Use of established procedures	b. Lack of conflict of interest	f. Known risk to reputation	c. Agreement among sources	g. Ability to give reasons	d. Reputation	h. Careful habits	<ol style="list-style-type: none"> 7. Inducing, and judging inductions <ol style="list-style-type: none"> a. Generalizing <ol style="list-style-type: none"> 1) Typicality of data; limitation of coverage 2) Sampling 3) Tables and graphs b. Inferring explanatory conclusions and hypotheses <ol style="list-style-type: none"> 1) Types of explanatory conclusions and hypotheses <ol style="list-style-type: none"> a) Causal claims b) Claims about the beliefs and attitudes of people c) Interpretations of authors' intended meanings d) Historical claims that certain things happened e) Reported definitions f) Claims that something is an unstated reason or unstated conclusion 2) Investigating <ol style="list-style-type: none"> a) Designing experiments, including planning to control variables b) Seeking evidence and counterevidence c) Seeking other possible explanations 3) Criteria: Given reasonable assumptions, <ol style="list-style-type: none"> a) The proposed conclusion would explain the evidence (essential) b) The proposed conclusion is consistent with known facts (essential) c) Competitive alternative conclusions are inconsistent with known facts (essential) d) The proposed conclusion seems plausible (desirable) 8. Making and judging value judgments <ol style="list-style-type: none"> a. Background facts b. Consequences c. <i>Prima facie</i> application of acceptable principles d. Considering alternatives e. Balancing, weighing, and deciding <p>Advanced Clarification</p> <ol style="list-style-type: none"> 9. Defining terms, and judging definitions; three dimensions: <ol style="list-style-type: none"> a. Form <ol style="list-style-type: none"> 1) Synonym 2) Classification 3) Range 4) Equivalent expression 5) Operational 6) Example—nonexample b. Definitional strategy <ol style="list-style-type: none"> 1) Acts <ol style="list-style-type: none"> a) Report a meaning ("reported" definition) b) Stipulate a meaning ("stipulative" definition) c) Express a position on an issue ("positional," including "programmatic" and "persuasive" definition) 2) Identifying and handling equivocation <ol style="list-style-type: none"> a) Attention to the context b) Possible types of response: <ol style="list-style-type: none"> i) "The definition is just wrong" (the simplest response) ii) Reduction to absurdity: "According to that definition, there is an outlandish result!" iii) Considering alternative interpretations: "On this interpretation, there is this problem; on that interpretation, there is that problem" iv) Establishing that there are two meanings of key term, and a shift in meaning from one to the other c. Content 10. Identifying assumptions <ol style="list-style-type: none"> a. Unstated reasons b. Needed assumptions; argument reconstruction <p>Strategy and Tactics</p> <ol style="list-style-type: none"> 11. Deciding on an action <ol style="list-style-type: none"> a. Define problem b. Select criteria to judge possible solutions c. Formulate alternative solutions d. Tentatively decide what to do e. Review, taking into account the total situation, and decide f. Monitor the implementation 12. Interacting with others <ol style="list-style-type: none"> a. Employing and reacting to "fallacy" labels (including) <table style="width: 100%; border: none;"> <tbody> <tr> <td>1) Circularity</td> <td>12) Conversion</td> </tr> <tr> <td>2) Appeal to authority</td> <td>13) Begging the question</td> </tr> <tr> <td>3) Bandwagon</td> <td>14) Either-or</td> </tr> <tr> <td>4) Glittering term</td> <td>15) Vagueness</td> </tr> <tr> <td>5) Namecalling</td> <td>16) Equivocation</td> </tr> <tr> <td>6) Slippery slope</td> <td>17) Straw person</td> </tr> <tr> <td>7) Post hoc</td> <td>18) Appeal to tradition</td> </tr> <tr> <td>8) Non sequitur</td> <td>19) Argument from analogy</td> </tr> <tr> <td>9) Ad hominem</td> <td>20) Hypothetical question</td> </tr> <tr> <td>10) Affirming the consequent</td> <td>21) Oversimplification</td> </tr> <tr> <td>11) Denying the antecedent</td> <td>22) Irrelevance</td> </tr> </tbody> </table> b. Logical strategies c. Rhetorical strategies d. Presenting a position, oral or written (argumental) <ol style="list-style-type: none"> 1) Aiming at a particular audience and keeping it in mind 2) Organizing (common type: main point, clarification, reasons, alternatives, attempt to rebut prospective challenges, summary—including repeat of main point) 	1) Circularity	12) Conversion	2) Appeal to authority	13) Begging the question	3) Bandwagon	14) Either-or	4) Glittering term	15) Vagueness	5) Namecalling	16) Equivocation	6) Slippery slope	17) Straw person	7) Post hoc	18) Appeal to tradition	8) Non sequitur	19) Argument from analogy	9) Ad hominem	20) Hypothetical question	10) Affirming the consequent	21) Oversimplification	11) Denying the antecedent	22) Irrelevance
a. Expertise	e. Use of established procedures																														
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Source: Ennis, R.H. (1985). "A Logical Basis for Measuring Critical Thinking Skills". *Educational Leadership*, 3(2), 44-48.

When the above mentioned abilities, interact with the critical thinking dispositions, there is a comprehensive picture of how to go about the process of deciding what to believe or do. This comprehensive overview is presented in the Figure 1.1.1.

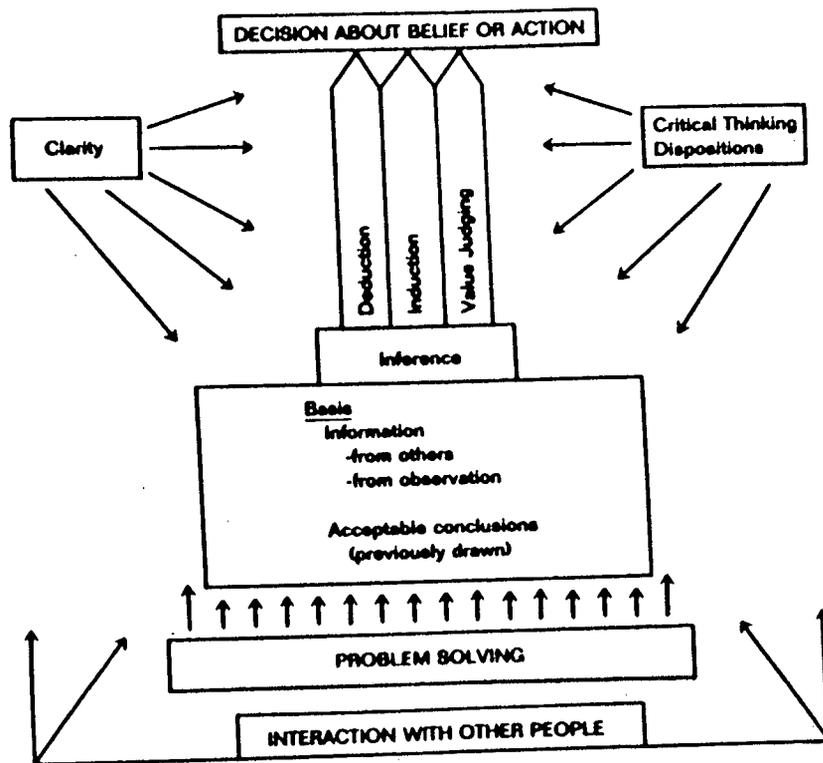


Fig. 1.1.1: The Process of Deciding What to Believe or Do

Source: Ennis. R.H., Norris. S.P. (1990). "Critical Thinking Assessment: Status, Issues, Needs". In S. Legg & J. Agina (Eds.), *Cognitive Assessment of Language and Math Outcomes* (Vol. 36 in the series *Advances in Discourse Process*, R. O. Freedle, Ed.). Norwood, N.J.: Ablex.

The arrows coming from the disposition box in Fig. 1.1.1 depict the diffusion of the disposition's throughout the process of critical thinking. The sections of the list of abilities, Elementary clarification and advanced clarification, are concerned with the clarity that must permeate the process of critical thinking, as depicted by the arrows emanating from the clarity box in Fig. 1.1.1. The section of the list of abilities, Basic support, is concerned with the information basis for the decision. The inference section is concerned with the step from the basis to the decision, depicted by the inference box and the pointed inference columns, representing three basic types of inference. The strategy and tactics section connects the decision process with problem solving and emphasizes aspects of interacting with others, including making written and oral representations, and developing strategies for dealing with others. This section is represented by the boxes at the bottom of the figure (Ennis, Norris, 1990).

Paul Richard (1992) consider critical thinking in a strong sense. On this view he distinguishes two important sense of critical thinking, a weak sense and a strong one. Those who think critically only with respect to monological issues and as a result consider multilogical issues with a pronounced monological bias have merely mastered weak sense of critical thinking. This will serve the interest of a particular individual or group to the exclusion of other relevant persons and groups. On the other hand, the strong sense of critical thinking involves a concern for other persons arguments. It takes into account the interests of diverse person and groups. In this sense, a critical thinker is one who is able to think well and fairmindedly not just about her own beliefs and viewpoints, but about beliefs and viewpoints that are diametrically opposed to his or her own. This ability to see things from others point of view, which may be novel and contradictory with respect to one's point of

view is what Paul refers as dialogical thinking.

According to Paul, there are three groups of mental structures essential to the development of a critical thinker: (1) proficient micro-skills, such as the ability to recognise a vague sentence, a questionable assumption, a contradiction or inconsistency, an inference or implication; (2) refined macro abilities, such as the ability to read and write critically, engage in give-and-take of discussion and debate, evaluate sources of information, or create and explore arguments and theories; and (3) traits of mind, which are the intellectual virtues and moral commitments that transform thinking from a selfish, narrow-minded foundation to a broad, open minded foundation. Table 1.1.2 shows the dimensions of critical thought that these mental structures encompass.

No other theorists in the critical thinking movement address the underlying issues with the depth of philosophical analyses that Siegel offers. According to him a critical thinker is one who is "appropriately moved by reasons" (Siegel, 1989, p. 24). In so defining, he relate critical thinking with rationality he consider critical thinking as an emodiment of the ideal of rationality. In his view critical thinking is best conceived as the educational cognate of rationality. Rationality in turn is to be understood as being "co-existence with the relevance of reasons" (Scheffler, 1965, Quated in Siegel, 1989). A critical thinker is one who recognize the importance, and convincing force of reasons. When assessing claims, evaluating procedures, or making judgements, the critical thinker seeks reasons on which to base his or her assessment, evaluation or judgement. Moreover, to seek reason is to recognize and commit oneself to principles governing such activity. Critical thinking is thus, principled thinking (Siegel, 1980, p. 8).

TABLE NO. 1.1.2**35 Dimensions of Critical Thought****A. Affective Strategies**

- S-1 thinking independently
- S-2 developing insight into egocentricity or sociocentricity
- S-3 exercising fairmindedness
- S-4 exploring thoughts underlying feelings and feelings underlying thoughts
- S-5 developing intellectual humility and suspending judgment
- S-6 developing intellectual courage
- S-7 developing intellectual good faith or integrity
- S-8 developing intellectual perseverance
- S-9 developing confidence in reason

B. Cognitive Strategies — Macro-Abilities

- S-10 refining generalizations and avoiding oversimplifications
- S-11 comparing analogous situations: transferring insights to new contexts
- S-12 developing one's perspective: creating or exploring beliefs, arguments, or theories
- S-13 clarifying issues, conclusions, or beliefs
- S-14 clarifying and analyzing the meanings of words or phrases
- S-15 developing criteria for evaluation: clarifying values and standards
- S-16 evaluating the credibility of sources of information
- S-17 questioning deeply: raising and pursuing root or significant questions
- S-18 analyzing or evaluating arguments, interpretations, beliefs, or theories
- S-19 generating or assessing solutions
- S-20 analyzing or evaluating actions or policies
- S-21 reading critically: clarifying or critiquing texts
- S-22 listening critically: the art of silent dialogue
- S-23 making interdisciplinary connections
- S-24 practicing Socratic discussion: clarifying and questioning beliefs, theories, or perspectives
- S-25 reasoning dialogically: comparing perspectives, interpretations, or theories
- S-26 reasoning dialectically: evaluating perspectives, interpretations, or theories

C. Cognitive Strategies — Micro-Skills

- S-27 comparing and contrasting ideals with actual practice
- S-28 thinking precisely about thinking: using critical vocabulary
- S-29 noting significant similarities and differences
- S-30 examining or evaluating assumptions
- S-31 distinguishing relevant from irrelevant facts
- S-32 making plausible inferences, predictions, or interpretations
- S-33 evaluating evidence and alleged facts
- S-34 recognizing contradictions
- S-35 exploring implications and consequences

Source: Paul, Richard. W., et. al. (1989), *Critical Thinking Handbook: 6th-9th Grade*. Rohenart Park CA: Centre for Critical Thinking and Moral Critique.

reason assessment component of critical thinking, and is able to assess reason, and to understand the nature of reason and their assessment, it is not sufficient for him to be a critical thinker. Equally necessary is that a person have a willingness and an appropriate attitude towards critical thinking. This is where he brings in the second component of critical thinking, the critical attitude or critical spirit component.

In order to be a critical thinker, a person must have, in addition to the reason assessment component, certain attitudes, dispositions, habits of mind, and character traits, which together may be labelled the critical attitude or critical spirit. By critical spirit he meant a person must be disposed to make use of his reason assessment component and he should have a willingness and commitment to confirm judgement and action to principle. Above all he should have certain character which is inclined to seek, and to base judgement and action upon reasons; which reject partiality and arbitrariness; which is committed to the objective evaluation of relevant evidence; and which values such aspects of critical thinking as intellectual honesty, justice to evidence, sympathetic and impartial consideration of interests, objectivity, and impartiality.

According to Sternberg (1985) "Critical thinking comprises mental process, strategies, and representation people use to solve problems, make decisions, and learn new concepts". This account of critical thinking is based upon his Triarchic Theory of Human Intelligence, which views thinking skills as a subset of intelligent functioning. Based on this theory, he views critical thinking skills from three aspects of intellectual functioning as discussed in the following paragraphs.

The first aspect is relation of thinking skills to the internal world of

individual. It is aimed at the very essence of what critical thinking is about. What do we do when we think critically and how do we do it. In order to understand the critical thinking skills we must first identify the mental processes and representation underlying thought. Sternberg divides these mental processes or skills involved in critical thinking in to three basic kinds: Metacomponents, Performance components and knowledge acquisition components.

Meta-components are higher order executive processes used to plan what one is going to do, monitor while one is doing it, and evaluate it after it is done. The performance components are lower order, non-executive processes used to execute the instructions of the meta-components and provide feedback to them. And the knowledge acquisition components are the processes used to learn concepts or procedures.

The second aspect of intellectual functioning is that the relation of thinking skills to the external world of the individual. The relation of thinking skills to the external world of the individual deals with the contextual antecedents and consequences of the use of mental representations, processes, and strategies. Here is what he brings in the importance applying critical thinking skills into the practical affairs of every day world. Here, he emphasizes that critical thinking skills should be taught in a way that maximize the probability of their transfer to real life situation.

The third aspect is the relation of thinking skills to the experience of the individual. It deals with the interface between the internal world, on the one hand, and the external world on the other: It is through experience that this interface is achieved. In the triarchic theory,

emphasis is placed on two levels of experience: coping with novelty and automatization of information processing. Copng with novelty involves dealing with task and situations that are not only new, but new in kind. Automatization of information processing comes to play when material that is novel becomes quite familiar. The more the student is able to automatize information processing, the more the mental resources left over for coping with new kinds of challenges. The details are given in the Table 1.1.3.

TABLE 1.1.3
Three Aspects of Intellectual Functioning

- I. Internal World of The Individual**
 - 1. Metacomponents,**
 - * Recognizing that a problem exists.
 - * defining the nature of the problem
 - * Selecting a set of lower-order processing components or steps to solve the problem.
 - * Combining the processes or steps into an overall strategy.
 - * Selecting a mental representation (for example, spatial or linguistic) upon which the components and strategies can act.
 - * Monitoring one's own problem solving.
 - * Understanding and using external feedback.
 - 2. Performance Components**
 - * Inferring relations between stimuli
 - * Applying previously inferred relations to new stimuli
 - * Mapping higher-order relations between relations.
 - 3. Knowledge-acquisition components**
 - * Selective encoding - determining what information is relevant and what is irrelevant for one's particular purposes.
 - * Selective combination - putting the relevant information together.
 - * Selective comparison - relating new information to old information.

II. Functions in context

- * Adaptation - one changes oneself or one's resources to fit the environment.
- * Shaping - one changes environment to fit oneself or one's resources.
- * Selection - One simply choose a new environment.

III. Factors of experience

- * Coping with Novelty - dealing with tasks and situations that are not only new, but new in kind.
 - * Automatization - Automatization of information processing comes to play when material that was once novel becomes quite familiar
-

In Sternberg's approach, critical thinking becomes redefined as adaptive intelligence. What is valued in this form of critical thinking is not so much the mastery of the abstract syntactic principles but actual problem solving (Benderson quated in Haynes, 1991). Like that of Ennis for Sternberg too critical thinking is a practical activity of problem solving.

According to Mathew Lipman, Critical Thinking is skillful, responsible thinking that facilitates good judgement because it (1) relies upon criteria (2) is self correcting, and (3) is sensitive to context" (Lipman, 1988). His account highlights six key elements in critical thinking. To begin with, critical thinking is a skillful thinking, and according to him these skills are proficient performances that satisfy relevant criteria. So to think critically one need to employ a vast variety of cognitive skills, which he considers grouped into families such as reasoning skills, concept formation skills, inquiry skills, and translation skills.

The second aspect in his definition is responsible thinking. It points to the relationship between critical thinker and the community

that he or she addresses. The critical thinker sees an obligation to present reason in light of acceptable standards, because such reasons are subject to the judgement of competent members of fields relevant to the issue involved. Then he emphasize upon good judgement. Here he brings our attention that a casual thinking will not lead to good judgement, because it is not based upon any relevant reason and criteria. Critical thinking is called for in those situation in which considerations must be weighed and alternatives assessed, situations that call for the assessment of priorities and determination of truth and relevance.

The criteria are the next aspect. Criteria are those reasons that reflect the critical thinker's assessment of the essential factors to be taken into account when offering an analysis or when supporting and challenging a claim. Lipman offers a number of examples that indicate what he has in mind by criteria; these include: "Standards, Laws, regulations, guidelines, directions, requirements, specifications, stipulations, conventions, norms, regularities, principles, assumptions, presuppositions, definitions, ideals, purposes, objectives, credentials, procedures, policies. A critical thinker, thus, is called upon to make the framework of her/his argument clear, and to make available, the considerations that she takes as crucial to the inquiry in which he/she is engaged. These criteria are not taken as absolute, rather they may be questioned, and changed or even replaced, as critical thinking progresses. In his view the next aspect of critical thinking is that it is self-correcting, a critical thinker is subjected change his or her view when there is sufficient reason to do so. A critical thinker welcomes the critique and re-evaluation of his or her reasoning. Lastly, critical thinking is sensitive to context. While thinking critically a person uses criteria in relation to the context of their application.

National Council for Excellence in Critical Thinking Instruction (1991) stated "Critical thinking is the intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing or evaluating information gathered from or generated by, observation, experience, reflection, reasoning or communication as a guide to belief and action".

Critical thinking has been defined variously by various distinguished scholars. However, a close examination of these definitions reveal that to a great extent all these definitions say something in different ways. The amount of agreement among scholars regarding the nature of critical thinking clearly outweigh the disagreement.

Recent literature in the field of critical thinking has included definitions and analysis of critical thinking ranging from the broad definition of Seigel (1988) to the detailed articulation of skills and dispositions found in the work of Ennis (1985).

Most of the main account of critical thinking including those of Ennis, Paul, Mcpeck, Seigel, Sternberg, agree at least to this extent; critical thinking has (at least) two central components: a cognitive component, which involves abilities and skills relevant to the proper understanding and assessment of reasons, claims, and arguments, and an affective component which is understood as a complex of dispositions, attitudes, habits of mind, and character traits. Considering the cognitive components, Ennis call it as critical thinking abilities and list down hundred and odd, Paul name it as macro abilities and micro skills and list down 26 of it. Seigel consider this as reason assessment component, and Sternberg view this from three aspects of intellectual functioning by listing down subcategories. Coming to affective

component, Ennis call it as critical dispositions and list down thirteen of it. Paul name it as affective dimension and identify nine of it. Harvey Seigel name it as critical spirit and Robert Sternberg consider this as motivational factors.

Thus, we observe that critical thinking is the art of self-monitored, self-correcting, and self-disciplined thought. Critical thinkers apply internal standards of thoughts to their thinking while they think. Clarity, accuracy, precision, consistency, relevance depth and breadth are standards that apply to all disciplined thought. A critical thinker is one who appropriately move by reasons. He has a willingness and an ability to scrutinize and evaluate thinking - one's own as well as others' - to determine truth, accuracy, or worth and to construct logical arguments to justify claims or assertions. Such a thinking is called critical because it judges according to prescribed criteria, not because it is negative or accusatory. The abilities to recognize, analyse, judge and formulate valid argument through the application of reasoning and rules of logic are central to critical thinking.

1.1.4 Programs for Developing Critical Thinking

The programs for developing critical thinking skills have been with us for thousands of years, although they have not always been recognised as such. The traditional name for such programs has been logic. In recent years a good deal of interest has been expressed concerning the possibility of teaching thinking skills, and a number of techniques purporting to teach such skills have been developed (Bransford and Stein, 1984; Covington, Crutchfield, Davies and Olton, 1974; De Bono, 1975; Lipman, Sharp and Oscanyan, 1980; Whimbey and Lochhead, 1980; Paul 1989; Sternberg, 1985; Feuerstein, Rand Hoffman and Miller, 1980). What follows here is a brief description about

various programs meant for developing critical thinking.

Whimbey and Lochhead (1980) designed a program entitled "Problem Solving and Comprehension: A short Course in Analytical Reasoning". This programme is fairly typical of educationally based programs for training critical thinking skills. It can be used as a main text or as a supplementary text on courses on critical thinking. The program requires thinking aloud to a partner about the steps taken in solving problems, problems like those used on intelligence, aptitude, and simple achievement tests. The partner points out but does not correct errors. The program assumes that few errors are not made because of lack of knowledge of vocabulary, arithmetical facts, and so on, but rather because of errors in reasoning such as: failing to observe and use all relevant facts of a problem; failing to approach the problem in a systematic, step by step manner; jumping to conclusions and not checking them; and failing to construct a representation of the problem. Through carefully designed problem exercises, the program elicits procedures for reasoning and problem solving that avoid these errors.

A second example is the longer term program developed by Feuerstein, Rand, Hoffman, and Miller (1980) entitled "Instrumental Enrichment: An Intervention Program for Cognitive Modifiability". This is designed to provide students with critical cognitive functions and strategies and to help them realize their potential to learn on their own. The technique has two ingredients. As a set of 14 (increasingly complex) paper and pencil exercises designed to help students identify basic principles of thinking and to practice self-monitoring with respect to use of these principles, and (b) a set of training procedures involving teacher-guided "bringing" back and forth between the principles identified in the exercises and various subject matters of interest. Feuerstein's theory is

basically a theory of cognitive development, and the key construct of this theory is what Feuerstein calls a "Mediated Learning Experience" (MLE). MLE is said to occur when an individual is shown or taught cognitive methods for interpreting information, for solving problem, or/for learning something. This program, like Whimbey and Lochheads, is seen as a bridge between relatively content-free exercises and thinking in curriculum content domains.

The next two programs to be described here differ from those just mentioned in that they teach thinking in the context of generally familiar knowledge. Covington, Crutchfield, Davies, and Olten (1974) have published a program entitled, "The Productive Thinking Program: A Course in Learning to Think". Each lesson in the program is based on illustrated story which presents a challenging problem that students attempt to solve. The students are led through a problem-solving process and at appropriate points are required to state the problem in their own words, formulate questions, analyze information, generate new ideas, test hypotheses, and evaluate possible courses of action. These procedures are formulated as thinking guides that are presented throughout the various lessons and problem sets.

Another program developed is the CoRT thinking program by de Bono (1975) in England (CoRT stands for Cognitive Research Trust). The specific thinking strategies taught are like the meta-cognitive, Self-monitoring strategies that have been already mentioned. A number of features of the program make it both similar and dissimilar to the others described here. The contents of the program are topics of interest in every day life, such as deciding on a career, how to spend one holiday, moving to a new house, and changing to a new job. This program emphasizes skills that are not dependent on the prior acquisition of curriculum

subject matter. However, unlike Whimbey and Lochhead and Feurestein, the CoRT program keeps away from puzzles, games, and other such abstractions.

"Philosophy for Children a Program for Developing Thinking Developed by Lipman, Sharp, and Oscanyan (1979, 1980), aims at fostering thinking skills in the specific context of school curriculum. Lipman and colleagues attempt to help children learn to think philosophically. They reject the assumption that "the learning process is nothing more than the transmission of the contents of human knowledge from the old to the young". They adopt an alternative position that emphasizes the importance of thinking. They emphasize that philosophical thinking does not simply involve thinking and reasoning; it involves thinking about thinking. According to them, a discipline that stress formal inquiry might be considered in the very, beginning of a curriculum rather than later in the educational process. Towards this end the several parts of this program employ the procedures of philosophic logic and inquiry in the context of science, ethics, social studies, and language arts. The program designers believe that thinking is de-emphasized in education that gives either knowledge acquisition or problem solving techniques a primary status. Lipman states that the pragmatic nature of inquiry must be made apparent in the course of acquiring knowledge and skill.

Sternberg's (1986) approach to teaching thinking is based on his Triarchic Theory of Intelligence. The program "Intelligence Applied: Understanding and Increasing Intellectual Skills" is designed to help people improve their abilities to perform the processes assumed to underly intelligent behaviour. It is appropriate for students in secondary school and college and can be used as either a semester or a year long

course.

Sternberg's program is based upon several key instructional principles. First, one must teach for transfer, rather than by merely hoping it will occur. Second, the program, emphasizes motivating both students and teachers. Third, the program emphasizes training of metacomponents as well as performance components and knowledge acquisition components, as well as their application to novel and real world situations. Finally, the program has an entire chapter on emotional and motivational blocks to the use of one's intelligence. The program consists of two elements: a student's text, which contains narrative materials and exercises for students to complete, and a teacher's guide, which contains material teachers can use to maximize the effectiveness of the program.

Richard Paul et. al. (1989) of The Center for Critical Thinking and Moral Critique at Sonoma State University in Rohnert Park, California, have developed four handbooks for critical thinking which illustrating the remodelling of lesson plans for critical thinking instruction. The handbook explain critical thinking by translating general theory into specific teaching strategies. The multiple strategies allow "novice" critical thinkers to begin with elementary strategies, while more "advanced" critical thinkers can use more complex strategies. The four grade level handbooks can be used either as the basis for critical thinking staff development, or an independent resource for teachers. Starting from standard lessons and standard practice, the teacher sees what the weaknesses in standard lessons and how they may be remedied. The use of multiple strategies in the handbook addresses the need to integrate the cognitive and affective domains of thought, thus going beyond on skills alone.

The program is based on the assumption that if teachers can develop the art of critiquing lesson plans they use and learn how to use that critique as the basis for remodelling the lesson plans, they will progressively (a) refine and develop their own critical thinking skills and insights (b) reshape the actual or living curriculum, and (c) develop their teaching skills.

1.1.5 Assessment of Critical Thinking

Determining the quality of people's critical thinking requires gathering information on their thinking. Testing is one way of gathering this information, but there are others, such as non-manipulative observation of various sorts, interviews, and questionnaires. Several tests have been advanced that purport to measure critical thinking skills. These tests overlap to a large degree in the skills they measure. The most common critical thinking tests are in a multiple-choice format, which makes them easy to score by machine. One obvious advantage of machine-scorable tests is the economy achieved by their large scale use in testing. Some of the commonly used critical thinking tests are discussed below.

The Curry Test of Critical Thinking. The Curry Test of Critical Thinking (Curry, 1971), is a pencil and paper objective test designed to measure critical thinking ability. Norms were established on students from the Ninth through Twelfth grades. The five subtests are (a) Fact and Opinion, (b) False Authority, (c) Making an Assumption, (d) Inadequate data and (e) Improper Analogy. For total scores the estimated split-half reliability coefficient corrected by the Spearman-Brown formula was .72. That the 10 intercorrelations among the five subtests were not greater than .20 suggested that each subtest was relatively unreliable or that the subtests were measuring different critical thinking abilities. Curry (1971)

reported that her test did not discriminate against poorer readers and that vocabulary it used was geared to the range of normal reading abilities found in the Ninth through Twelfth grades.

The Cornell Critical Thinking Test (Ennis and Millman, 1985) is based on Ennis's conception of critical thinking, as briefly described earlier. The test is available in two levels, X and Z. Level X is appropriate for secondary School (Grade 7) and beyond. Level Z primarily for college students (and bright secondary school students). Level X has 71 questions and a time limit of 50 minutes. Level Z has 52 questions but the same time limit as Level X.

Level X contains four sections. The first section contains items asking for the bearing, if any, of information on a hypothesis. The hypothesis is in every case a general statement. Examinees must indicate whether a particular hypothesis is warranted by the data. The second section is concerned with measuring examinees ability to judge the reliability of information on the basis of its source and the conditions under which it is obtained. The third section measures students ability to judge whether a statement follows from its premises, and the fourth section involves identification of assumptions.

Level Z contains seven sections, measuring the examinee's ability to (a) indicate whether a statement follows from its premises, (b) detect equivocal arguments, (c) evaluate reliability of observations and authentically of sources, (d) judge the direction of support, if any, for a given hypothesis, (e) focus on choosing of useful predictions for hypothesis testing, (f) define terms, and (g) spot gaps in arguments.

Norms for both levels of the Cornell Critical Thinking Test are given

as percentile equivalents. Internal consistency reliabilities for various groups appear to center around 8 for Level X and around 7 for Level Z. Correlations with other tests are available. They seem to center around 5 for verbally oriented intelligence tests. The reported correlation with the Watson-Glaser, 48, is not higher than the correlation of the test with verbal IQ and scholastic aptitude measures. The correlation of the Cornell with the ACE Test of Critical Thinking, 44, is also no better than the correlation of the Cornell with the Watson-Glaser. These data are not auspicious in indicating a clear, differentiable construct of "critical thinking" apart from general verbal intelligence.

The Ennis-Weir Critical Thinking Essay Test. It was developed by Robert H. Ennis and Eric Weir (1985) is aimed at grades 7 through college. Also intended to be used as teaching material. Incorporates getting the point, seeing the reasons and assumptions, stating one's point, offering good reasons, seeing other possibilities, and responding to/avoid equivocation, irrelevance, circularity, reversal of an if-then relationship, overgeneralization, credibility problems, and the use of emotive language to persuade (Ennis, R.H. & Norris, S.P; 1990).

The Cornell Class - Reasoning Test, Form X (1964) by Robert H. Ennis, William L. Gardiner, Richard Morrow, Dieter Paulus, and Lucille Ringel at University of Illinois is aimed at grades 4-14). Consists of seventy-two items, each containing a premise asserting a class relationship, such as "No A's are B's". Each of twelve logical forms is tested by six items of varying types of content (Ennis, R.H. & Norris, S.P; 1990).

New Jersey Test of Reasoning Skills, Form B, developed by Virginia Shipman (1983) of the Educational Testing Service and promoted in conjunction with Lipman's Philosophy for Children program. The New

Jersey Test of Reasoning Skills is a 50-item inventory purporting to measure 22 different skill areas: converting statements, translating into logical form, inclusion/exclusion, recognizing improper questions, avoiding jumping to conclusions, analogical reasoning, detecting underlying assumptions, eliminating alternatives, inductive reasoning, reasoning with relationships, detecting ambiguities, discerning causal relationships, categorical syllogistic reasoning, distinguishing differences of kind and degree, recognizing transitive relationships, recognizing dubious authority, reasoning with four-possibilities matrices, contradicting statements, whole-part and part-whole reasoning, and conditional syllogistic reasoning. Like the other tests, this one is highly verbal. Its reliabilities are reported to be in the mid to high 80s, and it is reported to correlate at the .6 to .8 level with subtests of the New Jersey College Basic Skills Placement Test, which is a test of verbal and mathematical skills emphasizing achievement at least as much as aptitude. The fact that the New Jersey Test of Reasoning Skills correlates at the .8 level with the "Reading Comprehension" and "Sentence Sense" subtests of the placement test might be seen by some as slightly disturbing: all three of the tests described so far are highly verbally loaded, and one might well wonder, as to the extent that what they measure is separable from general verbal skills. Indeed, the little evidence accumulated so far does not indicate a clear separation at all, perhaps because a fairly high level of verbal comprehension is prerequisite for high scores on all of these tests.

The Triarchic Test of Intellectual Skills. This test is new, is currently available in two forms only from the author (Sternberg), and is not yet normed. The triarchic test is based on Sternberg's (1985) triarchic theory of intelligence and, hence, does not purport to separate critical thinking from intelligence. The test is appropriate for high school and

college levels. The 12 untimed subtests of the triarchic test are equally divided between verbal and nonverbal content and measure (a) metacomponential thinking skills (planning, monitoring, evaluating), (b) performance-componential skills (inferring relations, applying relations, mapping higher order relations between domains), (c) knowledge-acquisition componential skills (learning concepts in natural contexts), (d) ability to deal with novelty (distinguishing relevant from irrelevant information, combining relevant information in a logical way, bringing previously acquired knowledge to bear on the acquisition and understanding of new knowledge), (e) automatization of information processing (making conscious and controlled processing subconscious and automatized), and (f) adaptive flexibility (bringing the various kinds of skills described above to bear on everyday adaptation, as in route planning and evaluating inferential fallacies in everyday reasoning). No normative, reliability, or validity information are yet available (Sternberg, 1985).

Watson-Glaser Critical Thinking Appraisal (1994) Form S by Goodwin Watson and Edward M Glaser contain five subtests. The details are given in Chapter III: Description of Tools.

In addition to these published and readily available tests a few people have worked and published in the area of critical thinking testing. In particular Wordan, (1981) developed a critical thinking/critical reading appraisal for grades three through six. Barfield (1997) developed an instrument for assessing critical thinking skills of language-minority elementary school students. To assess critical thinking a qualitative instrument was developed by Clauson (1997) which incorporate an assessment processes based on Dewy's (1933) concepts of self-reflection

and critical thinking as problem solving. Claytor (1997) developed The Adult Medical Nursing Critical Thinking Instrument (AMNCTI) specifically to assess critical thinking skills in nurses. Mc Murray (1991) established the reliability and concurrent validity of a measure of critical thinking skills in biology. The 52 items in this test was selected from a readily available item pool developed for instructional purpose.

John Follman, of the University of South Florida, and associates published results of factor analyses of critical thinking tests with tests of achievement, scholastic aptitude, and logical reasoning (Follman, Hernandez, & Miller, 1969; Follman, Brown & Burg, 1970). They concluded that critical thinking is not a general ability but rather composite of general and specific factors, and that English Achievement correlated quite highly with critical thinking. W.B. Michael, of the University of Southern California, and associates have also been involved in factor analyses of critical thinking tests (Michael, Devaney, & Michael, 1980; Landis & Michael, 1981). In one of the studies Michael *et. al.* held that Guilford's structure of intellect model holds promise as an explanation of critical thinking components. Modjeski and Michael (1983) evaluated the manuals of the Cornell and Watson-Glaser test against the standards for educational and psychological tests. Watson-Glaser test was evaluated as a superior measuring device to the Cornell with respect to number of essential standards.

The two most widely used tests, the Watson-Glaser and the Cornell tests, are listed under recent publication dates, but the original versions are much older. The Watson-Glaser was developed in the late 1930s, and the Cornell in the late 1950s. These tests have been steadily, though modestly, used since development, with Watson-Glaser probably the most often used of the two.

To conclude, several tests are available for measuring critical thinking skills. The philosophically based ones are highly loaded verbally but measure reasoning in the verbal context rather than straight knowledge or fact comprehension. The distinguishability of their scores from verbal intelligence is marginal. The psychologically based test contains both verbal and nonverbal test items. This test makes no attempt to distinguish between critical thinking and intellectual skills. All of the tests provide means for assessing reasoning without heavy demands upon students' knowledge base (Sternberg, 1985).

1.2 Need/Significance of the Study

The recent developments in critical thinking theory and practice show that it is an area of educational concern that can no longer be ignored. Significant amount of work both theoretical and practical has been done on critical thinking abroad. Now there is a growing awareness among the educators that critical thinking is a desirable human trait which should be taught explicitly in our schools. Concerned scholars and educators particularly abroad have enhanced our conceptual understanding of critical thinking, proposed instructional practices to promote it, designed curriculum and instructional materials that emphasises it, and developed assessment techniques to measure it. Much works remains to be done by practitioners.

We know that the success of any innovations depends upon the context in which it is implemented. Introduction and transfer of successful innovation from one country to another, one society to another, and one institution to another depends upon multiplicity and variety of contextual factors. If we have to implement critical thinking instruction in our schools, we must have a thorough understanding of

the existing context. We must know where our schools stand so far as critical thinking is concerned, what psycho-contextual factors promote it, and what socio-demographic variables influence the development of critical thinking of the students. Having identified the kinds of skills students need to develop now in order to function well in the future, it is imperative that we evaluate the capabilities that our students currently possess. Similarly if teachers are to be charged with developing students' critical thinking skills, the first step is to look at the methods teachers currently use and to find out what they actually accomplish. And it is research which helps us in this direction.

If one knows, the current level of critical thinking that students possess, the methods that teachers currently use to develop it, the Psycho-contextual factors which promote it, and the socio-demographic variables which influence the development of it, in Indian situation, the process of developing critical thinking abilities in our students would be greatly improved.

In abroad a good deal of research had gone into the area of critical thinking. Intelligence as a correlate of critical thinking is studied by many researchers (Samuel, 1970; Handfield, 1980; Brabeck, 1981; Kehler, 1982; Rogers, 1992; Gambino, 1995). These studies concluded that the ability to think critically is significantly related to Intelligence. These studies were conducted on different samples and only one study (Kehler, 1982) was conducted on secondary schools. Hence, more studies need to be conducted on secondary school students particularly in India.

The relationship between critical thinkings and academic achievement was studied by several researchers (Samuel, 1970; Knite, 1980; Kwak, 1981; Kehler, 1982; Mayes, 1986; Alouf, 1989; Ircink,

1990, Sidney, 1989; Jordon, 1990; Johnson, 1990; Mc Garrity, 1990; Brown, 1991; Smith, 1996; Nathan, 1997). Except Samuel (1970), Johnson (1990), Mc Garrity (1990), and Nathan (1997), all others concluded that the critical thinking is positively correlated with academic achievement. The contradictory findings necessitate many more researches in this area at secondary level in particular.

Development of critical thinking is also studied in relation to various other variables such as age, gender, subjects taught, training, year of experience, and socio-economic status. No significant relationship between critical thinking and socio-economic status was reported by Handfield (1980), Johnson (1990), M Murithi (1998). Handfield (1980), Knight (1981), Kehler (1982), Sidney (1989), Ircink (1990), Smith (1990), Cargnel (1998) found no gender difference in critical thinking ability where as Goldberg (1991), Brown (1991), Foss (1995) M' Murithi (1998), found significant gender difference in critical thinking ability. Hence, more studies need to be conducted in Indian context to find out whether there is significant sex difference in critical thinking.

Use of innovative teaching strategies in Science and Mathematics classrooms resulted in significant improvement in critical thinking (Samuel, 1970; Mc Cune, 1990; Sidney, 1989; Smith, 1996). Similarly Fennly (1989), Jordan (1991), Commeyras (1992), Dickson (1992) and Hendrix (1995) found that programs aimed at developing critical thinking brought out corresponding improvement in language abilities. Teachers use of critical thinking strategies in relation to the years of experience was studied by Boikai (1990) and Kezar (1992) and their findings are somewhat contradictory. Therefore, more studies need to be conducted in Indian context to see if the teachers vary in the use of critical thinking

strategies in relation to the subjects they teach and the years of experience.

To the best of the knowledge of the researcher, only a limited number of studies (Pillai and Nayar, 1968; Nayar, 1969; Anju, 1989; Benny, 1990; Srikantaswamy, 1995; Coca, 1998; Sheeba, 1998) have so far been conducted in India. Thus Critical Thinking is one of the most neglected areas of research in our country. This necessitate more studies to be conducted by the researchers in India.

A significant positive correlation between critical thinking and achievement was found by Pillai & Nayar (1968), Nayar (1969), Benny (1990), Coca (1998), Sheeba (1998). Three of these studies were limited only to achievement in science and the remaining two studies (Coca, 1998; Sheeba, 1998) were conducted on B.Ed trainees and higher secondary students respectively. There are no studies conducted on secondary school students to find out the correlation between critical thinking and achievement in different school subjects as well as achievement as a whole. Nayar (1969) found a gender difference in critical thinking in favour of boys but no such difference was reported by other studies (Benny, 1990; Coca, 1998; Sheeba, 1998). Hence more studies need to be conducted to confirm the findings of sex difference in critical thinking. Coca, (1998) and Sheeba (1998) found no significant difference in critical thinking between rural and urban students. Similarly Nayar (1969) and Coca (1998), found no difference in critical thinking between the Government and private school students. Only two studies in each category may not be considered sufficient to arrive at valid conclusions regarding school difference (Management and location) in development of critical thinking.

Except one Ph.D study, all other Indian studies reported above are M.Ed or M.Phil dissertation, where the conclusions are not based on large scale representative sample. Moreover, there are no studies conducted so far to find out the possible influence of socio-economic status, home background and teachers experience on critical thinking. Hence there is a necessity to study critical thinking in relation to these variables.

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/teaching skills which contribute for the development of critical thinking in students. Therefore, studies need to be conducted to find out whether secondary school teachers use suitable teaching strategies for developing critical thinking in the students while teaching different subjects, and the use of critical thinking teaching strategies has any effect on the students level of critical thinking.

Considering the facts stated in the proceeding paragraphs it is necessary to study the development of critical thinking among the secondary school students in Indian context. Whether the school as a context (types of school) affects the development of critical thinking, whether there exists gender difference in critical thinking, whether academic background of a student in any way influences his/her critical thinking are some of the questions which need to be answered by the researchers. Also it is desirable to study whether home background of a child influences his/her critical thinking ability. Moreover, it is necessary to investigate whether the teachers of our secondary schools employ the teaching strategies in teaching different subjects, which positively contribute towards the development of critical thinking in students. The

answers to these and other related questions will go a long way not only in expanding knowledge in the field but also in helping teachers practitioners to take suitable measures for developing critical thinking in students.

1.3 Specification of the Problem

1.3.1. Objectives of the study

The present investigation was conducted:

1. to establish norms for critical thinking ability of the secondary school students in the state of Goa.

and to study the:

2. levels of critical thinking of the secondary school students.
3. correlation between critical thinking and intelligence eliminating the effect of socio-economic status;
4. correlation between critical thinking and socio-economic status eliminating the effect of Intelligence;
5. correlation between critical thinking and academic achievement in different school subjects eliminating the effect of intelligence;
6. variation, if any, in critical thinking between the students studying in rural and urban schools eliminating the effect of intelligence;
7. variation, if any, in critical thinking between the students studying

- in government and private schools eliminating the effect of intelligence;
8. variation, if any, between boys and girls in critical thinking eliminating the effect of intelligence;
 9. variation, if any, in critical thinking between the students coming from Nuclear and Joint family eliminating the effect of intelligence;
 10. Variation, if any, in critical thinking between Marathi speaking students and Konkani speaking students eliminating the effect of intelligence;
 11. Variation, if any, in critical thinking among Hindu, Muslim and Christian students eliminating the effect of Intelligence;
 12. extent to which the secondary school teachers make use of the various techniques/strategies for developing critical thinking in their students;
 13. variation, if any, in the use of critical thinking teaching strategies between Government and Private school teachers;
 14. variation, if any, in the use of critical thinking teaching strategies among Science, Social Studies and Language teachers;
 15. variation, if any, in the use of critical thinking teaching strategies among teachers who have teaching experience of 0-5 years, 10-20 years and above 25 years;

16. variation, if any, in the use of critical thinking teaching strategies between the teachers of high critical thinking (students) schools and low critical thinking (students) schools;
17. comparative homebackground of students having high and low levels of critical thinking.

1.3.2. Hypotheses of the Study

To realise the objectives stated above (except objective No. 1, 2, 12 and 17) the following hypotheses were tested.

1. There is no significant positive correlation between critical thinking appraisal score and intelligence test score eliminating the effect of socio-economic status score.
2. There is no significant positive correlation between critical thinking appraisal score and SES score eliminating the effect of intelligence test scores.
3. There is no significant positive correlation between critical thinking appraisal scores and academic achievement score in each of the school subjects, as well as academic achievement or as a whole eliminating the effect of intelligence test scores.
4. There is no significant difference between the mean critical thinking scores of rural and urban school students eliminating the effect of intelligence test scores.
5. There is no significant difference between mean critical thinking

scores of government and private school students eliminating the effect of intelligence test scores.

6. There is no significant difference between boys and girls in their mean critical thinking scores eliminating the effect of intelligence test scores.
7. There is no significant difference between the mean critical thinking scores of students coming from nuclear and joint families eliminating the effect of intelligence test scores.
8. There is no significant difference between mean critical thinking scores of Marathi speaking students and Konkani speaking students eliminating the effect of intelligence test scores.
9. There is no significant difference of mean critical thinking scores among Hindu, Christian and Muslim students eliminating the effect of intelligence test scores.
10. There is no significant difference between the mean critical thinking teaching strategy scores of Government and private school teachers.
11. There is no significant difference in mean critical thinking teaching strategy scores among Science, Social Studies and Language teachers.
12. There is no significant difference in mean critical thinking teaching strategy scores among teachers who have teaching experience of upto 5 years, 10-20 years and above 25 years.

13. There is no significant difference between mean critical thinking teaching strategy scores of the teachers of high critical thinking and low critical thinking (students) schools.

1.3.3. Operational Definition of Terms.

1. Critical Thinking:

Critical Thinking for the present study is conceptualized as the ability to reason dialectically or logically in synthesizing multiple frames of reference to resolve new problems. The critical thinking skills addressed in the present study include inference, recognition of assumptions, deduction, interpretation, and evaluation of arguments (Watson and Glaser, 1980).

Revised Watson-Glasor Critical Thinking Appraisal was used to measure critical thinking of students. Hence, critical thinking was operationally defined as the score obtained by an individual on the Watson-Glasor Critical Thinking Appraisal.

2. Intelligence:

Culture Fare Intelligence Scale by Cattell et al was used to measure the intelligence of the students. Hence, intelligence was operationally defined as the score obtained by individual student on the Cattell Culture Fare Intelligence Scale.

3. Academic Achievement:

The score obtained by the students in different subjects in the S.S.C. examination conducted by Goa Board of Secondary and Higher Secondary Education in March - 1998 was considered as their academic achievement.

4. Socio-economic Status:

The Socio-economic status is a blend of two statuses social and economic. Socio-economic status would therefore, be a ranking of an individual by the society he lives in, in terms of his material belongings and cultural possessions along with the degree of respect, power and influence he weilds in the society. In the present study the socio-economic status of the students was measured in terms of caste, education, occupation, monthly income, assets, position in the society and facilities available at home. The socio economic score of the students were the score obtained by taking the weightages assigned to various sub-categories under the seven variables mentioned above based on the scoring key/scheme developed/adapted by Pradhan and Behera (1997).

5. Contextual Variables:

In the present study, the students immediate setting (i.e., the school and the home) was considered.

(a) The School Context

i) Location: Rural and Urban School:

All the schools situated in rural areas (a rural area being so defined in the 1991 census report) are termed as rural schools in the study. On the other hand, the schools situated in urban areas (an urban area being so defined in the 1991 census report) are termed as urban schools.

ii) Management: Government and Private Schools:

The schools which are owned and managed by Government of Goa are the Government Schools and the schools which are owned and managed by the individual/voluntary agencies/Charitable trusts/ NGO's/ but financially supported by the government of Goa are

considered as private schools in the study.

iii) Teaching Strategies:

The specific teaching behaviour exhibited by the teachers in the classroom while teaching different subjects which are relevant for the development of critical thinking were considered as the teaching strategies.

B. Home Background

Home background of a student in the present study include the following:

- i) Parents education and occupation
 - ii) Economic status of the family
 - iii) Types of family and size of family
 - iv) Language (mother tongue)
 - v) Religion
 - vi) Facilities and practices in the home and surroundings.
- and vii) Parents child and/or significant elder-child interaction.

1.3.4. Scope and Delimitation of the Study

The scope of the study covers a wide range. It studied the critical thinking abilities of the secondary school students of the state of Goa during the academic year 1997-98 in relation to different variables like intelligence, academic achievement, home background, nature and location of schools and teaching strategies. However, due to time and budgetary constraints the study was delimited on different aspects as follows:

1. The study was restricted to only the students of standard Xth.
2. Only the state (Goa) Government schools and those private schools

which receive grants-in-aid from the Government of Goa were included.

3. Detailed Home background of only those students who were having high and low level of critical thinking was studied.
4. The study was restricted to only the non-verbal intelligence of the students.
5. Only the marks obtained by the students in different subjects in the standard Xth examinations held in March, 1998 were considered as their academic achievement.
6. Only 21 out of 35 dimensions of Critical Thinking were included in the Critical Thinking Teaching Behaviour Inventory.
7. Critical Thinking in the present study is restricted to drawing of inference, recognition of assumptions, deduction, interpretation and evaluation of arguments as measured by the Watson-Glaser Critical Thinking Appraisal (1994).

It may be mentioned here that the findings of the present study can be generalised to the schools that were included in the study in particular and to the other schools in the state of Goa in general. Moreover, the findings can also be generalised to the schools in other states of India provided the environment and the characteristics of the students are similar to the schools/students included in the present study.

CHAPTER II
REVIEW OF RELATED
RESEARCHES

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REVIEW OF RELATED RESEARCHES

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. Through out 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, Finnely (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 Mc Graw 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 Essay 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 out performed 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 counter parts. 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, accomodators, 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.

CHAPTER III
DESIGN OF THE STUDY

CHAPTER III

DESIGN OF THE STUDY

3.0 Introduction

A research design is a systematic organized plan to carry out a study in a particular area. It is the structural framework within which the study is conducted. It is the research design that specifies the research approach to be followed and the data gathering tools and techniques to be used for the study. It also specifies the procedure to be followed in collecting, tabulating and analyzing the data. It is a purposeful scheme of action proposed to be carried out in a sequence during the research process. "A research design is the arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy in procedure" (Selltiz, 1962, 50). The various aspects of the research design followed in the present study are explained under different heads in the following pages.

3.1 The Research Approach

The selection of a research approach and the specific design within that which is appropriate in investigating a research problem depends upon the nature of the problem and the kind of data that the problem entails. Keeping these in view, the researcher has followed "Descriptive-comparative survey method" in the present study.

3.2 Population and Selection of Sample

The target population for the study consisted of all the Class X students studying in different types of schools and their teachers in the academic year 1997-98 in the state of Goa.

The sample for the study was selected using stratified random sampling technique. First of all, the investigator obtained a list of Secondary Schools in the state from the Directorate of Education, Government of Goa, Panaji. Then on the basis of location (Rural/Urban) and management (Government/Private) the schools were classified into four categories as mentioned below:

- 1) Rural Government
- 2) Urban Government
- 3) Rural Private
- 4) Urban Private

Ten percent of schools from each of these categories were randomly selected. Altogether 27 schools were selected. The list of selected schools is given in Appendix A. The students of Class X studying in each of these schools thus selected, formed the invited sample (of students) for the study. However, in some schools having more than one Division/Section, only one Division/Section was selected randomly. The data producing sample of students consists of 918 students. The detailed breakup of sample of students is given in Table 3.2.1.

TABLE 3.2.1**Distribution of Sample of Students**

Management \ Location	Rural		Urban		Total
	Boys	Girls	Boys	Girls	
Government	60	71	57	52	240
Private	124	156	200	198	678
Total	184	227	257	250	918

However, it needs to be mentioned here that all the 918 students were not received all the data gathering tools. It happened due to absence of a few students during the administration of one test or the other. Hence, the number of students varied from one test to the other.

All the teachers working in these 27 schools formed the invited sample of teachers. The data producing sample of teachers consisted of 209 teachers. The detailed breakup of the sample of teachers is given in the Table 3.2.2.

TABLE 3.2.2**Distribution of Sample of Teachers**

Management \ Subject	Government	Private	Total
Science	17	63	80
Social Studies	10	54	64
Language	19	46	65
Total	46	163	209

3.3 Data Gathering Tools

The following tools were used for collecting the data for the study.

1. Culture Fair Intelligence Scale III (English) by Cattell et. al.
2. Watson-Glaser Critical Thinking Appraisal (WGCTA) Form-S developed by Watson and Glaser (1994)
3. Home Background Data Sheet (HBDS)
4. Critical Thinking Teaching Behaviour Inventory (CTTBI)
5. Information Schedule.

3.1.1 Watson-Glaser Critical Thinking Appraisal (WGCTA)

The Watson-Glaser Critical Thinking Appraisal (WGCTA) measure (Watson and Glaser, 1994) has been identified as a test that pioneered in the measurement of critical thinking. Originated in the late 1930's, the instrument, which has undergone several changes over 60 years of research and development, has culminated in the present form; WGCTA-Form-S.

The precursors of the WGCTA were developed by Goodwin Watson (1925) and Edward Glaser (1937). These tests were developed with careful consideration given to the theoretical concept of critical thinking, as well as to issues of practical applications. In 1964, Psychological Corporation, San Antonio, USA, published WGCTA Forms Ym and Zm; each contained 100 items and replaced an earlier version of the test, Form Am. In 1980, Forms Ym and Zm were modified in the interest of clarity, current word usage, and the elimination of racial and sexual stereotypes. The modified instruments, each containing 80 items, were published as Form A and Form B. Later in 1994, WGCTA Form-S, a

shortened version of WGCTA Form A was developed. Composed of 16 scenarios and 40 items selected from the 80 item Form A. Form S can be taken in 30 minutes; it takes an additional five to ten minutes to read the directions and answer questions. The test is suitable for individuals at the Grade IX level and above. It is in reusable booklet form i.e., separate test booklet and separate answer sheet. A copy of the tool is given in Appendix-B.

The WGCTA is consisted of five subtests. Detail description of each subtest is given in the following paragraphs.

Sub Test 1: Inference - Discriminating Among Degrees of Truth or Falsity of Inferences Drawn from Given Data:

In this sub test, each exercise begins with a statement of facts that one is to regard as true. After each statement of facts there are several possible inferences. One needs to examine each inference separately and make a decision as to its degree of truth or falsity. This could be done by deciding whether each inference is T (True), PT (Probably true), ID (Insufficient data), PF (Probably False), and F (False). For each inference, one has to make a mark on the answer sheet under the appropriate option that s(he) has selected. There are seven items in this subtest (Sl. No. 1-7).

Sub Test 2: Recognition of Assumptions - Recognising Unstated Assumptions or Presuppositions in Given Statements or Assertions:

In this subtest there are three statements. Each statement is followed by several proposed assumptions. The examinee is to decide for

each assumption whether a person, in making the given statement, is really making that assumption - that is, taking for granted, justifiably or not. There are two alternatives for each assumption: 1) "Assumption Made" (if the given assumption is taken for granted in the statement), 2) "Assumption not made" (if the assumption is not necessarily taken for granted in the statement). There are eight items in this subtest (Sl. No. 8-15).

Sub Test 3: Deduction - Determining Whether Certain Conclusions Necessarily Follow from Information in Given Statements or Premises:

In this test, each exercise consists of several statements (premises) followed by several suggested conclusions. The examinee is to study the conclusion beneath the statements and if (s)he thinks it necessarily follows from the statements given then (s)he has to select the alternative "Conclusion Follows". If (s)he thinks it is not a necessary conclusion from the statements given, then the alternative to be selected is "Conclusion does not follow". There are nine items in this subtest (Sl. No. 16-24).

Subtest 4: Interpretation - Weighing Evidence and Deciding if Generalizations or Conclusions Based on the Given Data are Warranted:

Each exercise in this subtest consists of short paragraph, followed by several suggested conclusions. For the purpose of this test, it is assumed that everything in the short paragraph is true. The examinee is to judge whether or not each of the proposed conclusions logically follows beyond a reasonable doubt from the information given in the paragraph. Thus there are two options: 1) "Conclusion Follows" (if the proposed conclusion follows beyond a reasonable doubt from the facts given). 2)

"Conclusion does not Follow" (if the proposed conclusion does not follow beyond a reasonable doubt from the facts given). The examinee has to select any one of the alternatives and indicate the same on the answer sheet. There are seven items in the sub-test (Sl. No. 25-31).

Sub-Test 5: Evaluation of Arguments - Distinguishing Between Arguments that are Strong and Relevant and Those that are Weak or Irrelevant to a Particular Question at Issue:

In this sub-test there is a series of questions. Each question is followed by several arguments. For the purpose of this test, these arguments are to be regarded, as true. The examinee is to decide whether it is a strong or weak arguments and select either of the two alternatives, viz. "Argument Strong" or "Argument Weak". There are nine items in this sub-test (Sl. No. 32-40)

Translation of WGCTA

The investigator translated the WGCTA into Marathi since rural schools students could understand Marathi better. The translation was done by a professional translator who was well experienced in the task and extremely competent in both the languages. The translated version was given to 3 experts for a critical evaluation and the suggestions given by them were incorporated into the final form. Validity of the translated version was established by administering both the English and Marathi Version to a group of randomly selected Standard Xth students who are equally competent in both the languages. A validity coefficient of .92 was obtained for a sample of 234 students. The test-retest reliability of the translated version of WGCTA was established by administering and re-

administering the tool on a sample of 80 standard X students from two schools. The time interval was one week. A 0.94 coefficient of stability was established with no significant difference between means and standard deviation across time.

3.3.2 Culture Fair Intelligence Scale III

The Culture Fair Intelligence Scale III by Cattell et. al. measures individual intelligence in a manner designed to reduce, as much as possible, the influence of verbal fluency, cultural climate, and educational level. The test can be administered individually or in a group. It is a non-verbal test. The scale III is suitable for individuals at the age level 13 and above.

It consists of four subtests. In the first subtest; Series, the individual is presented with an incomplete, progressive series. His/her task is to select from among the choices provided, the answer which best continues the series. There are 13 items in this and the time allotted is 3 minutes. The second subtest is Classification. Here, the individual is presented with five figures. His/her task is to correctly identify two figures which are in some way different from other three. There are 14 items and time allotted is 4 minutes. The third subtest is Matrices and the individual's task is to correctly complete the design or matrix presented to the left of each row. There are 13 items in this and the time allotted is 3 minutes. The fourth subtest, Conditions (or Topology), requires the individual to select, from the five choices provided, the one which duplicates the conditions given in the far left box. There are 10 items and the time allotted is 2 1/2 minutes. Altogether, there are 50 items in

this scale and the time allotted for completing the test is 12 1/2 minutes. At the beginning of each subtest, examples are given so that the task requirements are clear to the examinee. A copy of the scale is given in Appendix-C.

3.3.3 Critical Thinking Teaching Behaviour Inventory (CTTBI)

One of the objectives of the present investigation was to study the teaching strategies used by teachers of different subjects for developing critical thinking among students. Review of literature revealed that there is no tool available to identify specific teaching behaviour/skills which contribute for the development of critical thinking. Hence, the researcher had to develop an inventory for this purpose, based on the work of Richard Paul and others (1989) discussed in Chapter I. The procedure followed in developing the Critical Thinking Teaching Behaviour Inventory has been described in the following paragraphs.

Construction of "35 Dimensions of Critical Thinking - A Rating Scale"

Even though developing all the 35 dimensions of critical thinking (as discussed in Chapter I) in the children is ideal, constraints in terms of time, syllabus coverage, nature of curriculum, students' and teachers' potential, infrastructure facilities etc. exist in our schools which may act as hindrance in this direction. Keeping this in mind, it became necessary to identify from among the 35 dimensions, only those which can actually be developed among the secondary schools students in Goa. In order to realise this, the investigator prepared a rating scale (35 Dimensions of Critical Thinking - A Rating Scale, Appendix-D).

In order to give a clear perspective of each dimension/strategies of critical thinking to the persons who are rating, the investigator developed specific teacher behaviours for all the 35 dimensions/strategies of critical thinking. This draft was given to 3 experts, who had competence in the field and were familiar with centre's work (centre for Critical Thinking and Moral Critique, Sonoma State University, California). They were asked to critically analyse each teacher behaviour to see if it represents corresponding dimension/strategy of critical thinking. Based on the feedback received from the experts necessary changes were incorporated in the draft.

Under each dimension certain number of specific teacher behaviour ranging from 3-7 were identified and listed. The experts were expected to rate these dimensions taking the help of the specific teacher behaviours under each dimensions. Each dimension was required to be rated on a 5 point scale representing the extend to which the teacher would be able to develop these among secondary school students in Goa. The scale value 1 represents "Not at all", 2 represents "Hardly", 3 represents "To Some Extent", 4 represents "To a great Extent" and 5 represents "Very Much".

Selection of a Panel of Experts and Administration of the 35 Dimensions of Critical Thinking - A Rating Scale: In order to identify a panel of experts to rate the 35 Dimensions/Strategies of critical thinking, the investigator made a list of all the Head Teachers of secondary schools, Teacher Educators and Principals of Higher Secondary Schools in Goa. This list was given to five senior most Head Teachers/Principals who had

a fairly good knowledge about all the Head Teachers/Principals in the state. They were asked to select sixty head teachers whom they thought were highly dedicated, competent, and known for their academic excellence. An analysis of the responses of these five persons revealed that they had very good agreement of the persons whom they have chosen for the purpose. Based on this the investigator prepared a list of sixty Head Teachers/Principals. He also selected another twenty persons from a list of Teacher Educators and other eminent educationists in the state who were retired or in service. The investigator made sure that all the panelists were (1) familiar with the secondary school syllabus of Goa (2) familiar with the various school practices and (3) had experience in teaching at secondary school level in Goa.

35 Dimensions of Critical Thinking - a Rating Scale was send to the eighty experts selected for the purpose requesting them to rate the same and return to the investigator in the enclosed self addressed stamped envelop. In spite of the best effort only thirty seven rating scales were received back. The ratings given by the experts were tabulated by taking the rating for each dimension horizontally and the name of the experts vertically. The mean value for each dimension was calculated. Since this was a five point scale, the dimensions which had the mean value 3.5 and above were retained, the remaining dimensions were rejected. Altogether 21 dimensions of critical thinking were selected for inclusion in the Critical Thinking Teaching Behaviour Inventory.

Construction of the Critical Thinking Behaviour Inventory (CTTBI)

Now, in order to find out the extent to which the secondary school

teachers are using these dimensions/strategies to develop critical thinking among secondary school students, a Critical Thinking Teaching Behaviour Inventory (CTTBI) was prepared. For this purpose only the specific teacher behaviours under each dimensions/strategies of critical thinking were used and the twenty one dimensions were not made known to the teachers in the inventory.

There are 106 specific teacher behaviour (items) representing all the 21 different dimensions/strategies of critical thinking. The 21 dimensions of critical thinking and the number of teacher behaviours under each of these dimensions are given in Table 3.3.1.

TABLE 3.3.1**21 Dimensions/Strategies of Critical Thinking with the Number of Teacher**

Behaviours		
Sl. No.	Dimensions of Critical Thinking	
Sl. No.	No. of teacher behaviour (Items)	
1.	Thinking Independently	6
2.	Exercising Fairmindedness	7
3.	Developing Intellectual Humility and Suspending Judgements	5
4.	Developing Intellectual Perseverance	5
5.	Developing Confidence in Reason	8
6.	Comparing Analogous Situations: Transferring Insights to New Context.	4
7.	Developing One's Perspective: Creating or Exploring Beliefs, Arguments or Theories	5
8.	Clarifying Issues, Conclusions or Beliefs	6
9.	Clarifying and Analysing the Meanings of Words or Phrases	7
10.	Evaluating the Credibility of Sources of Information	4
11.	Questioning Deeply: Raising and Pursuing Root or Significant Questions	6
12.	Generating and Assessing Solutions	7
13.	Reading Critically: Clarifying or Critiquing Texts	5
14.	Listening Critically: The Art of Silent Dialogue	4
15.	Making Interdisciplinary Connections	3
16.	Practicing Socratic Discussions: Clarifying and Questioning Beliefs, Theories or Perspectives.	4
17.	Noting Significant Similarities and Differences	4
18.	Distinguishing Relevant from Irrelevant Facts	5
19.	Making Plausible Inferences, Predictions, or Interpretations	4
20.	Evaluating Evidences and Alleged Facts	3
21.	Exploring Implications and Consequences	4
Total:		106

Each teacher behaviours was to be rated on a 5 point scale representing the extent to which the teachers are able to incorporate these teaching behaviours. The scale values are given below:

Description	Rating point
Not at all	1
Hardly	2
Sometimes	3
Often	4
Very often	5

Scoring Procedure of CTTBI: Depending upon the purpose of a researcher, the scoring of CTTBI could be done in two ways. Firstly, the total score for each dimension could be calculated. Secondly, the total score for entire inventory could be calculated. Since each item was rated on a five point scale the number selected by a person to a particular item is considered as his/her score for that item. The dimension score can be calculated by finding the mean score of all the items under each of the dimensions separately. The mean score of all the items together in the inventory gives the inventory score for a person. A copy of the final form of CTTBI is given in Appendix - E.

Validity and Reliability of the CTTBI

The CTTBI has validity as evident from the manner in which it was constructed. The test-retest reliability of the inventory was established by administering and re-administering on a randomly selected groups of 40 teachers from 7 secondary schools. The time interval was one week. A 0.85 coefficient of stability was established with a mean and standard

deviation almost identical across time.

3.3.4 Home Background Data Sheet (HBDS)

As there was no readymade Home Background Data Sheet available for use in the present study, the researcher himself developed and standardized a Home Background Data Sheet. The details of procedures followed in constructing and standardizing the same has been discussed below.

First of all the researcher went through the literature on critical thinking in order to identify different aspects at home that would influence development of critical thinking. Secondly, he made an analysis of available Socio Economic Status (SES) scales and other questionnaires meant for collecting information regarding the family background. Thirdly, the investigator discussed with some of the experts in the field. Thus, before the actual process of starting the construction of the HBDS, the investigator did his best to get a clear cut idea on the different aspects of Home Background Data Sheet that needed the attention of the investigator. It was decided to include the following aspects in the data sheet.

1. General Information
2. Details of family members
3. Facilities available at home
4. Practices at home
5. Facilities and practices in the home surroundings
6. Additional information on any of the above.

On the basis of the above aspects a matrix (Table 3.3.2) was prepared to serve as the basis for framing the questions/items of the HBDS. The questions/items were developed from the matrix.

TABLE 3.3.2.**Matrix Showing Different Aspects for Preparing HBDS**

Sr.No.	Aspects	Sub-Aspects	Specifications
1.	General Information		Name of the student, Name of the school, class and Division, Age, Gender, Religion, Caste, state, mother tongue, location (Rural/ Urban), languages known, Type of family (Nuclear Joint).
2.	Details of family members	Father	Age, Qualification, Occupation, Salary/income, Total Assets. Position on the community
		Mother	-do-
		Brother	-do-
		Sister	-do-
		Other members staying in the family	-do-
3.	Facilities at home	T.V.	Programs viewed, Discussions of programs
		Radio	Programs listened, discussions of programs
		Tape recorder	types of cassette listened, different uses
		Telephone	different uses
		Computer	different uses
		Newspaper	Names of news paper, types of news read, discussions of it.
		Magazines	Name, type of articles read, discussions, and aspects of discussion
		Books (home library)	types of book, degree of use
		Any other facilities	facilities other than the one mentioned above
4.	Practices at home	Help to family members and community	Brother, Sister, Father, Mother, Community, Nature of help, and how often

	Help from family members	Father, Mother, Brother, Sisters, Nature of help and how often
	Activities after school hours and on holidays	Study, Discussion, Entertainment, Sports and Games, Household Work Computer Class, Tution, Dance Class, Reading, Playing, Religious Classes and any other. Involvement and approximate time spend on these.
	Festivals celebrated	Name, participation and nature of participation.
	Casual discussions in the family	matters discussed and nature of participation
	Family atmosphere	Freedom of expression, importance given to the ideas, encouragement for questioning various practices with whom most free and least free of discuss the problem, satisfying the needs by parents, obeying every orders.
	Visit to neighbours and relatives	How often, the activities done during such visits
5.	Facilities and practices in home surroundings	Library Frequency of visit, types of books available, Nature of selection and reading Clubs nature and functions of the club, membership, role and activities Any other facilities Mention the facilities available other than the ones mentioned above Activities organised in the community Literary programs, cultural programs, health camp community survey, film show, talk by experts, developmental activities, environment building activities and any other organized, participated, role played
6.	Any Additional Information	- Additional information on any of the matters discussed in the data Sheet.

A separate card was used for each items. This was done keeping in mind the fact that the items could be re-framed, revised or replaced by better item(s) without recopying the entire instrument. This procedure also provides flexibility in arranging items in the most appropriate order before the HBDS is put into its final form.

There were two types of items in the HBDS, viz; restricted or closed response type and open-ended response type. Again within the closed/restricted responses types, three types of items were included viz; Short response/supply type where the respondent is required to supply the required data/information called forth by the item(s); alternative response type (Yes/No); and multiple choice items having 3 options. The open-ended response items were included for obtaining greater depth of response, wherever required.

The first draft of the HBDS was sent to a panel of experts for critical examination and comments to improve it. They were requested to point out the inaccuracies, inconsistencies and suggest alternative items/new items wherever required. Then based on the feedback received, the items were revised/modified. Also some items were dropped and some new items were added. Then the HBDS was printed for administration in a pilot test (try out).

The questionnaire was administered for a group of 50 standard Xth students. The investigator visited the schools and personally administered it. The main purpose of the pilot test was not to collect data but to get an insight into the various difficulties faced by the subjects

while completing the data sheet. The investigator also discussed at length about each items with the students to find out if they had any difficulty in understanding the items and giving the response. Some items were revised on the basis of the feedback received. Now the questionnaire was ready for administration.

Validity and Reliability of the Data Sheet: The Data Sheet had validity as evident from the manner in which it was developed. The test-retest reliability of the data sheet was established by administering and re-administering on a randomly selected group of 120 students of class X from 5 secondary schools. The time interval was one week, considering the nature of the instruments, the usual procedure of reliability coefficient was not calculated in this case. The procedure followed was as follows:

- The response of each individual subject on each item/sub item on both the occasions (test-retest) was compared.
- The percentage of consistency of response of each subject on the data sheet (responses to all the items and sub-items together) was calculated.

It was found that the percentage of consistency ranged from 90 to 96 percent. It indicated that the stability of the data sheet was very high. A specimen copy of the final form of the data sheet is given in the Appendix - F.

Scoring of HBDS: The data collected using the HBDS were scored/coded in two ways: one is for the qualitative analysis by employing (a) frequency and percentage analysis (b) content analysis. The second is for the quantitative analysis by finding out the Socio-Economic Status (SES) score. The details are explained in the following paragraphs.

The socio-economic status of the students was measured in terms of the seven variables, viz. caste, education, occupation, monthly income, assets, position in the society and facilities available at home. (The weightages assigned to various subcategories under the seven variables are based on the scoring key/Scheme developed/adapted by Pradhan and Behera (1997).

Subjects were classified into different categories based on their caste, education, income and assets of parents. The weightages given to various categories/level under caste, education, income and assets are given in Table 3.3.3.

TABLE 3.3.3.
Weightages Given to the Items (Education, Income, Assets & Caste)
in the Socio-economic Scale.

Sl. No	Education	Weightage	Income	Weightage	Caste	Weightage	Assets	Weightage
1.	D.Lit/Ph.D/M.D/M.S M.E.	9	Above 12,000	8	High Caste	4	Above 10 Lakhs	8
2.	Masters Degree	7	between 8000- 12,000	7	Other backward community	2	5 - 10 Lakhs	7
3.	M.B.B.S./B.E/L.L.B.	6	between 4000- 8000	6	Scheduled caste/sche-duled Tribe	1	2 - 5 Lakhs	5
4.	B.A/B.Sc/B.Com/+3	5	between 1500- 4000	5			50,000 - 2 Lakh	4
5.	Plus Two	4	between 500- 1500	3			20,000 - 50,000	2
6.	Std. IX and X	3	less than 500	1			Below 20,000	1
7.	Std. V - VIII	2	Not at all	0			Not at all	0
8.	Upto Std. IV	1						
9.	Illiterate	0						

Students were also classified on the basis of position of their parents in the community. The available facilities were also taken into the consideration in scoring. The weightage given to various categories under position in the community and facilities available are given in Table 3.3.4.

TABLE 3.3.4
Weightages Given to the Items (Facilities & Positions) in the Socio-economic Scale.

Facilities	Weightage	Position	Weightage
TV/VCP	2	Chairperson/MLA/MP etc.	3
Radio	1	Party worker/office bearer of some organisation/ association	2
Tape-recorder	2	Members of Various Organisation/association	1
Telephone	2	No position	0
Computer	3		
Newspaper	1		
Magazine	1		

People were classified into different categories based on their occupation. Various Occupations and the weightage given to each is given in Appendix-H.

3.3.5. Information Schedule

The academic achievement of the pupil was measured by means of the composite scores of languages, social studies, Maths and Science,

based on the Class X results in the annual examinations conducted by Goa Board of Secondary and Higher Secondary Education. These were deemed to be quite a satisfactory and acceptable index of pupil's academic achievement in view of the said examination being common and uniform to all pupils and having been simultaneously conducted on them. The scores of the students were collected from the school office record using the information schedule developed by the researcher. A copy of the information schedule is given in Appendix-G.

3.4 Rationale for Using the Tools

The rationale for using the standardized tool (WGCTA and Cattell's Culture Fair Intelligence Scale III) is explained in the following pages.

Rationale for using WGCTA: This is one of the most widely used test. This instrument is widely cited as a very useful research tool in critical thinking, in journal articles, doctoral dissertations and research reports (Pillai & Nayar, 1968; Nayar, 1969; Robert, 1970; Samuel, 1970; Nolan, 1970; Junes, 1980; Handfield, 1980; Kehler, 1982; Hoehn, 1982; Norton, 1986; Mayes, 1986; Danielson, 1986; Fennelly, 1989; Ircink, 1990; Rogers, 1991; Bitner, 1991; Susan, 1992; West, 1994; Gambino, 1995; Clocklin, 1996; Pyzdrowsk, 1997; Rose, 1997; Nathan, 1997; Mc Donough, 1998; Coca, 1998; Sheeba, 1998; Cargnel, 1998).

The various forms of the WGCTA have been independently evaluated by a number of authors. For reviews of the test, see Hovland (1959), Hill (1959), Crites (1972), Helmstadter (1985) and Berger (1985). Theoretical discussion of critical thinking ability and the WGCTA can be

found in Sternberg (1985), Sternberg and Baron (1985), Norris (1988, 1989), Fulton (1989), Ennis and Norris (1990), Paul and Nosich (1991). Finally, psychometric evaluation of the WGCTA are presented in Follman, Miller and Hernandez (1969), Follman, Brown and Burg (1970), Wilson and Wagner (1981), Landis and Michael (1981), Modjeski and Michael (1983).

A careful and specific verbal definition of critical thinking has been formulated for the test. The investigator is in agreement with the authors definition of critical thinking and the way in which the test items operationalise the construct. The test includes problems, statements, arguments and interpretation of data similar to those that are encountered on daily basis at work, in the classroom, and in newspaper and magazine articles. The items are subjected to appropriate psychometric criteria before inclusion in the test. A wide variety of reliability indexes are computed using different groups and different methods for assessing this characteristic of the test.

To determine reliability, estimates were made of the tests internal consistency. For the development sample (N=1608), Cronbach's alpha Coefficient (γ alpha, Cronbach, 1970) was 0.81. γ alpha values for other number of groups ranged between 0.66 and 0.83. In addition a 0.81 coefficient of stability (test-retest reliability) was established with a mean and standard deviation almost identical across time. To support the equivalence of Form S and Form A part - whole correlation was calculated. The resulting coefficient (γ pm) for a number of groups ranged

between 0.89 and 0.97. The alternate form reliability coefficient of 0.75 was established earlier for Form A and B (Watson and Glaser, 1980).

Both content and construct validities were established based on various instructional programs. Content validity was determined by how well the WGCTA measured specified objectives of critical thinking program as defined by Watson and Glaser. Construct validity was based on increases in WGCTA scores after experiencing instructional approaches such as laboratory centered biology classes (Sorenson, 1966) and data centered experimental earth science classes Agne and Blick (1972), strategies deemed to develop critical thinking abilities.

Easy administration - individually or in groups - and scoring, demonstrated reliability and validity, and easily interpretable results make WGCTA an ideal instrument for conducting research on critical thinking. Moreover, the person administering the test does not require any special training. The time required for administering is approximately one hour (including the time for distribution and collection of test booklet and answer sheet, and giving directions) making it well suited for administration during two classroom period in a school. Allen Berger in his review of WGCTA states that "Nonetheless, even with these cautions and limitations this reviewer knows of no similar test that is on a par with the Watson-Glaser Critical Thinking Appraisal" (Berger, 1985).

Rational for using Culture Fair Intelligence Scale - III: This is a psychometrically sound instrument, developed upon a comprehensive theoretical foundation, with maximum possible validity and reliability.

The irrelevant influences of cultural learning, social climate and verbal fluency is reduced to the minimum while preserving the predictive utility of the test across a broad spectrum of concrete behaviours. The test also provides high administrative and scoring convenience and maximum economy of testing time.

Reliability requires that a test be consistent. Since no single index of consistency is likely to satisfy all possible uses to which the test will be put, three separate methods of evaluation are given. The first method evaluates consistency in item content, while the second evaluates consistency across the two parts. The third method evaluates consistency in test scores over time. All coefficients are quite high and have been evaluated across large and widely diverse samples.

The internal consistency of the items, calculated by a variety of methods including split-half and appropriate internal consistency formula was 0.87 for full test (Form A + B) and 0.76 for short form (Form A) for a sample of 3999 Males and Females. Alternate form reliability coefficient for a sample of 832 males and females was 0.80 for full test and 0.67 for short form. In addition 0.84 and 0.73 coefficient of stability were established on a group of school students (N-650) for full test and short form respectively.

Both concept and concrete validities were established. The concept validity was established by finding how well the test measures the pure intelligence factor which it was designed to measure. The direct correlation with the pure intelligence factor, for a sample of 702 school

students were 0.92 and 0.85 for full test and short form respectively. The concrete validity was established by finding the correlation with other general intelligence tests. 0.69 and 0.66 correlation coefficients were established on a group of students and adults (No. 673) for full test and short form respectively. The instrument also correlates with standard measures of scholastic achievement, critical thinking, job-performance and behaviour ratings.

Cross-Cultural Stability of the test was established in many studies. Of particular importance are such researches as those by: (a) Rodd (1958), who found almost no difference between mean of Chinese students and a control group of comparably aged American Students; (b) Cattell (1951), who found no statistically significant differences in means when complete, cross sectional samples of the 10 year old population of a large metropolitan city were tested over a 13 years time span; and (c) investigators such as Mac Arthur and Elley (1963) and Weiss (1971), who have demonstrated the construct validity of the test in non-English speaking populations.

In summary, it is evident that the Culture Fair Scale show up well under psychometric scrutiny. The various consistency and validity coefficients that have been presented here are based upon representative samples and are very significant. In addition there is a strong evidence for cross-cultural stability too. The test is easy to administer and added to this is easy scoring and use/application. The time required for administering is only 25 to 30 minutes making it well suited for administering during one classroom period in a school. Moreover, this

scale is widely used by researchers in many countries. A specimen copy of the scale is given in Appendix.

3.5. Data Collection Procedures

After selecting the sample of schools, the researcher visited the schools and personally met the Head-Teachers to seek their permission and cooperation for conducting the study. After they agreed to extent their co-operation and provide all facilities required for collection of data, the date and time for the purpose was fixed in each school. Then the investigator visited the schools as per the schedule and collected the data. The data were collected in three phases in each school as discussed in the following paragraphs.

Phase I: Collection of data from students: In this phase, all three data gathering tools viz: WGCTA, the Culture Fare Intelligence Scale III and HBDS were administered on the students. On the first day the WGCTA and HBDS were used. Before the test administration the researcher explained to the students, in the presence of class teacher the purpose of his visit and his expectation from them. First two periods were used for administering WGCTA. In the beginning the students were given the WGCTA answer sheet and were asked to furnish certain information about them in the answer sheet. Then the test booklets were distributed with all the necessary directions for taking the test. After a period of one hour the students were asked to return the answer sheet along with the test booklet. In the fourth period after a gap of one period, the Home Background Data Sheets (HBDS) were distributed. Though the details to be furnished were self explanatory, the investigator read all the details

Education. Using the information schedule, the scores (marks) obtained by the students were collected from the official records.

3.6. Scoring and Tabulation of Data

On completion of data collection, the data sheets were filed school wise. Each file consists of WGCTA answer sheet, intelligence test answer sheets, Home Background Data Sheets (HBDS), Critical Thinking Teaching Behaviour Inventory (TCTTBI) and the academic achievement record.

Scoring of WGCTA was taken up first. The scoring key developed by the authors was used. At first the investigator crossed-out multiple responses to the same item with a heavy red mark that showed through the holes in the stencil (Key). Then checked for any answer space that were not completely erased by the examinee in changing an answer and the same were completely erased by the investigator himself. Next, placed the scoring key (stencil) over the answer sheet and counted the number of correctly marked spaces appearing through the holes in the stencil. The sum total of this was recorded on the answer sheet in the appropriate space provided for the purpose. As there were 40 items in total and each correct response was given one point, the maximum raw score one student could get is 40. Then the scores were tabulated keeping in mind the objectives and hypothesis of the study.

In scoring Culture Fare Intelligence Scale III, the scoring key developed by the authors was used. At first the investigator crossed-out multiple responses to the same item with a heavy red mark that showed

through the holes in the stencil. Then placed the scoring key (stencil) over the answer sheet and counted the number of correctly marked spaces appearing through the holes of the stencil. A credit of one point was given for each correctly responded item. Since altogether there were 50 items the maximum possible score was 50. The scores of the pupils were recorded in the total score space given in the answer sheet. The score was tabulated keeping in mind the objectives and the hypothesis of the study.

Before, scoring the Critical Thinking Teaching Behaviour Inventory, the investigator checked each inventory to know whether all the items were answered by the teacher. Five incomplete inventories were excluded from the study. Since each item was rated on a five points scale, the number selected by a teacher for a particular item was considered as his/her score for that item. The sum total of score on all the items under each of the 21 dimensions were obtained. Sum of scores for all the 21 Dimensions was the score of a teacher on the CTTBI as a whole. Then the score obtained by the teachers on all the 21 dimensions were transferred from the inventory to a table prepared for the purpose by taking the 21 dimensions vertically and the name of the teachers horizontally. For the purpose of analysis, dimension means, teacher means and school means were calculated from this table. In order to find out the mean value of each dimensions for a school the total score obtained by all the teachers on a particular dimension was divided by the product of number of teachers and number items under each dimensions. The teacher mean score on the inventory was calculated by dividing the total score on all 21 dimensions by the total number of items in the inventory (106). The

school mean score was obtained by finding out the mean of the mean scores of all the teachers in a particular school.

For scoring HBDS the investigator selected only those data sheets for which the students have supplied information of all the six variables, viz. caste, education, occupation, monthly income, position in the society and facilities available at home. The socio-economic status of the students is measured in terms of these six variables. The investigator scored each of the six status areas separately for each subject by giving the corresponding score to the entries made by the students using the scoring scheme given in Section 3.3.4 The total score (SES score) was entered in each inventory by totaling the scores obtained for each of the six variables. Then the scores of the students were tabulated for analysis.

3.7. Statistical Techniques/Procedures/Methods:

Data were analyzed using the following statistical methods/techniques.

1. Pearson product moment method of correlation(s) and partial correlation.
2. t - test
3. Analyses of Variance (ANOVA)
4. Analyses of Covariance (ANCOVA)
5. Frequency and percentage analysis.
6. Content Analysis.

CHAPTER IV
PRESENTATION AND ANALYSIS
OF DATA, INTERPRETATION
OF RESULTS AND DISCUSSIONS

CHAPTER IV

PRESENTATION AND ANALYSIS OF DATA, INTERPRETATION OF RESULTS AND DISCUSSION

4.0 Introduction

In this chapter, first of all, the tabulated data of critical thinking appraisal scores and intelligence test scores of the students are presented. The Skewness and Kurtosis of the distribution of test scores were found out. The distribution of test scores were represented in the form of Histograms and the best fitting normal curve was superimposed on it. The ordinates (Y) of the normal curve at different points were calculated using the formula:

$$Y = \left(\frac{uN}{\sigma} \right) f(x) \text{ where}$$

u = range of the class intervals

N = Number of subjects

σ = SD of the distribution

$f(x)$ = normal function of the ordinates at different
z units

The normality of distribution in each case was also tested using X^2 by finding the departure from the expected frequency in normal distribution.

Followed by this, presentation and analysis of data, interpretation of results and discussions are made. The researcher adopted both .05 and .01 level of significance to test significance of the obtained results. The researcher analyzed the data in the computer using the SPSS_PC+ Package.

4.1 Graphical Representation of Data

4.1.1 Critical Thinking Test Scores

TABLE 4.1.1

Frequency Distribution of Critical Thinking Test Scores

Score	Frequency		
34 - 37	1		
30 - 33	2	Mean	= 18.48
26 - 29	26	Median	= 18.00
22 - 25	149	S.D.	= 3.83
18 - 21	358	Skewness	= - .040
14 - 17	272	Kurtosis	= .632
10 - 13	64		
6 - 9	11		
2 - 5	1		
Total	884		

The tabulated data of critical thinking test scores of the students are presented in Table 4.1.1 is represented in Fig. 4.1.1 and the best fitting normal curve is superimposed on it after calculating the coordinates (Y) of the normal curve at different points presented in Table 4.1.2

TABLE 4.1.2
Ordinates of the Normal Curve in Fig 4.1.1

Standard Score	Normal Function	Adjusted Ordinate
Z	f(x)	Y
3.0	0.00443	4.09
+ 2.5	0.01753	16.18
+ 2.0	0.05399	49.85
+ 1.5	0.12952	119.58
+ 1.0	0.24197	223.4
+ 0.5	0.35207	325.04
0.0	0.39894	368.31
- 0.5	0.35207	325.04
- 1.0	0.24197	223.4
- 1.5	0.12952	119.58
- 2.0	0.05399	49.85
- 2.5	0.01753	16.18
- 3.0	0.00443	4.09

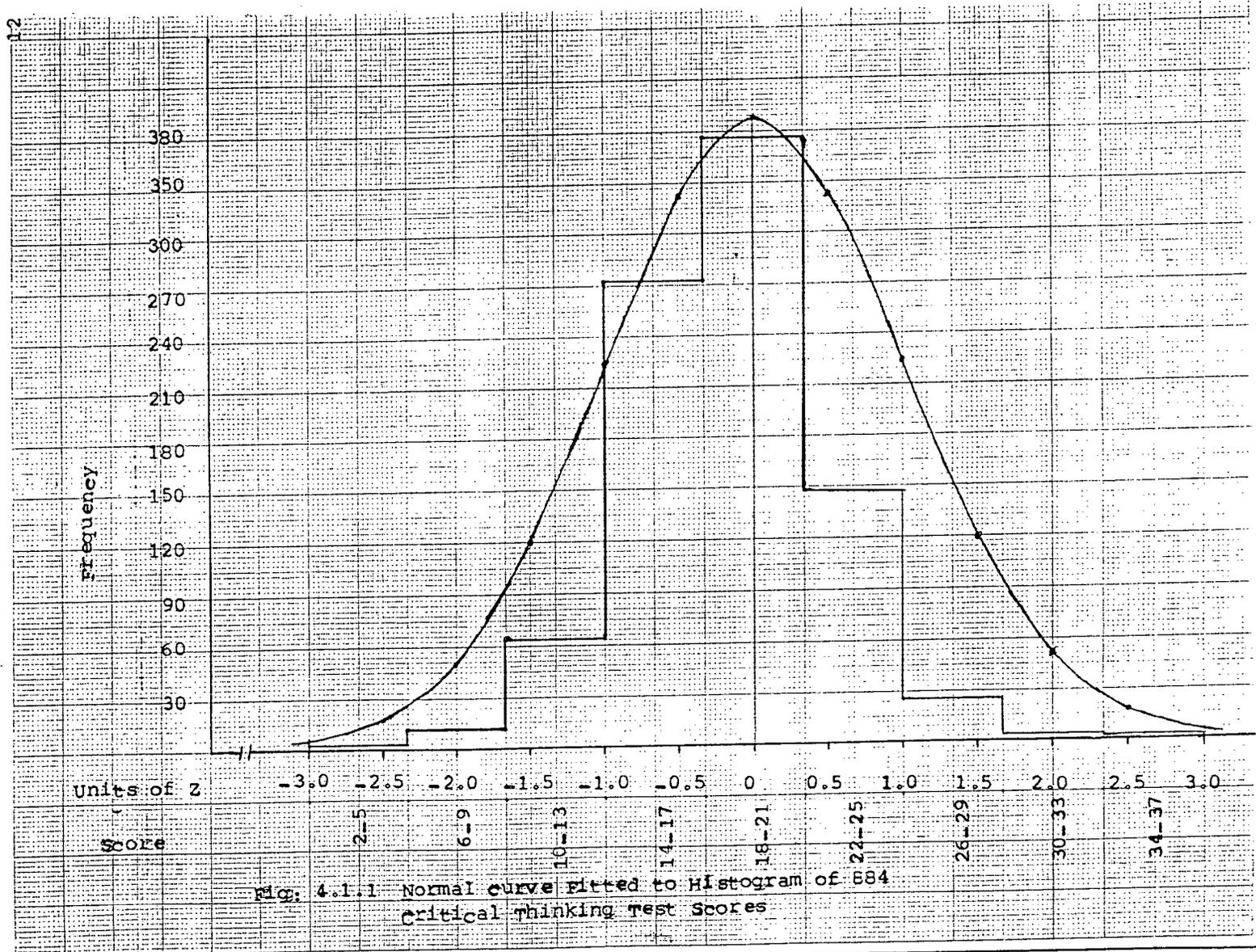


Fig. 4.1.1 Normal curve Fitted to Histogram of 684 critical thinking test scores

4.1.2 Intelligence Test Scores

TABLE 4.1.3

Frequency Distribution of Intelligence Test Scores

Class Interval	Frequency		
29 - 32	5		
25 - 28	40		
21 - 24	103	Mean	= 15.34
17 - 20	204	Median	= 15.00
13 - 16	252	S.D	= 5.20
9 - 12	188	Skewness	= 0.235
5 - 8	83	Kurtosis	= -.281
1 - 4	6		
Total	881		

The tabulated data of intelligence test scores of the students are presented in Table 4.1.3 is presented in Fig. 4.1.2 and the best fitting normal curve is superimposed on it after calculating the coordinates (Y) of the normal curve at different points presented in Table 4.1.4

TABLE 4.1.4
Ordinates of the Normal Curve in Fig 4.1.2

Standard Score	Normal Function	Adjusted Ordinate
Z	f(x)	Y
+ 3.0	0.00443	3.00
+ 2.5	0.01753	11.88
+ 2.0	0.05399	36.59
+ 1.5	0.12952	87.78
+ 1.0	0.24197	163.98
+ 0.5	0.35207	238.59
0.0	0.39894	270.36
- 0.5	0.35207	238.59
- 1.0	0.24197	163.98
- 1.5	0.12952	87.78
- 2.0	0.05399	36.59
- 2.5	0.01753	11.88
- 3.0	0.00443	3.00

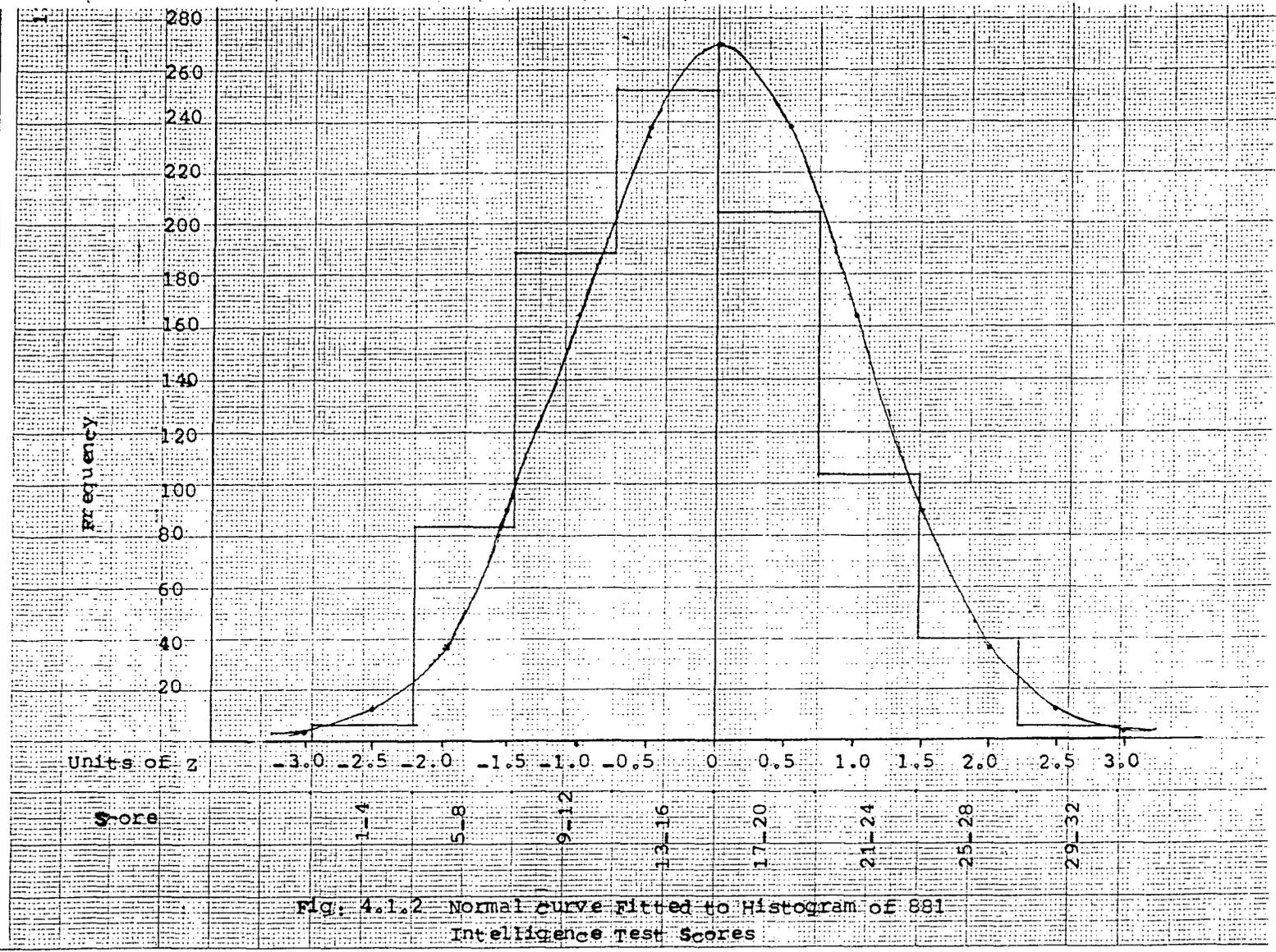


Fig. 4.1.2 Normal curve Fitted to Histogram of 881 Intelligence Test Scores

4.2 Tests for Normality of Distribution of Test Scores

4.2.1 Critical Thinking Test Scores

The X^2 test of normality of the distribution of critical thinking test scores of 884 students in Table 4.1.1 is computed in Table 4.2.1

TABLE 4.2.1
Chi-square Test of Normality of Distribution of Critical
Thinking Test Scores

Score	Observed (fo)	Normal (ft)	$\frac{(fo - ft)^2}{ft}$
30 and above	3	1.85	0.71
26 - 29	26	27.66	0.09
22 - 25	149	160.80	0.87
18 - 21	358	340.51	0.89
14 - 17	272	267.59	0.07
10 - 13	64	77.17	2.25
9 and below	12	8.4	1.54
	884	884.00	6.42

The calculated X^2 6.42 with 4 degrees of freedom is far less than x^2 0.01 (= 13.22) and X^2 0.05 (9.48). Thus, it is clear that no significant difference between the observed frequencies and the frequencies expected in a normal distribution was found. Thus, the results clearly indicated the distribution of critical thinking scores of the students is normal one. In other words, it is a normal distribution.

4.2.2 Intelligence Test Scores

The X^2 test of normality of the distribution of intelligence test scores of 881 students in Table 4.1.3 is computed in Table 4.2.2

TABLE 4.2.2
Chi-square Test of Normality of Distribution of

Intelligence Test Scores			
Score	Observed (fo)	Normal (ft)	$\frac{(fo - ft)^2}{ft}$
29 and above	5	5.0	0.00
25 - 28	40	29.5	3.74
21 - 24	103	107.4	0.18
17 - 20	204	225.3	2.01
13 - 16	252	257.3	0.11
9 - 12	188	174.3	1.08
5 - 8	83	65.6	4.62
4 and below	6	16.6	6.77
	881	881	18.51

It is found that the calculated $X^2 = 18.51$ is greater than $X^2_{0.01}$ (= 15.09). Thus the distribution of intelligence test scores of students is not considered to approximate to a normal distribution. The skewness of 0.235 indicates that the distribution is positively skewed. The Calculated Kurtosis 0.281 is more than the kurtosis of a normal distribution (0.263). Thus, the distribution can be said as platykurtic. The distribution of intelligence test scores depart significantly from normal

distribution. This may be due to failure of students in each class, less intelligent students are progressively dropped out.

4.3 Analysis of Data, Interpretation of Results and Discussions

4.3.1 Development of Norms

In educational testing norms are useful for interpretation of test performance of pupils. There are no norms available in critical thinking at the state level in Goa. Since the sample for the present study was selected from the entire state of Goa, it was decided to develop norms for the use of teachers and researchers in future. The following types of norms were developed.

- a) Norms in Terms of Levels of Critical Thinking.
- b) Percentile Norms.
- c) Standard Score Norms. (T-score)

a) Norms in Terms of Levels of Critical Thinking.

For qualitative interpretation of scores five levels of critical thinking such as Very High, High, Average, Low and Very Low were established. The details are given in Table 4.3.1.

TABLE 4.3.1
Levels (Norms) of Critical Thinking

Level	Normal Curve Area	Score (Range)
Very High	$> M + 1.8 \sigma$	26 and above
High	$M + .6 \sigma$ to 1.8σ	22 - 25
Average	$M \pm .6 \sigma$	16 - 21
Low	$M - .6 \sigma$ to -1.8σ	12 - 15
Very Low	$< M - 1.8 \sigma$	11 and below

Note: The M = Mean and σ = S.D. of the group were 18.48 and 3.83 respectively.

b) Percentile Norms.

The raw score and the corresponding percentile scores are presented in Table 4.3.2.

TABLE 4.3.2
Raw Scores (Critical Thinking Score) and the Percentile Scores

Raw Score	Percentile
28 - 34	99
27	98
26	97
25	95
24	91
23	86
22	80
21	71
20	61
19	51
18	39
17	28
16	20
15	14
14	9
13	6
12	4
11	2
1-10	1

c) Standard Score Norms (T-Score)

The critical thinking raw score and the corresponding T-Scores are given in Table 4.3.3.

TABLE 4.3.3
Raw Score (Critical Thinking Score) and the T-scores

Critical Thinking Score	T-Score
1	4.4
2	7.0
3	9.6
4	12.2
5	14.8
6	17.4
7	20.1
8	22.6
9	25.2
10	27.9
11	30.5
12	33.1
13	35.7
14	38.3
15	40.9
16	43.5
17	46.1
18	48.7
19	51.4
20	53.9
21	56.6
22	59.2
23	61.8
24	64.4
25	67.0
26	69.6
27	72.2
28	74.9
29	77.5
30	80.0
31	82.7
32	85.3
33	87.9
34	90.5

Computation of partial r's

- When (1) stands for critical thinking scores,
 (2) for intelligence test scores and
 (3) for socio-economic status scores

$$r_{12.3} = 0.16$$

The Z value of the $r_{12.3}$ is as follows

$$\begin{aligned}\sigma_r &= 1/\sqrt{799 - 3 - 1} \\ &= 0.03547 \\ Z &= (0.1598 - 0)/0.03547 \\ &= 4.51\end{aligned}$$

A value of Z of 2.58 was required at 1 percent level. The observed Z value of 4.51 is greater than this. Hence, the partial 'r' is significant at the 1 percent level. This showed that critical thinking is significantly (positively) correlated with intelligence even after the effect of socio-economic status was eliminated. Thus the hypotheses that there is no significant positive correlation between critical thinking and intelligence eliminating the effect of socio-economic status was rejected at 0.01 level. The value of correlation was found to be +.16 which is positive and low.

The above finding is similar to those of Handfield (1980), Kehler (1982), Rogers (1991) Gambino (1992) who also found significant positive correlation between critical thinking and intelligence/ cognitive development. However Brabeck (1981) reported that critical thinking and reflective judgement are separate constructs and attainment of critical thinking skills is necessary but not sufficient for development of higher levels of reflective judgement. Similarly, Samuel, (1970) reported that the

students' scholastic aptitude scores in verbal and/or mathematical ability is an indication of his ability to thinking critically but does not reflect his potential to gain in critical thinking. It is important to mention here that the subjects of these studies were quite different from the present study and also none of these studies reported, controlled for the effect of socio-economic status in finding the relationship of critical thinking and intelligence. A positive correlation between critical thinking and intelligence suggest that there would be a likelihood of a child with higher level of intelligence showing higher level of critical thinking. However, the correlation was found to be low indicating that there would be many exceptions too. The student's intelligence score is an indication of his ability to think critically but does not by itself promote higher level of critical thinking.

4.3.4 Correlation between Critical Thinking and Socio-Economic Status Eliminating Intelligence

The coefficient of correlation (r) between variables have already been obtained while testing the previous hypothesis. This hypothesis was tested only by computing the partial r and finding the Z value of partial r .

The partial $r = + .064$

The significance of the observed partial $r_{13.2} (= .064)$ is tested below:

$$\begin{aligned} Z &= (0.064 - 0) / .03547 \\ &= 1.8 \end{aligned}$$

It was found that a Z value of 1.8 is not significant at 0.05 level ($Z = 1.8 < Z_{0.05} = 1.96$). Hence, a significant correlation was not observed between critical thinking and socio-economic status. Thus the hypotheses that there is no significant correlation between critical thinking and socio-economic status eliminating the effect of intelligence was retained at 0.05 level. The value of correlation was found to be + 0.064 which is positive but very negligible. However, it needs to be mentioned here that the r between critical thinking and socio-economic status (without eliminating the effect of intelligence) was 0.10 which was significant at .05 level.

The finding showed that there is no significant positive correlation between critical thinking and socio-economic status after eliminating the effect of intelligence. It indicates that the socio-economic status (so far as the variables included under SES in this study is concerned) of the family by itself do not play any significant role in the development of critical thinking ability of a student.

The findings of this study are supported by the findings of Handfield (1980), Johnson (1990), M Murithi (1998) who also found no significant relationship between critical thinking and socio-economic status.

4.3.5 Correlation between Critical Thinking and Academic Achievement Eliminating Intelligence

The partial correlation coefficients and the corresponding Z value for each of the school subject are given in Table 4.3.4

TABLE 4.3.4**Partial rs and Z Values for the School Subjects**

Subjects	Partial r	Z - Value
Languages	+ .165	4.76
Social Studies	+ .179	5.16
Mathematics	+ .152	4.38
Science	+ .156	4.49
Total (All Subjects)	+ .176	5.07

The Z value of 2.58 was required at 1 percent level. The observed Z values of 4.76, 5.16, 4.38, 4.49 and 5.07 for languages, social studies, Mathematics, science and total respectively were greater than the required value of 2.58. Hence, it is clear that all the partial rs were significant at 1 percent level (Table 4.3.4). It showed significant correlation between critical thinking and academic achievement even after controlling for intelligence. Thus the hypotheses that there is no significant positive correlation between critical thinking and academic achievement (each subjects separately as well as the total) eliminating the effect of intelligence test scores was rejected at 0.01 level. All the r values were positive but low.

These findings are similar to those of Pillai & Nayar (1968), Nayar (1969), Knight (1981), Kwak (1981), Kehler (1982), Mayes (1986), Ircink (1990), Sidney (1989), Benny (1990), Jordon (1990), Brown (1991), Smith (1996), Coca (1998), Sheeba (1998), who also found significant positive correlation between critical thinking and academic achievement. However, it was found that these findings were not in conformity with

those of Samuel (1970), Johnson (1990), Mc Garrity (1990) and Nathan (1997) who found no significant relationship between these variables. An analysis of these studies indicated that in all the studies the effect of intelligence was not eliminated in finding the relationship between critical thinking and academic achievement which was a prime concern of this investigation.

In the above findings critical thinking emerged as a correlate of achievement. Development or improvement of critical thinking ability of the students may bring out corresponding improvement in academic achievement. The positive correlation between critical thinking and academic achievement in language, social studies, mathematics and science indicated that the students ability to think critically and corresponding improvement in achievement is not restricted to a particular subject. Even though the students critical thinking score is an indication of his ability to improve academic achievement but does not by itself promote higher level of achievement.

4.3.6 Rural-Urban Variation in Critical Thinking

The critical thinking test scores of rural and urban students were compared by taking intelligence test scores as covariate, employing Analysis of Covariance (ANCOVA). The results are given in Table 4.3.5.

TABLE 4.3.5

**Summary of ANCOVA: Rural-Urban Variation in Critical Thinking
Eliminating the Effect of Intelligence**

Source of Variation	SS	df	MS	F-Value
Between groups	1.65	1	1.65	.12*
Within groups	11749.68	844	13.92	

* Not significant at 0.05 level

The F-value of 0.12 for rural and urban students is not significant at 0.05 level with df of 1/844 (Table 4.3.5). It showed that the mean critical thinking scores of rural and urban school students did not differ significantly. In other words, Rural and Urban students had the same level of critical thinking. Hence, the hypotheses that there is no significant difference between the mean critical thinking scores of rural and urban school students eliminating the effect of intelligence test score was retained at 5 percent level. When no significant difference was found eliminating the effect of intelligence the researcher with his curiosity wanted to find out if the mean critical thinking scores of rural and urban students differed significantly without eliminating the effect of intelligence test scores, using t-test. The results are given in Table 4.3.6.

TABLE 4.3.6
Significance of Difference between Mean Critical Thinking

Scores of Rural and Urban Students					
Location	N	Mean	S.D	df	t-value
Rural	396	18.31	3.60	882	1.25 (N.S.)
Urban	488	18.63	4.00		

N.S. - not significant at 5 percent level

Table 4.3.6 shows that a difference in mean score of 0.32 is not significant at 0.05 level ($t = 1.25$, therefore, $t < t_{0.05} = 1.96$). It indicated no significant difference between the mean critical thinking scores of rural and urban students even with the presence of the effect of intelligence.

The result of the present study confirmed the findings of Sheeba (1998) and Coca (1998) who also did not find any rural urban variation in critical thinking among teacher trainees and higher secondary school students respectively. Thus it is clear that location (rural - urban variation) had no effect on the development of critical thinking. This might be because of no difference in the rural and urban environment in the state of Goa. The home and school environment in both the rural and urban setting are the same so far as the contextual factors affecting the development of critical thinking is concerned. This was evident from the fact that no difference was observed by the researcher between rural and urban home environment of the students so far as the data collected using Home Background Data Sheet was concerned. Moreover, it is clear

from the Table 4.3.7 that the rural and urban school teachers do not vary in the extent to which they used critical thinking teaching strategies which contribute for the development of critical thinking. Hence no difference occurred in the development of the critical thinking between rural and urban students. It can be concluded that the students develop the ability to think critically to the same level irrespective of rural or urban background. The development of critical thinking ability do not depend upon the rural or urban setting as no school or home environment differences were reported in the two settings in the present study.

TABLE 4.3.7

Significance of Difference between Mean Critical Thinking

Teaching Strategy Scores of Rural and Urban School Teachers

Location	N	Mean	S.D	df	t-value
Rural	117	3.72	0.46	207	1.21 (N.S.)
Urban	92	3.64	0.41		

N.S. - not significant at 5 percent level

4.3.7 Difference in Critical Thinking between Government and Private School Students

The Critical thinking test scores of Government and private school students were compared by taking intelligence test scores as covariate, employing analysis of covariance (ANCOVA). The results are given in Table 4.3.8

TABLE 4.3.8
Summary of ANCOVA: Critical Thinking Scores of
Government and Private School Students

Source of Variation	SS	df	MS	F-value
Between groups	27.79	1	27.79	2.00 (N.S.)
Within groups	11723.54	844	13.89	

N.S. - Not significant at 0.05 level

From Table 4.3.8 it is evident that F-value of 2.00 is not significant at 5 percent level with df equal to 1/844. This indicated that the mean critical thinking scores of Government and Private school students did not differ significantly. In other words, Government and private school students had same level of critical thinking. Hence the null hypotheses of no significant difference between critical thinking of government and private school students eliminating the effect of intelligence was retained at 5 percent level.

Further, in order to find out whether the two mean critical thinking scores (government and private school students) differ significantly without eliminating the intelligence test score, the t-test was applied. The results are given in Table 4.3.9.

TABLE 4.3.9
Significance of Difference between Mean Critical Thinking Scores of
Government and Private School Students

Management	N	Mean	S.D	df	t-value
Government	231	18.29	3.86	882	.90 (N.S.)
Private	653	18.56	3.82		

N.S. - Not significant at 0.05 level

The t-value of 0.90 was not significant (Table 4.3.9). This indicated that there is no significant difference between the mean critical thinking scores of government and private school students even without eliminating the effect of intelligence test score.

The result of the present study is in agreement with the findings of Nayar (1969) and Coca (1998), who also did not find any difference in critical thinking of government and private school students. Thus, it is clear from the above findings that development of critical thinking in school students does not depend upon the type of schools in which they study (i.e. the type of management -Government or private). This might be due to that there could be no difference in the school practices in these two types of schools which contribute for the development of critical thinking. This is evident from the fact that no significant difference was found in the use of critical thinking teaching strategies (which contribute for development of critical thinking) between the government and private school teachers (Hypotheses No. 10)

4.3.8 Gender Difference in Critical Thinking

The mean critical thinking scores of boys and girls were compared, by taking intelligence test score as covariate, using analysis of covariance (ANCOVA) and the results are presented in the Table 4.3.10

TABLE 4.3.10

Summary of ANCOVA: Critical Thinking Scores of Boys and Girls				
Source of Variation	SS	df	MS	F- Value
Between groups	29.48	1	29.48	2.12 (N.S.)
Within groups	11721.85	844	13.89	

N.S.- Not significant at 0.05 level

The F - Value of 2.12 for boys and girls is not significant at 0.05 level with the df of 1/844 (Table 4.3.10). This indicated that the critical thinking scores of boys and girls do not differ significantly. The boys and girls had the same level of critical thinking. Hence, the hypotheses that there is no significant difference between boys and girls in their mean critical thinking scores eliminating the effect of intelligence test score was retained. Further, the researcher out of his curiosity applied t-test to know whether the mean critical thinking scores of boys and girls differ significantly without controlling for intelligence test score. The result of t-test is given in Table 4.3.11.

TABLE 4.3.11**Significance of Difference between Mean Critical Thinking****Scores of Boys and Girls**

Gender	N	Mean	S.D	df	t-Value
Boys	426	18.79	3.70	882	2.24*
Girls	458	18.21	3.92		

* Significant at 0.05 level

Table 4.3.11 shows that the mean difference in critical thinking score between boys and girls is significant at 5 percent level ($t = 2.24 > t_{.05} = 1.96$). This revealed that there is a significant difference between boys and girls in their mean critical thinking scores without eliminating the effect of intelligence test score and the difference is in favour of boys. This shows that boys had significantly higher critical thinking than girls. This is due to the fact that the boys included in the study had significantly higher intelligence than the girls (Table 4.3.12) and it is a fact that intelligence and critical thinking are significantly positively correlated. (Hypotheses No. 1 of the study). And it is due to this reason that the ANCOVA result (Table 4.3.10) was not found significant.

TABLE 4.3.12**Significance of Difference between Mean Intelligence****Scores of Boys and Girls**

Gender	N	Mean	S.D	df	t-value
Boys	431	16.08	4.99	879	4.29*
Girls	450	14.60	5.26		

* Significant at 0.05 level

From the above discussion it is clear that girls and boys do not differ significantly in their ability to think critically. The findings is in agreement with the findings of Handfield (1980), Knight (1981), Kehler (1982), Sidney (1989), Ircink (1990), Benny (1990), Smith (1990), Cargnel (1998), Coca (1998), Sheeba (1998), who also reported no gender difference as far as critical thinking is concerned. However, it was found that the finding of the study is not in conformity with those of Nayar (1969), Brown (1991), Goldberg (1991), Foss (1995), M Murithi (1998), who found a significant gender difference in critical thinking. Nayar (1969) found the gender difference in favour of boys while Brown (1991) and Goldberg (1991) found in favour of girls.

As evident from the studies reported above, the result of the studies conducted (earlier) on gender difference in critical thinking is inconclusive. Some studies had found significant gender difference might be due to the fact that these studies had not eliminated the effect of intelligence and the difference could be due to the difference in intelligence rather than actual difference in critical thinking.

4.3.9 Difference in Critical Thinking between the Students coming from Joint and Nuclear Families

The critical thinking scores of students coming from nuclear and joint families were compared by taking intelligence as a covariate. The data were analysed using analysis of covariance (ANCOVA) and the results are presented in Table 4.3.13

TABLE 4.3.13**Summary of ANCOVA: Critical Thinking Scores of Students**

Coming from Nuclear and Joint Families				
Source of variation	SS	d.f	MS	F-value
Between groups	10.31	1	10.31	
Within groups	11015.69	800	13.77	.75 (N.S.)

N.S. - Not significant at 0.05 level

As evident from Table 4.3.13 the F-value of .75 for critical thinking scores of students coming from nuclear and joint families is not significant at 0.05 levels with df of 1/800. It shows that the mean critical thinking scores of students coming from nuclear and joint families did not differ significantly when scores on intelligence were used as covariate. In other word, it is clear that the students coming from nuclear and joint families had the same level of critical thinking. In the light of this the hypotheses that there is no significant difference between the mean critical thinking scores of students coming from nuclear and joint families eliminating the effect of intelligence test score was retained.

Further, in order to know if the mean critical thinking scores of nuclear and joint families students differ significantly without eliminating the effect of intelligence, t-test was applied and the results are given in table 4.3.14

TABLE 4.3.14
Significance of Difference between Mean Critical Thinking Score
of Nuclear and Joint Family Students

Type of family	N	Mean	S.D	df	t-value
Nuclear	694	18.52	3.77	836	1.21 (N.S.)
Joint	144	18.10	3.94		

N.S. - Not significant at 0.05 level

Table 4.3.14 shows that the difference in mean score of .42 is not significant at 0.05 level ($t = 1.21$, therefore $t < t_{0.05} = 1.96$). This indicated no significant difference between the mean critical thinking scores of nuclear and joint family students even without eliminating the effect of intelligence. The findings presented in the preceding paragraphs clearly showed that the students coming from joint and nuclear families did not differ in critical thinking ability.

4.3.10 Difference in Critical Thinking between Marathi and Konkani Speaking Students

The critical thinking scores of Marathi speaking and Konkani speaking students were compared by taking intelligence test score as covariate. The data were analyzed using analyses of covariance (ANCOVA) and the results are presented in Table 4.3.15

TABLE 4.3.15

**Summary of ANCOVA: Critical Thinking Scores of
Marathi Speaking and Konkani Speaking Students**

Source of variation	SS	df	Ms	F-value
Between groups	45.50	1	45.50	3.43 (N.S.)
Within groups	9295.98	701	13.26	

N.S. - Not significant at 0.05 level

The F-value of 3.43 was not found significant at 0.05 level with the df of 1/701 (Table 4.3.15). This indicates that the mean critical thinking scores of Marathi and Konkani speaking students did not differ significantly. In other words, Marathi and Konkani speaking students had same level of critical thinking. Hence, the hypotheses of no significant difference between mean critical thinking scores of Marathi speaking and Konkani speaking students eliminating the effect of intelligence is retained at .05 level.

Since no significant difference between the Marathi and Konkani speaking students in critical thinking was found, the researcher wanted to know if the two means differ significantly without controlling for intelligence and for the purpose Analyses of Variance (ANOVA) was applied.

TABLE 4.3.16
Summary of ANOVA: Critical Thinking Scores of
Konkani and Marathi Speaking Students

Source of variation	S.S	df	MS	F-Value
Between groups	67.42	1	67.42	4.79*
Within groups	10236.13	727	14.80	

* Significant at 0.05 level

As evident from Table 4.3.16 the F-value of 4.79 is significant at 0.05 level with df of 1/727. This revealed that there is a significant difference between mean critical thinking scores of Konkani and Marathi speaking students without eliminating the effect of intelligence test score. The mean critical thinking scores of Marathi speaking students (M=19.22) was higher than the mean critical thinking score of Konkani speaking students (M=18.30). However, the difference could be attributed to intelligence. This is evident from the data in Table 4.3.17 which clearly showed that the intelligence test score of the Marathi speaking students was higher than the Konkani speaking students. And this was due to the reason that the ANCOVA result (Table No. 4.3.15) was not found significant. The findings of the study thus, revealed that language background (speaking/mother tongue Marathi or Konkani) of the students did not have any effect on development of critical thinking in the children.

TABLE 4.3.17
Significance of Difference between Mean Intelligence Score of
Marathi and Konkani Speaking Students

Language	N	Mean	S.D	df	t-value
Konkani	615	14.96	5.18	704	3.73*
Marathi	91	17.12	5.10		

* Significant at 0.01 level

4.3.11 Difference in Critical Thinking Among the Hindu, Muslim and Christian Students

The data were analyzed by using ANCOVA where intelligence acted as a co-variate. The results are given in Table 4.3.18

TABLE 4.3.18
Summary of ANCOVA: Critical Thinking Score of Hindu,
Christian and Muslim Students

Source of variation	SS	df	MS	F-value
Between group	63.69	2	31.84	2.32(N.S)
Within group	10968.16	798	13.75	

N.S. - Not significant at 0.05 level

The F-value of 2.32 (Table 4.3.18) for critical thinking scores of Hindu, Muslim and Christian students was not significant at 0.05 level (with df 2/798). It shows that critical thinking scores of Hindu, Christian and Muslim students did not differ significantly when the effect of

intelligence was controlled. In the light of this, the hypotheses of no significant difference of mean critical thinking scores among Hindu, Christian and Muslim students eliminating the effect of intelligence is accepted at .05 level.

Further in order to know if the mean critical thinking scores of Hindu, Christian and Muslim Students differ significantly without eliminating the effect of intelligence, Analysis of Variance (ANOVA) was applied. The result are given in Table 4.3.19

TABLE 4.3.19
Summary of ANOVA: Critical Thinking Scores of Hindu,
Christian and Muslim Students

Source of Variation	SS	df	MS	F-value
Between groups	60.21	2	30.10	2.09 (N.S)
Within group	12040.46	834	14.44	

N.S. - Not significant at 0.05 level

The F-value of 2.09 (Table 4.3.19) is not significant at 0.05 level with df of 2/834. This indicated no significant difference among mean critical thinking score of Hindu (M=18.61), Christian (M=17.97) and Muslim (M=18.17) students even by controlling for the effect of intelligence.

From the above findings it is clear that the religious background of the children had no effect on their development of critical thinking

ability. It showed that Hindu, Christian and Muslim families may not have any differences in their child rearing practices and the atmosphere which they provide at home. Facilities and encouragement given to the children might also be same.

4.3.12 Use of Critical Thinking Teaching Strategies by the Teachers

The mean scores for each of the 21 dimensions of critical thinking were calculated. Based on the means, the dimensions were arranged in the increasing order and tabulated in Table 4.3.20. The mean score for a dimension was calculated by adding all the scores of all the teachers in a particular dimension and dividing the total by number of teachers and the result was again divided by the number of items in each dimension.

TABLE 4.3.20

**Rank Order (The Extent to Which Each Dimension was Used
in Order) of the 21 Dimensions of Critical Thinking**

Sr. No.	Critical Thinking Dimensions	Mean	Rank
1	Evaluating Evidence and Alleged Facts	3.93	1
2	Reading Critically: Clarifying or Critiquing Texts	3.90	2
3.	Developing Confidence in Reason	3.88	3
4.	Developing Intellectual Perseverance	3.84	4
5.	Questioning Deeply: Raising and Pursuing Root or Significant Questions	3.79	5
6.	Developing One's Perspective: Creating or Exploring Beliefs, Arguments or Theories	3.72	6
7.	Thinking Independently	3.69	7
8.	Comparing Analogues Situations: Transferring Insights to New Context	3.64	8
9.	Distinguishing Relevant from Irrelevant Facts	3.56	9
10.	Clarifying Issues, Conclusions or Beliefs	3.53	10
11.	Practicing Socratic Discussions: Clarifying and Questioning Beliefs, Theories or Perspectives	3.47	11
12.	Clarifying and Analysing the Meanings of Words or Phrases	3.44	12
13.	Generating and Assessing Solutions	3.39	13
14.	Listening Critically: The Art of Silent Dialogue	3.33	14
15.	Noting Significant Similarities and Differences	3.27	15
16.	Developing Intellectual Humility and Suspending Judgements	3.24	16
17.	Exploring Implications and Consequences	3.23	17
18.	Making Interdisciplinary Connections	3.18	18
19.	Exercising Fairmindedness	3.16	19
20.	Making Plausible Inferences, Predictions, or Interpretations	3.13	20
21.	Evaluating the Credibility of Sources of Information	3.09	21

The mean score for each teacher on the entire inventory was calculated. Based on these mean values, the extent to which the teachers make use of these strategies were found out and the results are presented in Table 4.3.21.

TABLE 4.3.21

Frequency Distribution of Teachers on the Basis of the Extent to Which They Used Critical Thinking Teaching Strategies

Extent of Critical Thinking Strategies Used	Score (Range)	Frequency	Percentage
Very Often	Above 4.50	3	1.44
Often	3.51 - 4.50	77	36.84
Sometimes	2.51 - 3.50	123	58.85
Hardly	1.51 - 2.50	6	2.87
Not at all	Below 1.51	0	0
Total		209	100.00

The data in Table 4.3.21 indicated that only a negligible percentage of teachers were found using critical thinking strategies very often and thirty seven percentage of teachers used these strategies often. About three fifth's of the teachers were using the strategies sometimes and very negligible percentage used hardly any of these strategies. There are no teachers who have not used any of these strategies.

From the above findings it is clear that the majority of teachers were using the critical thinking teaching strategies only sometimes.

4.3.13 Difference between Government and Private School Teachers in the Use of Critical Thinking Teaching Strategies

TABLE 4.3.22

Significance of Difference between Mean Critical Thinking

Teaching Strategy Scores of Government and Private School Teachers

Management	N	Mean	S.D	df	t-value
Government	46	3.70	.47	206	.16 (N.S.)
Private	162	3.69	.45		

N.S. - Not significant at 0.05 level

The t- value of 0.16 was not found significant (Table 4.3.22). It reflects that the mean critical thinking teaching strategy scores of government and private school teachers did not differ significantly. Hence, the hypothesis that there is no significant difference between the mean critical thinking teaching strategy score of government and private school teachers is retained. It shows that both the government and private school teachers were using critical thinking strategies to the same extent. This finding is in agreement with the findings of Coca (1998) who also found no difference in the use of critical thinking strategies by government and private higher secondary school teachers.

Government and private school teachers did not differ in the use of critical thinking teaching strategies might be because of the fact that (1)

the teachers in both the type of schools did not differ so far as their qualifications, years of teaching experience and the subjects they teach etc. are concerned. Further to specify the fact that the teachers did not differ in the use of critical thinking teaching strategies when the teaching experience (Hypotheses No. 12) and subjects they teach (Hypotheses No. 11) were considered.

4.3.14 Difference in Use of Critical Thinking Teaching Strategies Among Science, Social Studies and Language Teachers

Data were analysed employing Two way Analyses of Variance (ANOVA) and the results are presented in Table 4.3.23

TABLE 4.3.23

Summary of Two Way ANOVA: Critical Thinking Teaching Strategy Score by Subjects and Years of Experience

Source of Variation	SS	df	MS	F-value
A (Subjects)	0.36	2	.18	.96*
B (Year of Experience)	1.02	2	.51	2.73*
A x B	1.06	4	.27	1.42*
Within groups	28.43	152	.19	

* Not significant at 0.05 level

The F value of .96 of critical thinking strategy scores of science, social studies and language teachers was not found significant (Table 4.3.23). It indicated that the mean critical thinking teaching strategy scores of Science (M=3.73), Social Studies (M=3.65) and Language

($M=3.71$) teachers do not differ significantly from each other. Therefore, the hypothesis that there is no significant difference in mean critical thinking teaching strategy scores among science, social studies and language teachers is accepted at 0.05 level. On the basis of mean critical thinking teaching strategy score it is evident that the science, social studies and language teachers were using critical thinking teaching strategies to the same extent in their classroom teaching. The findings of the study confirmed the findings of Coca (1998).

This study indicated that the teachers were using critical thinking teaching strategies to the same extent irrespective of the subject that they were teaching. Hence it is evident that teaching and developing critical thinking is possible in any subject area and is not limited to a particular discipline. The same is also evident from the significant positive correlation that the critical thinking had with mathematics, science, language and social studies achievement. This finding supported by the findings of Fennly (1989), Jordan (1991), Dickson (1992), Hendrix (1995), and Commeyras (1992) who found that programs aimed at developing critical thinking brought out corresponding improvement in language abilities and achievement. Similarly, use of innovative teaching strategies in science classrooms resulted in significant improvement in critical thinking and science achievement (Samuel, 1970; Mc Cune, 1990; Sidney, 1989; Smith, 1996). Similar findings were also reported in mathematics.

4.3.15 Use of Critical Thinking Teaching Strategies by the Teachers in Relation to Years of Teaching Experience

Table 4.3.23 shows that the difference in mean critical thinking strategy scores among teachers who had teaching experience of 0-5 years, (M=3.64), 10-20 years (M=3.67) and above 25 years (M=3.83) was not significant at 5 percent level. This indicated that the teachers use of critical thinking strategy do not vary with their experience. Thus the hypothesis that there is no significant difference in mean critical thinking strategy score among teachers who have teaching experience of 0-5 years, 10-20 years and above 25 years is accepted at 5 percent level.

The findings of the study is supported by the findings of Coca (1998) who also did not find any significant difference in the use of critical thinking teaching strategies in relation to the years of experience. However the finding of this study is not in confirmity with the findings of Boikai (1990) and Kezar (1992). Kezar (1992) reported significant inverse relationship between year of teaching experience and students gain in critical thinking score implying that the teachers who were less experienced were using, different techniques which promote critical thinking, to a higher level than the more experienced teachers. Whereas in the present study no relationship was found between the years of experience and the use of critical thinking teaching strategies.

Boikai (1990) analyses for critical thinking teaching behaviours showed significant differences for both age and teaching experience. Teachers most positive about these behaviours were 36-40 years old and had 5 to 12 years of teaching experience. The oldest teachers and those

with the most experience were the least interested in applying these behaviours. Further in terms of teaching strategies, significant differences existed for teachers level of education and teaching experience. Teachers with the lowest levels of education and those with 5-12 years of teaching experience showed the greatest interest in using these strategies. Teachers with higher level of education and those with the least experience were the least interested in these strategies. Whereas in the present study no such relationship was found between the use of critical thinking teaching strategies and years of experience.

In the present investigation the use of critical thinking strategies did not vary with experience. This indicates that as the years of experience increase there is no increase or decrease in the use of critical thinking strategies. The teachers ability and interest do not change over the years as far as use of critical thinking strategies are concerned.

4.3.16 Difference in the Use of Critical Thinking Teaching Strategies between the Low and High Critical Thinking School (Students) Teachers

To analyse the data for this part of the study, first of all, the mean critical thinking scores of each of the 27 schools was obtained (This was done by adding the scores of all the students of the school and dividing the sum by number of students). Now each school was treated as an unit and the mean scores were considered as critical thinking score of the schools. The mean and standard deviation of these 27 schools were calculated. Using the mean and standard deviation, the schools were classified into three groups: High Critical Thinking Schools ($>M + 1$ S.D.), Average Critical Thinking Schools ($M \pm 1$ S.D.) and Low Critical

Thinking Schools ($< M - 1 \text{ S.D.}$). Only the critical thinking teaching strategies scores of the teachers working in the high and low critical thinking schools were considered for analysis.

The critical thinking teaching strategy scores of the teachers working in the high and low critical thinking schools (Students), were compared using Analyses of Variance. The results are presented in Table 4.3.24.

TABLE 4.3.24

**Summary of ANOVA: Critical Thinking Teaching Strategy Scores
of Teachers Working in the High and Low Critical Thinking Schools**

Source of Variation	SS	df	MS	F-value
Between groups	.97	1	.97	4.41*
Within groups	12.72	59	.22	

* Significant at 0.05 level

The F-value of 4.41 is significant at 0.05 level with the df of 1/59 (Table 4.3.24). This indicated that the mean critical thinking teaching strategy scores of the teachers of high ($M = 3.72$) and low ($M = 3.45$) critical thinking schools differ significantly and the difference is in favour of the teachers belonging to high critical thinking (Students) schools. In the light of this the hypothesis that there is no significant difference between mean critical thinking teaching strategy scores of the teachers of high critical thinking schools and low critical thinking schools was rejected at 0.05 level of significance. From this it can be concluded that the teachers who belong to the schools, where the students mean critical

thinking score is high, were using the critical thinking teaching strategy to greater extent than the teachers who belong to the schools where the students mean critical thinking score is low. In other words, there is a direct relationship between the use of critical thinking teaching strategies and the students level of critical thinking. The comparative mean critical thinking teaching strategies scores of the teachers' of high and low critical thinking schools are presented in fig. 4.3.1

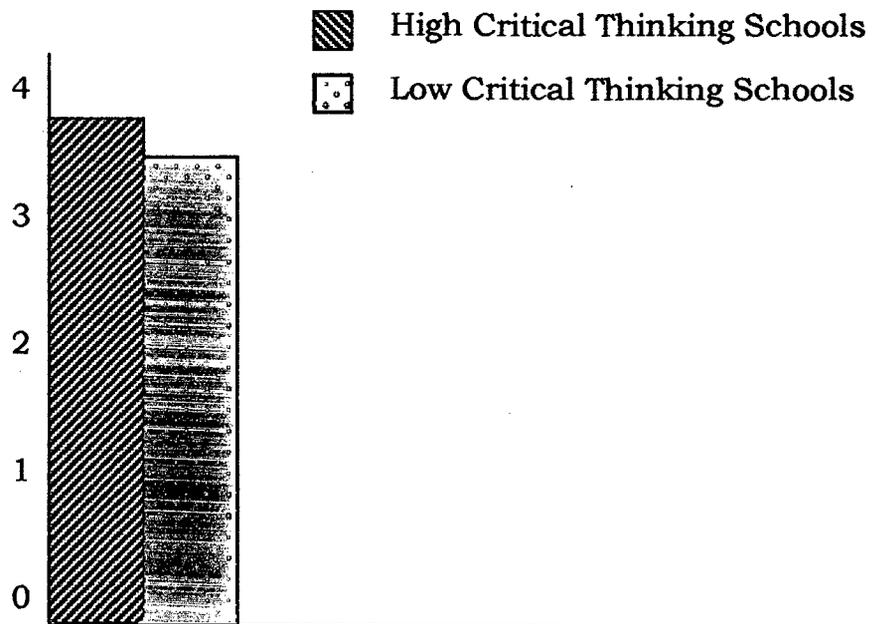


Fig. 4.3.1 : Mean Critical Thinking Teaching Strategies Scores between High & Low Critical Thinking Schools

The finding is in agreement with the findings of Knight (1981) Channault (1989), Susan (1996) and Smith (1996). Knight (1981) reported a significant difference between the increase of students critical thinking scores for those students with teachers experienced in teaching critical thinking over those students with teaches not experienced in teaching critical thinking. Chennault (1989) revealed that the students with critical thinking strategy curriculum had higher mean scores than the group with the traditional curriculum. Susan (1992) reported a significant increase in critical thinking scores for students after they had been exposed to an alteration of teacher questions. Smith (1992) found teaching science as inquiry improved critical thinking skills of students.

4.3.17 Comparative Home Background of High and Low Critical Thinking Ability Students

In order to obtain the list of high and low critical thinking students, the entire sample was divided into three groups using the Mean (M) and Standard Deviation (S.D.) as follows:

- i) High Critical Thinking Group ($> \text{Mean} + 1 \text{ S.D.}$),
- (ii) Average Critical thinking group ($M \pm 1 \text{ S.D.}$) and
- (iii) Low critical thinking group ($< M - 1 \text{ S.D.}$).

Home background of high and low level of critical thinking groups were compared (analysed) using frequency and percentage analysis. There were 136 and 125 students in the high and low critical thinking groups respectively.

A. Facilities at Home**(a) Television****TABLE 4.3.25****Availability and Use of Television**

Television	High Critical Thinking Group		Low Critical Thinking Group	
	No.	%	No.	%
Availability	121	88.97	91	72.8
Use:				
Entertainment & Educational	83	61.03	40	32.0
Entertainment	34	25.00	51	40.8
Educational	4	2.94	0	0
Discussion:				
Always	11	8.09	14	11.2
Sometimes	76	55.88	48	38.4
Not at all	34	25.00	29	23.2

From the data in Table 4.3.25 it is clear that higher percentage of students in the high critical thinking group had television at home compared to the low critical thinking group. Higher percentage of the students in the high critical thinking group were viewing various educational and entertainment television programs than the low critical thinking ability students. The difference was very significant so far as the viewing of educational programs was concerned. Further, the data indicated that a higher percentage of students in the high critical thinking group used to discuss about the various aspects of the programs they viewed than the low critical thinking group.

(b) Radio**TABLE 4.3.26****Availability and Use of Radio**

Radio	High Critical Thinking Group		Low Critical Thinking Group	
	No.	%	No.	%
Availability	64	47.06	64	51.2
Use:				
Entertainment	40	29.41	38	30.4
Educational	19	13.97	7	5.6
Non-Use	5	3.68	19	15.2
Discussion	0	0	0	0

The data in Table 4.3.26 show that a slightly higher percentage of students in the low critical thinking group had radio at home. But higher percentage (43 percent) of students in the high critical thinking group listened to various educational and entertainment programs than low critical thinking group (36 percent) and the difference is very significant in case of educational programs. On the other hand, a higher percentage of students in the low critical thinking group did not use the radio at all.

(c) Tape Recorder**TABLE 4.3 27****Availability and Use of Tape Recorder**

Tape Recorder	High Critical Thinking Group		Low Critical Thinking Group	
	No.	%	No.	%
Availability	83	61.03	71	56.8
Use:				
Entertainment	72	52.94	71	56.8
Educational	11	8.09	0	0

From the data in Table 4.3.27 it is clear that higher percentage of students in the high critical thinking group had tape recorder at home than the low critical thinking group. Also students in the higher group used to listen to various educational programs and none in the low critical thinking group were doing so.

(d) Telephone

TABLE 4.3.28

Availability and Use of Telephone

Telephone	High Critical Thinking Group		Low Critical Thinking Group	
	No.	%	No.	%
Availability	57	41.91	16	12.8
Use:				
General	23	16.91	16	12.8
Study	19	13.97	0	0
Study & General	15	11.03	0	0

The data in Table 4.3.28 revealed that a very high percentage of students in the high critical thinking group had telephone facility than the low group. Also very higher percentage of students in the high critical thinking group were using the telephones for study as well as general purposes whereas the low group used it only for general purpose.

(e) News Papers

TABLE 4.3.29**Subscription and Use of News Papers**

News Papers	High Critical Thinking Group		Low Critical Thinking Group	
	No.	%	No.	%
Subscription	108	79.41	77	61.6
Reading	97	71.32	53	42.4
Articles Read				
Political	11	8.09	6	4.8
Sports	25	18.38	10	8.0
Scientific & Environmental	19	13.97	6	4.8
International	4	2.94	8	6.4
All types	38	27.94	23	18.4
Discussion	49	36.03	17	13.6
Number of News Papers		1 to 6		1 to 3

The data presented in Table 4.3.29 showed that higher percentage of students in the high critical thinking group had news papers at home than the low critical thinking group. Similarly, very high percentage of students in the high group used to read various news items than the low group. In other words, though the students of both the groups used to read different types of news items, the percentages of students in the high critical thinking group doing the same in all the cases was higher compared to the low critical thinking group. With regard to the discussions of the articles read, it was found that a very higher percentage of high critical thinking ability students than the low critical thinking students used to do so. The number of news papers subscribed

at home varied from 1 to 6 in the case of high critical thinking group whereas in the case of low critical thinking students it was only 1 - 3.

(f) Magazines

TABLE 4.3.30

Subscription and Reading of Magazines

Magazines	High Critical Thinking Group		Low Critical Thinking Group	
	No.	%	No.	%
Subscription	49	36.03	16	12.8
Reading	47	34.56	10	8.0
Articles Read				
a) Stories & Jokes	15	11.03	0	0
b) Scientific & Environmental	8	5.88	3	2.4
c) Quiz	4	2.94	0	0
d) Health & Film	9	6.62	0	0
e) All types	11	8.09	7	5.6
Discussion	26	19.12	0	0

Higher percentage of students in the high critical thinking group than their low group counterparts had magazines (subscribed) at home (Table 4.3.30). Of the students who had different magazines, it was found that almost all the students in the high critical thinking group were reading various articles/items such as stories, scientific articles, articles related to environmental aspects, Quiz etc., where as only a negligible percentage of students in the low group used to do the same. With regard to discussion of various articles, it was observed that a significant percentage of students in the high critical thinking group used to have

discussion of various articles whereas none in the low critical thinking group had such a practice.

(g) Home Library

TABLE 4.3.31

Availability of Books and Reading

Books	High Critical Thinking Group		Low Critical Thinking Group	
	No.	%	No.	%
	Available	61	44.85	20
Reading	57	41.91	13	10.4

It was found that (Table 4.3.31) higher percentage of students in the high critical thinking group had different types of book such as, novels, stories, encyclopedia, comics, puzzles, Dictionaries, at home compared to the students in the low critical thinking group. Further, a very higher percentage of high than low critical thinking ability students used to read various books.

From the above findings related to facilities at home, it was observed that the students belonging to the high critical thinking group had better facilities in terms of television, radio, tape recorder, telephone, news papers, magazines, and books. Also it was observed that these students were using such facilities for a variety of purposes compared to their low critical thinking ability counterparts. Moreover the knowledge and experiences gained by using such facilities have been shared with parents and elders by way of discussions and deliberations.

the students help their family members were higher in the case of high critical thinking ability students.

(b) **Help from Family Members**

TABLE 4.3.33

Help Received from Family Members at Home

Help from Family	High Critical Thinking Group		Low Critical Thinking Group	
	No.	%	No.	%
Help	91	66.91	57	45.6
Study	76	55.88	51	40.8
Study & Entertainment	15	11.03	6	4.8

The data (Table 4.3.33) showed a higher percentage of students in the high critical thinking group were getting help from the family members than the low critical thinking group. Out of those who received help, (in both the groups) comparatively higher percentage of students in the high group used to receive help for both study and entertainment. Helping the family members in different activities provides opportunities to the children to interact with others in the family in a variety of ways. Such experiences might have some positive contribution, directly or indirectly for development of critical thinking.

(c) **Activities at Home****TABLE 4.3.34****Involvement of Various Activities at Home**

Activities	High Critical Thinking Group		Low Critical Thinking Group	
	No.	%	No.	%
Studying	136	100	125	100
Discussion of various Matters	79	58.09	15	12.0
Entertainment	106	77.94	79	63.2
Games & Sports	83	61.03	65	52.0
Computer Class	28	20.59	2	1.6
Music Class	4	2.94	1	0.8
Dance Class	13	9.56	10	8
Reading	106	77.94	22	17.6
Prayer & Religious Instruction	93	68.38	76	55.88

It was observed that students from both groups were involved in all the activities listed in Table 4.3.34. However, it was found that in all the activities except study, higher percentage of students exhibiting high critical thinking were involved in these activities compared to their low critical thinking ability counterparts. Participation of students in such activities was undoubtedly providing these children variety of experiences which might be playing a vital role in shaping their cognitive behaviour.

(d) **Discussions at Home****TABLE 4.3.35****Discussions of Various Matters at Home between
Children and Parents/Elders**

Discussion	High Critical Thinking Group		Low Critical Thinking Group	
	No.	%	No.	%
Discussion	76	55.88	05	04
Matters of discussion:				
	- Personal			Nil
	- Political			
	- Scientific			
	- Environmental			
Nature of Participation:				
	- Questioning			Nil
	- Arguing			
	- Inquiring			
	- Narrating			

With regard to casual discussion of various matters (Table 4.3.35) fifty-six percent of students in the high critical thinking group used to discuss with parents and elders. The matters of discussion included personal, political, scientific, cultural and environmental aspects and the students were participating by questioning, arguing, inquiring, and narrating. However, in case of students belonging to low critical thinking group only four percent of them stated that they used to discuss with parents and elders. But none of them indicated what matters they discuss and the role played by them in such discussions.

From the findings it is clear that the students who exhibited higher critical thinking were getting the scope for participation in various ways in discussing various matters with their parents and elders at home. But the students who had low critical thinking ability were from such families where there was no scope for such discussion.

Participation in the discussion of such wide variety of subject matters by way of questioning, inquiring, arguing and narrating must be providing the students the opportunity for enhancing their thinking skills.

(e) **Atmosphere at Home**

TABLE 4.3.36

Home Atmosphere of the High and Low Critical Thinking Students

Atmosphere		High Critical Thinking Group		Low Critical Thinking Group	
		No.	%	No.	%
		Questioning various Practices by Students	Yes	91	66.91
	No	45	33.09	76	60.8
Following Every Orders Without Questioning	Yes	34	25.0	73	58.4
	No	102	75.0	52	41.6
Encouraging Discussion	Yes	109	80.15	49	39.2
	No	27	19.85	76	60.8
Valuing Opinion	Yes	117	86.03	44	35.2
	No	16	11.77	81	64.8

It is clear in Table 4.3.36 that two-third of the students belonging to the high critical thinking group were allowed by their parents/elders to question various practices (like custom, tradition, rules, norms etc.) at home and society. The percentage of low critical thinking students allowed to do so was only 39. Very high percentage (75 percent) of high critical thinking students than low critical thinking students stated that their parents/elders did not expect them to follow anything blindly. Instead they were given sufficient freedom to demand reason and justification. On the other hand, comparatively higher percentage of low achieving than high achieving students stated that their parents did not allow them to question anything and wanted them to follow their demands strictly. Four-fifths of the high critical thinking students disclosed that they discuss their problems and difficulties freely with the parents and their parents encouraged them to do so. However, only 39 percentage of low critical thinking students had this kind of opportunities at home. Compared to low critical thinking students, a very high percentage of high critical thinking students stated that their opinions on various matters were valued by their parents.

The findings revealed that the high critical thinking students had a far better atmosphere at home than the low critical thinking students. They had a congenial atmosphere at home which contribute for the development of critical thinking. The results pointed out that parents and elders who accept their children's ideas and engage them in conversation with democratic atmosphere enhance their children's critical thinking abilities.

C. Facilities and Practices in the Home Surrounding

a) Facilities

TABLE 4.3.37

Facilities in the Home Surrounding

Facilities Available	High Critical Thinking Group		Low Critical Thinking Group	
	No.	%	No.	%
	Library	46	33.82	14
Reading	41	30.15	9	7.2
Club	43	31.62	10	8.0
Participation	33	24.26	0	0

From the data in Table 4.3.37 it is clear that a higher percentage (three times more) of students in the high critical thinking group had library and club facilities in their home surrounding/ locality than the low group students. Also higher percentage of students in the high critical thinking group were making use of the library and club facilities compared to students in the low critical thinking group. Having facilities like library and clubs (Music Club, Science Club, Film Club, Sports Club) in the neighbourhood/locality and utilizing such facilities undoubtedly be providing the opportunities to the students to enlarge the horizon of knowledge as well as to interact with others in various ways, which might be helping them in some way or the other to enhance their thinking skills.

b) Activities

TABLE 4.3.38**Participation in Activities in the Home Surroundings/Community**

Activities	High Critical Thinking Group		Low Critical Thinking Group	
	No.	%	No.	%
Literary Programs	27	19.85	14	11.2
Cultural Programs	61	44.85	34	27.2
Health Camp	15	11.03	10	8.0
Community Survey	19	13.97	10	8.0
Film Show	30	22.06	34	27.2
Talk by experts	19	13.97	10	8.0
Developmental activities	23	16.91	6	4.8
Environmental building	42	30.88	20	16.0

The data in Table 4.3.38 show that the students in the high critical thinking were participating in all the activities conducted in the community and the percentage of participation varies from eleven percent to forty five percent. Although the students in the low critical thinking group were used to participate in all the activities, the percentage of students participating in these activities were comparatively lower than the students in the high critical thinking group.

It is clear from the data that except one activity i.e., film show, higher percentage of students from the high critical thinking group were participating in all the activities listed in Table 4.3.38, than the students from the low critical thinking group. Participation in such activities,

CHAPTER V
SUMMARY, CONCLUSION AND
RECOMMENDATIONS

CHAPTER V

SUMMARY, CONCLUSION & RECOMMENDATIONS

5.1 Summary

The goal of helping students to become effective thinkers is fundamental to any educational practice and is certainly not a new idea. John Dewey saw the development of an individual capable of reflective thinking as a prominent educational objective. The National Policy on Education - 1986 subsequently modified in 1992 has justifiably emphasised, "subject should be visualised as the vehicle to train the child to think, analyse, reason and articulate logically". Scholars are of the opinion that thinking is not another educational option. Rather it is an indispensable part of it, because being able to think critically is a necessary condition for being educated, and educationists have come to realise that teaching for developing critical thinking is an essential function of School.

The old way of educating that was passable in a relatively stable world no longer works. Rote memorisation is useless when what is memorised today is obsolete tomorrow. It is certainly easier in the short run, to lecture students and test for their ability to restate the lecture. In the long run, the didactic counterfeit of education leaves our citizens grossly unprepared and unable to assume their responsibilities, now unavoidable to make rational judgement about significant national and global issues.

As we approach the end of the 20th century, drastic social, political, economic and environmental changes around the globe demand citizens be trained to identify and analyse issues and problems not merely memorise facts and follow directions. Social demands for higher order thinking are increasing. There is an emphasis every where in the need for a future work force capable of more sophisticated thinking than was generally required in the past. Such skills as independent analysis, flexible thinking and problem solving are now considered basic requirements for many jobs. In addition, in this information age which is characterised by the rapid expansion of knowledge and the emergence of increasingly sophisticated technologies, the ability to adopt quickly to change, along with the capacity and willingness to learn new skills on the job assumes greater importance.

The rapid increase of available knowledge has particular significance for education. Content teachers frequently lament their inability to cover all the material in the content curriculum. The increased knowledge bases of many subjects quantitatively compound this task. It is clear that a different strategy is in order-one that emphasizes developing the lifelong learning and thinking skills necessary to acquire and process information within an ever-expanding field of knowledge.

It is time that we reverse the pervasive emphasis in education on lower rather than on higher order learning, on recall rather than on reasoning, on students merely "reproducing" rather than producing knowledge. If the teachers and educators are to be successful in coping with the contemporary demands of the society, they cannot avoid focussing their major efforts in developing children who can think independently and critically.

If we are to foster and strengthen critical thinking in schools and colleges, we need a clear conception of what it is and what it can be. Within the field of philosophy attempts to teach thinking and problem solving have been prevalent since the time of Aristotle and Plato. John Dewey, who was simultaneously an educator, philosopher and Psychologist defined reflective thought as the "careful persistent examination of an action, proposal, or belief and the analysis or use of knowledge in the light of grounds that justify it and its probable consequences". Smith (1953) also emphasized the judgemental aspect of critical thinking as "what a statement means and whether to accept or reject it". In this landmark paper, "A concept of Critical Thinking" Ennis (1962) elaborated on Smith's definition of critical thinking by delineating skills that called for the application of formal and informal logic. Ennis has since then considerably expanded his concept of critical thinking.

According to Ennis (1985) "critical thinking is reflective and reasonable thinking that is focussed on deciding what to believe or do". In so defining, he considers it as a goal directed thinking in which critical thinker consciously and rationally thinks about his or her thinking with a view to applying it in other contexts. For Ennis then critical thinking is a practical activity concerned with making decision of what to believe or do. This decision making results from the interaction of a set of dispositions toward critical thinking with a set of abilities for critical thinking.

In more recent times philosophers such as Seigel (1980), Mcpeek (1984), Lipman (1988), Paul (1989) and Norris (1990) have devoted their attention to understanding the bases of critical thinking.

Paul Richard (1992) consider critical thinking in a strong sense.

On this view he distinguishes two important sense of critical thinking, a weak sense and a strong one. According to Paul, there are three groups of mental structures essential to the development of a critical thinking: (1) proficient micro-skills, such as the ability to recognise a vague sentence, a questionable assumption, a contradiction or inconsistency, an inference or implication; (2) refined macro abilities, such as the ability to read and write critically, engage in give-and-take of discussion and debate, evaluate sources of information, or create and explore arguments and theories; and (3) traits of mind, which are the intellectual virtues and moral commitments that transform thinking from a selfish, narrow-minded foundation to a broad, open minded foundation.

No other theorists in the critical thinking movement address the underlying issues with the depth of philosophical analyses that Siegel offers. According to him a critical thinker is one who is "approximately moved by reasons" (Siegel, 1989, p. 24). In so defining, he relate critical thinking with rationality he consider critical thinking as an embodiment of the ideal of rationality.

According to Mathew Lipman Critical Thinking is skillful, responsible thinking that facilitates good judgement because it (1) relies upon criteria (2) is self correcting, and (3) is sensitive to context" (Lipman, 1988). His account highlights six key elements in critical thinking: critical thinking is skillful thinking, responsible thinking, based on good judgement, based on criteria, self correcting and sensitive to context.

National Council for Excellence in Critical Thinking Instruction (1991) state "Critical thinking is the intellectually disciplines process of actively and skilfully conceptualising, applying, analysing, synthesising

or evaluating information gathered from or generated by, observation, experience, reflection, reasoning or communication as a guide to belief and action".

Within the field of psychology, interest in establishing a cognitive basis for a pedagogy that fosters thinking and reasoning in school learning has been continuously expressed by educators and psychologists at least since John Dewey. In 1945 Max Wertheimer in his book on productive thinking described an insightful series of studies on problems solving in mathematics and science. He distinguished productive thinking from "blind intuition", equated the former with grasping the essential structure of the problem. Psychologists interested in the nature of critical thinking such as Piaget, Guilford, Feuerstein, Sternberg, have been particularly concerned with characterising critical thinking as it is performed under the limitations of the person and environment.

According to Sternberg (1985) "Critical thinking comprises mental process, strategies, and representation people use to solve problems, make decisions, and learn new concepts". This account of critical thinking is based upon his Triarchic Theory of Human Intelligence, which views thinking skills as a subset of intelligent functioning.

Critical thinking has been defined variously by various distinguished scholars. However, a close examination of these definitions reveal that to a great extent all these definitions say same thing in different ways. The amount of agreement among scholars regarding the nature of critical thinking clearly outweighs the disagreement.

Recent literature in the field of critical thinking has included

definitions and analysis of critical thinking ranging from the broad definitions of Seigel (1988) to the detailed articulation of skills and dispositions found in the work of Ennis (1985). Most of the main account of critical thinking including those of Ennis, Paul, Mcpeck, Seigel, Sternberg, agree at least to this extent; critical thinking has (at least) two central components: a cognitive component, which involves abilities and skills relevant to the proper understanding and assessment of reasons, claims, and arguments, and an affective component which is understood as a complex of dispositions, attitudes, habits of mind, and character traits.

Thus, we observe that critical thinking is the art of self-monitored, self-correcting, and self-disciplined thought. Critical thinkers apply internal standards of thoughts to their thinking while they think. Clarity, accuracy, precision, consistency, relevance depth and breadth are standards that apply to all disciplined thought. A critical thinker is one who appropriately move by reasons. He has a willingness and an ability to scrutinise and evaluate thinking - one's own as well as others' - to determine truth, accuracy, or worth and to construct logical arguments to justify claims or assertions. Such a thinking is called critical because it judges according to prescribed criteria, not because it is negative or accusatory. The abilities to recognise, analyse, judge and formulate valid argument through the application of reasoning and rules of logic are central to critical thinking.

The programs for developing critical thinking skills have been with us for thousands of years, although they have not always been recognised as such. The traditional name for such programs has been logic. In recent years a good deal of interest has been expressed concerning the possibility of teaching thinking skills, and a number of

concerned, what psycho-contextual factors promote it, and what socio-demographic variables influence the development of critical thinking of the students.

In abroad a good deal of research had gone into the area of critical thinking. Research in critical thinking relates to various psycho-contextual factors such as intelligence, gender, socio-economic status, academic achievement, the use of teaching strategies and years of teaching experience of teacher.

Results of the previous researchers on gender variations are not conclusive. Some studies have reported significant gender difference in favour of boys whereas some have reported in favour of girls. There are also studies which have reported no significant gender difference in critical thinking. Almost all studies have reported significant correlation between critical thinking and intelligence. The relationship between critical thinking and academic achievement was studied by several researchers. Most of them have reported significant correlation between academic achievement and critical thinking with an exception of a few studies. With regard to critical thinking and socio-economic status, most of the studies have reported no significant correlation. Teachers use of critical thinking strategies in relation to years of experience and level of education was studied and the findings were somewhat contradictory.

To the best of the knowledge of the researcher, only a limited number of studies have so far been conducted in India. Thus critical thinking is one of the most neglected area of research in our country. This necessitates studies to be conducted by the researchers in India. Of the studies conducted so far in India, significant positive correlation between critical thinking and achievement was found by five researchers.

Three of these studies were limited only to achievement in science and the remaining two studies were limited only to achievement in science and the remaining two studies were conducted on B.Ed trainees and higher secondary students. There are no studies conducted on secondary school students to find out the correlation between critical thinking and achievement in different school subjects as well as achievement as a whole. Studies on gender difference in critical thinking is inconclusive. Hence, more studies need to be conducted to confirm the findings of sex difference in critical thinking. Rural-urban and government-private school difference in critical thinking is not significant. Only two studies in each of the above categories may not be considered sufficient to arrive at valid conclusions regarding school difference (Management and Location) in development of critical thinking.

Moreover, there are not studies conducted so far to find out the possible influence of socio-economic status, home background, teachers experience, use of critical thinking strategies on critical thinking. Hence, there is a necessity to study critical thinking in relation to these variables.

Considering the facts states in the proceeding paragraphs it was thought necessary to study the development of critical thinking among the secondary school students in Indian context. If one knows, the current level of critical thinking that students possess, the methods that teachers currently use to develop it, the Psycho-contextual factors which promote it, and the socio-demographic variables which influence the development of it, in Indian situation, the process of developing critical thinking abilities in our students would be greatly improved.

Hence, keeping in mind the facts stated above the researcher decided to conduct the study entitled:

"Development of Critical Thinking Among Secondary School Students in Relation to Some Psycho-Contextual Variables".

Objectives of the study

The present investigation was conducted:

1. To establish the norms for critical thinking ability of the secondary school students in the state of Goa;

and to study the :

2. levels of critical thinking of the secondary school students;
3. correlation between critical thinking and intelligence eliminating the effect of socio-economic status;
4. correlation between critical thinking and socio-economic status eliminating the effect of Intelligence;
5. correlation between critical thinking and academic achievement in different school subjects eliminating the effect of intelligence;
6. variance, if any, in critical thinking between the students studying in rural and urban schools eliminating the effect of intelligence.
7. variation, if any, in critical thinking between the students studying in government and private schools eliminating the effect of intelligence;

8. variation, if any, between boys and girls in critical thinking eliminating the effect of intelligence;
9. variation, if any, in critical thinking between the students coming from Nuclear and Joint families eliminating the effect of intelligence;
10. variation, if any, in critical thinking between Marathi speaking students and Konkani speaking students eliminating the effect of intelligence.
11. variation, if any, in critical thinking among Hindu, Muslim and Christian students eliminating the effect of Intelligence;
12. extent to which the secondary school teachers make use of the various techniques/strategies for developing critical thinking in their students;
13. variation, if any, in the use of critical thinking teaching strategies between Government and Private school teachers;
14. variation, if any, in the use of critical thinking teaching strategies among Science, Social Studies and Language teachers;
15. variation, if any, in the use of critical thinking teaching strategies among teachers who have teaching experience of 0-5 years, 10-20 years and above 25 years;
16. variation, if any, in the use of critical thinking teaching strategies between the teachers of high critical thinking (students) schools

and low critical thinking (students) schools;

17. homebackground of students having high and low levels of critical thinking.

Hypotheses of the Study

To realise the objectives stated above (except objective Nos. 1,2,12 and 17) the following hypotheses were tested.

1. There is no significant positive correlation between critical thinking appraisal scores and intelligence test scores eliminating the effect of Socio-economic status scores.
2. There is no significant positive correlation between critical thinking appraisal score and SES score eliminating the effect of intelligence test scores.
3. There is no significant positive correlation between critical thinking appraisal scores and academic achievement scores in each of the school subjects, as well as academic achievement as a whole eliminating the effect of intelligence test scores.
4. There is no significant difference between the mean critical thinking scores of rural and urban school students eliminating the effect of intelligence test scores.
5. There is no significant difference between mean critical thinking scores of government and private school students eliminating the effect of intelligence test scores.
6. There is no significant difference between boys and girls in their

mean critical thinking scores eliminating the effect of intelligence test scores.

7. There is no significant difference between the mean critical thinking scores of students coming from nuclear and joint families eliminating the effect of intelligence test scores.
8. There is no significant difference between mean critical thinking scores of Marathi speaking students and Konkani speaking students eliminating the effect of intelligence test scores.
9. There is no significant difference of mean critical thinking scores among Hindu, Christian and Muslim students eliminating the effect of intelligence test scores.
10. There is no significant difference between the mean critical thinking teaching strategy scores of Government and private school teachers.
11. There is no significant difference in mean critical thinking teaching strategy scores among Science, Social Studies and Languages teachers.
12. There is no significant difference in mean critical thinking teaching strategy scores among teachers who have teaching experience upto 5 years, 10-20 years and above 25 years.
13. There is no significant difference between mean critical thinking teaching strategy scores of the teachers of high critical thinking and low critical thinking (students) schools.

The various terms are operationally defined as follows:

1. Critical Thinking:

Revised Watson-Glaser Critical Thinking Appraisal was used to measure critical thinking of students. Hence, critical thinking was operationally defined as the score obtained by an individual on the Watson-Glaser Critical Thinking Appraisal.

2. Intelligence:

Culture Fare Intelligence Scale by Cattell *et. al.* was used to measure the intelligence of the students. Hence, intelligence was operationally defined as the score obtained by individual student on the Cattell Culture Fare Intelligence Scale.

3. Academic Achievement:

The score obtained by the students in different subjects in the S.S.C. examination conducted by the Goa Board of Secondary and Higher Secondary Education in March 1998 was considered as their academic achievement.

4. Socio-economic Status:

In the present study the socio-economic status of the students was measured in terms of caste, education, occupation, monthly income, assets, position in the society and facilities available at home. The socio-economic score of the students were the score obtained by taking the weightages assigned to various sub-categories under the seven variables mentioned above based on the scoring key/scheme developed/adapted by Pradhan and Behera (1997).

5. Contextual Variables:

In the present study, the students immediate setting (i.e., the

school and the home) was considered.

6. Teaching Strategies:

The specific teaching behaviour exhibited by the teachers in the classroom while teaching different subjects which are relevant for the development of critical thinking were considered as the teaching strategies.

7. Home Background:

Home background of a student in the present study include the following:

- i) Parents education and occupation
- ii) Economic status of the family
- iii) Types of family and size of family
- iv) Language (mother tongue)
- v) Religion
- vi) Facilities and practices in the home and surroundings.
- and vii) Parents child and/or significant elder-child interaction.

The present investigation studied the critical thinking abilities of the secondary school students studying in different types of schools in India in relation to different variables like intelligence, academic achievement, home background, nature and location of schools and teaching strategies. However, the study is limited to the government and private wised schools of the state of Goa. The students studying in the academic year 1997-98 were investigated which was again confined to Class X. The study of teaching strategies was confined to the teachers working in the selected sample of 10 percent of schools. The home background of only those students who were having high and low level of critical thinking was studied.

Method of Study

Descriptive comparative survey method was used in this study. All the secondary school students in different types of schools and their teachers in the academic year 1997-98 in the state of Goa were the accessible population of the study. Ten percent of the schools (27 schools) of each of the four categories viz: Rural Government, Urban Government, Rural Private and Urban Private were selected using stratified random sampling technique. The final data producing sample consisted 918 students of Class X (one division from each school) and 209 teachers from these schools.

The following data gathering tools were used to collect data for the present study.

1. Watson-Glaser Critical Thinking Appraisal (WGCTA), Form-S developed by Watson and Glaser (1994).
2. Culture Fair Intelligence Scale-III (English) by Cattell *et. al.*
3. Critical Thinking Teacher Behaviour Inventory (CTTBI).
4. Home Background Data Sheet (HBDS).
5. Information Schedule.

The investigator personally visited all the schools and collected the data in three phases as follows:

- Phase I: Collection of data from students (critical thinking, intelligence and Home background).
- Phase II: Administration of critical thinking teaching Behaviour Inventory.
- Phase III: Collection of academic achievement score.

On completion of the data collection the responses of the subjects recorded in the answer sheets were scored following the instructions

given in the manual and the scoring key provided/developed for the purpose. The scores were tabulated keeping in view the objectives and hypotheses of the study. The researcher used different statistical techniques such as Pearson's Product Moment Method of Correlation and partial correlation, t-test, ANOVA, ANCOVA, Frequency and percentage analysis, and content analysis to analyse the data.

5.1.1 Major Finding of the Study

The following are the major findings of the present study.

1. Standard X students included in the study found to have average level of critical thinking.
2. Significant positive but low correlation between critical thinking and intelligence eliminating the effect of socio-economic status was found.
3. There existed significant positive but low correlation between critical thinking and socio-economic status. But after eliminating the effect of intelligence, no significant correlation was found between the two variables.
4. Significant positive but low correlation between critical thinking and academic achievement (in each subject separately as well as achievement as a whole i.e., all subjects together) was found.
5. The Rural and Urban school students did not differ significantly in their critical thinking ability.
6. The Government and private school students did not differ in their critical thinking ability.

7. Significant difference between the mean critical thinking scores of boys and girls was found. But eliminating the effect of intelligence, no significant difference was found between the two means.
8. There was no significant difference in critical thinking ability between the students from nuclear and joint families.
9. The Marathi speaking and Konkani speaking students did not vary in their critical thinking ability.
10. The Hindu, Christian and Muslim students did not differ in their critical thinking ability.
11. A very negligible percentage of teachers used critical thinking teaching strategies very often and thirty seven percent of teachers used these strategies often. More than fifty percent of teachers used the strategies only sometimes and a very negligible percentage used hardly any of these strategies.
12. The Government and Private school teachers did not differ in the extent to which they used critical thinking teaching strategies.
13. The Science, Social Studies and the Language teachers did not differ significantly in the use of critical thinking teaching strategies.
14. The teachers who had teaching experience of upto 5 years, 10-20 years and above 25 years did not differ in the extent to which they used critical thinking teaching strategies.

15. The use of critical thinking teaching strategies by the teachers of the high and low critical thinking schools differ significantly and the difference was in favour of teachers teaching in the high critical thinking schools.
16. Home background of students have a significant influence on the development of critical thinking ability.

5.2 Conclusions

Based on the findings of the study the following conclusions were drawn.

1. Students of Std. X in Goa possess average level of critical thinking ability.
2. Critical thinking is significantly positively correlated with intelligence.
3. There is no significant correlation between critical thinking and socio-economic status.
4. There is significant and positive correlation between critical thinking and academic achievement of secondary school students.
5. Locality of students (residing in rural or urban areas) does not have differential effect on development of critical thinking among secondary school students.
6. Types of schools (Government or Private managed) do not produce differential effect on the development of critical thinking ability among the secondary school students.

7. Gender is not a factor associated with development of critical thinking ability among secondary school students.
8. Type of family (Nuclear or Joint) is not a factor associated with development of critical thinking among school children.
9. Mother tongue of a child (speaking Marathi or Konkani) does not affect the development of critical thinking ability.
10. Religion is not a factor associated with development of critical thinking ability.
11. Majority of the secondary school teachers in Goa use critical thinking strategies only sometimes.
12. Government and private school teachers use critical thinking teaching strategies to the same extent.
13. Secondary school teachers teaching different subjects use the various critical thinking teaching strategies to the same extent.
14. Years of teaching experience of teachers is not a factor related to the extent to which they use the different critical thinking teaching strategies.
15. Use of different critical thinking teaching strategies by teachers in teaching different subjects helps in developing critical thinking ability of the students.

16. Home environment of the students affects the development of their critical thinking ability.

5.3 Recommendations

Based on the findings of the study the following action points are recommended for implementation.

1. Since the students under study possess average level of critical thinking, there is an urgent need to sensitise teachers of secondary schools about the need and importance of developing critical thinking among the students. This can be done by organising seminars/workshops/orientation programmes by school complex, SIE, DIET and secondary teacher education institutions in the state of Goa.

2. Since the study revealed that majority of teachers use critical thinking strategies only sometimes it is necessary that the teachers make conscious efforts to use the critical thinking teaching strategies as frequently as possible during teaching learning process in various school subjects. Intensive programmes/workshops needs to be conducted for the teachers to develop in them the skills of using various strategies. The workshops and seminars may focus on (i) Self reflection and critical analysis of the present methods followed (ii) exposure to critical thinking strategies (iii) approaches to incorporate the critical thinking strategies in the teaching learning process and (iv) remodelling the lesson plans incorporating the critical thinking strategies.

3. Exposure to methods of developing critical thinking could be emphasised during the pre-service teacher education programme by the teacher education institutions. The skills of using various critical thinking strategies should be developed in the prospective teachers during the pre-service programmes itself. Necessary training may be provided to them for incorporating the critical thinking teaching strategies in the lesson plans of different school subjects.
4. Since better quality home background has positive influence on development of critical thinking of students, the parents need to be oriented accordingly. This could be achieved by strengthening parent-teachers' associations. Parents should be made to understand the importance of providing a democratic home atmosphere in which ideas/views of their wards are encouraged and valued. Also for fostering thinking the importance of encouraging discussion of wide variety of subject matters by way of questioning, inquiring, arguing and sharing must be made known to the parents.
5. The study revealed that facilities and practices in the community too influence the development of critical thinking. This necessitates establishing a strong school community relationship. Critical thinking is shaped not only at home and school but community has also a major role to play. Students must be made to interact with the community by organising various community linked activities and also by making students play an active role in the activities organised by the community.
6. The notion that the private schools are better than government schools and urban schools are better than rural schools does not

hold good in the case of critical thinking. The study revealed the fact that the rural/government schools and urban/private schools student possess the same level of critical thinking. Hence it is necessary that all teachers irrespective of the types of schools in which they teach should make conscious efforts for enhancing critical thinking ability of their students by incorporating various critical thinking teaching strategies in teaching of different school subjects as well as by conducting various activities/programmes like debate, discussion, elocution etc.

7. Curriculum should be flexible. Rigid following of textual matters as it is should be avoided if one has to develop critical thinking among students. In this age of knowledge explosion, the teachers are unable to take the responsibility of transferring entire information to the students, instead students should be made independent by developing their critical thinking ability so that they are able to gather and process information by themselves. Coverage of syllabus in a stereotyped fashion and evaluating the lower order skills of recall should be done away if one is serious about fostering this ability.
8. The existing hue and cry about lowering academic standards could be taken care by developing critical thinking among students. Since the study revealed substantial relationship between critical thinking and achievements in different subjects, improvement in the first factor would naturally secure improvement in the second factor as well. Hence, it is necessary that critical thinking ability be properly emphasised in teaching different subjects. Critical thinking should be consciously cultivated through variety of situation; classroom teaching, in the laboratory, field study situations and through literary and cultural activities.

5.4 Suggestions for Further Research

1. The same study may be replicated on the students studying in other class levels.
2. The rural urban variation in development of critical thinking may be investigated in other geographical areas.
3. Critical thinking is a complex ability which takes times to develop. Longitudinal/Developmental studies may be undertaken to investigate the development of critical thinking skills over a period of time.
4. Teachers perception and attitudes towards teaching for developing critical thinking could be investigated by researchers in Indian context.
5. Studies can be taken up to ascertain the levels of critical thinking of teachers.
6. Since test results may not reflect all that transpires during a study of students' critical thinking skills, studies having a larger qualitative component in the design would be useful.
7. Intervention studies using programs that aimed at developing critical thinking may be taken up.
8. An indepth study can be conducted regarding the use of critical thinking teaching strategies by employing various techniques like participant observation, interviews etc.

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APPENDIX - A

LIST OF SCHOOLS INCLUDED IN THE STUDY

A. URBAN PRIVATE SCHOOLS

1. Acdils H.S.
2. A.J. de. Almeida H.S, Ponda
3. St. Andrews Institute, Vasco
4. Bhatikar Model H.S, Margao
5. Deepvihar H.S, Vasco
6. Gardian Agnel H.S, Saverdem
7. Mustifund H.S, Panaji
8. Rosary H.S, Miramar
9. Saraswath Vidyalaya, Mapusa

B. RURAL PRIVATE SCHOOLS

10. Abhinav Vidyamandir, Molem
11. Blessed Joseph Vaz H.S, Sancoale
12. Chandranath Education Society's H.S, Assolda
13. Ideal H.S, Piligao
14. St. Lawrence H.S, Agassaim
15. M.I.B.K. H.S, Khandepar
16. Peoples H.S, Camaurlim
17. Saviour of the World H.S, Loutolim
18. Sreeram H.S, Khadki

C. URBAN GOVERNMENT SCHOOLS

19. Government H.S, Dona paula
20. Government H.S, Ponda
21. Government H.S, Vadem - Nagar
22. Government H.S, Vasco Main

D. RURAL GOVERNMENT SCHOOLS

23. Government H.S, Amona
24. Government H.S, Dhavisherem
25. Government H.S, Guleli
26. Government H.S, Xeldem
27. Government H.S, Kundaim

AWGCTA APPENDIX B

Watson-Glaser
Critical Thinking Appraisal

Form S

Directions

This booklet contains five types of tests designed to find out how well you are able to reason analytically and logically. *Each test has separate directions that should be read carefully.*

Do not turn this page until instructed to do so.

Do not make any marks in this test booklet.

All answers are to be marked on the separate answer sheet provided. Use a sharp No. 2 pencil to mark your answers. If you wish to change an answer, be sure to erase your old answer completely.



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TEST 1: INFERENCE

DIRECTIONS

An inference is a conclusion a person can draw from certain observed or supposed facts. For example, if the lights are on in a house and music can be heard coming from the house, a person might infer that someone is at home. But this inference may or may not be correct. Possibly the people in the house did not turn the lights and the radio off when they left the house.

In this test, each exercise begins with a statement of facts that you are to regard as true. After each statement of facts you will find several possible inferences—that is, conclusions that some persons might draw from the stated facts. Examine each inference separately and make a decision as to its *degree* of truth or falsity.

For each inference you will find spaces on the answer sheet labeled T, PT, ID, PF, and F. For each inference make a mark on the answer sheet under the appropriate heading as follows:

- T** if you think the inference is definitely **TRUE**; that it properly follows beyond a reasonable doubt from the statement of facts given.
- PT** if, in the light of the facts given, you think the inference is **PROBABLY TRUE**; that it is more likely to be true than false.
- ID** if you decide that there are **INSUFFICIENT DATA**; that you cannot tell from the facts given whether the inference is likely to be true or false; if the facts provide no basis for judging one way or the other.
- PF** if, in the light of the facts given, you think the inference is **PROBABLY FALSE**; that it is more likely to be false than true.
- F** if you think the inference is definitely **FALSE**; that it is wrong, either because it misinterprets the facts given, or because it contradicts the facts or necessary inferences from those facts.

Sometimes, in deciding whether an inference is probably true or probably false, you will have to use certain commonly accepted knowledge or information that practically every person has. This will be illustrated in the example that follows.

Look at the example in the next column; the correct answers are indicated in the block at the right.

EXAMPLE

Two hundred students in their early teens voluntarily attended a recent weekend student conference in a Midwestern city. At this conference, the topic of race relations and means of achieving lasting world peace were discussed, since these were the problems the stu-

	Test 1				
	T	PT	ID	PF	F
1	○	●	○	○	○
2	○	○	○	●	○
3	○	○	●	○	○
4	○	○	○	○	●
5	●	○	○	○	○

dents selected as being most vital in today's world.

- As a group, the students who attended this conference showed a keener interest in broad social problems than do most other students in their early teens.
- The majority of the students had not previously discussed the conference topics in their schools.
- The students came from all sections of the country.
- The students discussed mainly labor relations problems.
- Some teenage students felt it worthwhile to discuss problems of race relations and ways of achieving world peace.

In the above example, inference 1 is probably true (PT) because (as is common knowledge) most people in their early teens do not show so much serious concern with broad social problems. It cannot be considered definitely true from the facts given because these facts do not tell *how much* concern other young teenagers may have. It is also possible that some of the students volunteered to attend mainly because they wanted a weekend outing.

Inference 2 is probably false (PF) because the students' growing awareness of these topics probably stemmed at least in part from discussions with teachers and classmates.

There is no evidence for inference 3. Thus, there are insufficient data (ID) for making a judgment on the matter.

Inference 4 is definitely false (F) because it is given in the statement of facts that the topics of race relations and means of achieving world peace were the problems chosen for discussion.

Inference 5 necessarily follows from the given facts; it therefore is true (T).

In the exercises that follow, more than one of the inferences from a given statement of facts may be true (T), or false (F), or probably true (PT), or probably false (PF), or have insufficient data (ID) to warrant any conclusion. Thus, you are to judge each inference independently.

Make a heavy black mark in the space under the heading that you think best describes each inference. If you change an answer, erase it thoroughly. Make no extra marks on the answer sheet.

Go on to the next page ▶

EXERCISES

In 1946 the United States Armed Forces conducted an experiment called "Operation Snowdrop" to find out what kinds of military personnel seemed to function best under severe arctic climatic conditions. Some of the factors examined were weight, age, blood pressure, and national origin. All of the participants in "Operation Snowdrop" were given a training course in how to survive and function in extreme cold. At the conclusion of the experiment, it was found that only two factors among those studied distinguished between personnel whose performance was rated as "effective" and those rated as "not effective" on the arctic exercises. These factors were: (1) desire to participate in the experiment, and (2) degree of knowledge and skill regarding how to live and protect oneself under arctic conditions.

1. Despite the training course given to all of the participants in "Operation Snowdrop," some participants exhibited greater arctic survival knowledge or skill than others.
2. It was believed by the Armed Forces that military operations might someday be carried out in an arctic-like environment.
3. A majority of the personnel who participated in "Operation Snowdrop" thoroughly disliked the experience.
4. Participants having normal weight and blood pressure were rated as significantly more effective on the arctic exercises than were the other participants.

Some time ago a crowd gathered in Middletown to hear the new president of the local Chamber of Commerce speak. The president said, "I am not asking, but demanding, that labor unions now accept their full share of responsibility for civic improvement and community welfare. I am not asking, but demanding, that they join the Chamber of Commerce." The members of the Central Labor Unions who were present applauded enthusiastically. Three months later all the labor unions in Middletown were represented in the Chamber of Commerce. These representatives worked with representatives of other groups on committees, spoke their minds, participated actively in the civic improvement projects, and helped the Chamber reach the goals set in connection with those projects.

5. Both the labor union representatives and the other members of the committees came to a better recognition of one another's viewpoints through their Chamber of Commerce contacts.
6. Union participation in the Middletown Chamber of Commerce greatly reduced worker-management disputes in that town.
7. Most of the union representatives regretted having accepted the invitation to participate in the Chamber of Commerce.

Go on to the next page ►

TEST 2: RECOGNITION OF ASSUMPTIONS

DIRECTIONS

An assumption is something presupposed or taken for granted. When you say, "I'll graduate in June," you take for granted or assume that you will be alive in June, that your school will judge you to be eligible for graduation in June, and similar things.

Below are a number of statements. Each statement is followed by several proposed assumptions. You are to decide for each assumption whether a person, in making the given statement, is really making that assumption — that is, taking it for granted, justifiably or not.

If you think that the given assumption is taken for granted in the statement, make a heavy black mark under "ASSUMPTION MADE" in the proper place on the answer sheet. If you think the assumption is *not* necessarily taken for granted in the statement, blacken the space under "ASSUMPTION NOT MADE." Remember to judge each assumption independently.

Below is an example. The block at right shows how these items should be marked on the answer sheet.

EXAMPLE											
<i>Statement:</i> "We need to save time in getting there so we'd better go by plane."											
<i>Proposed Assumptions:</i>											
1. Going by plane will take less time than going by some other means of transportation. (It is assumed in the statement that the greater speed of a plane over the speeds of other means of transportation will enable the group to reach its destination in less time.)	<table border="1"> <thead> <tr> <th colspan="2">Test 2 Assumption</th> </tr> <tr> <th>Made</th> <th>Not Made</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>● ○</td> </tr> <tr> <td>2</td> <td>● ○</td> </tr> <tr> <td>3</td> <td>○ ●</td> </tr> </tbody> </table>	Test 2 Assumption		Made	Not Made	1	● ○	2	● ○	3	○ ●
Test 2 Assumption											
Made		Not Made									
1	● ○										
2	● ○										
3	○ ●										
2. There is plane service available to us for at least part of the distance to the destination. (This is necessarily assumed in the statement since, in order to save time by plane, it must be possible to go by plane.)											
3. Travel by plane is more convenient than travel by train. (This assumption is not made in the statement — the statement has nothing to do with saving time, and says nothing about convenience or about any other specific mode of travel.)											

EXERCISES

Statement: "Zenith is the city to move to — it has the lowest taxes."

Proposed assumptions:

8. Lower taxes imply efficient city management.
9. In deciding where to live, it is important to avoid high taxes.
10. The majority of the residents in Zenith are content with their present city government.

Statement: "I'm traveling to South America. I want to be sure that I do not get typhoid fever, so I shall go to my physician and get vaccinated against typhoid fever before I begin my trip."

Proposed assumptions:

11. If I don't take the injection, I shall become ill with the fever.
12. By getting vaccinated against typhoid fever, I decrease the chances that I will get the disease.
13. Typhoid fever is more common in South America than it is where I live.

Statement: "If war is inevitable, we'd better launch a preventive war now while we have the advantage."

Proposed assumptions:

14. If we fight now, we are more likely to win than we would be if forced to fight later.
15. If we don't launch a preventive war now, we'll lose any war that may be started by an enemy later.

Go on to the next page ▶

TEST 3: DEDUCTION

DIRECTIONS

In this test, each exercise consists of several statements (premises) followed by several suggested conclusions. For the purposes of this test, consider the statements in each exercise as true without exception. Read the first conclusion beneath the statements. If you think it necessarily follows from the statements given, make a heavy black mark under "CONCLUSION FOLLOWS" in the proper place on the answer sheet. If you think it is not a necessary conclusion from the statements given, put a heavy black mark under "CONCLUSION DOES NOT FOLLOW," even though you may believe it to be true from your general knowledge.

Likewise, read and judge each of the other conclusions. Try not to let your prejudices influence your judgment - just stick to the given statements (premises) and judge each conclusion as to whether it necessarily follows from them.

The word "some" in any of these statements means an indefinite part or quantity of a class of things. "Some" means at least a portion, and perhaps all of the class. Thus, "Some holidays are rainy" means at least one, possibly more than one, and perhaps even all holidays are rainy.

Study the example carefully before starting the test.

EXAMPLE		Test 3	
Some holidays are rainy. All rainy days are boring. Therefore —		Conclusion	
		Does Not	
		Follows	Follow
1.	No clear days are boring. (The conclusion does not follow. You cannot tell from the statements whether or not clear days are boring. Some may be).	○	●
2.	Some holidays are boring. (The conclusion necessarily follows from the statements since, according to them, the rainy holidays must be boring.)	●	○
3.	Some holidays are not boring. (The conclusion does not follow, even though you may know that some holidays are very pleasant.)	○	●

EXERCISES

No person who thinks scientifically places any faith in the predictions of astrologers. Nevertheless, there are many people who rely on horoscopes provided by astrologers. Therefore -

- 16. People who lack confidence in horoscopes think scientifically.
- 17. Many people do not think scientifically.

All members of symphony orchestras enjoy playing classical music. All members of symphony orchestras spend long hours practicing. Therefore -

- 18. Musicians who play classical music do not mind spending long hours practicing.
- 19. Some musicians who spend long hours practicing enjoy playing classical music.

Rice and celery must have a good deal of moisture in order to grow well, but rye and cotton grow best where it is relatively dry. Rice and cotton grow where it is hot, and celery and rye where it is cool. In Timbuktu, it is very hot and damp. Therefore -

- 20. Neither the temperature nor the moisture conditions in Timbuktu are favorable for growing a celery crop.
- 21. The temperature and moisture conditions in Timbuktu are more favorable for growing rice than for growing celery, cotton, or rye.
- 22. Conditions in Timbuktu are not altogether favorable for growing a cotton or a rye crop.

Most persons who attempt to break their smoking habit find that it is something that they can accomplish only with difficulty, or cannot accomplish at all. Nevertheless, there is a growing number of individuals whose strong desire to stop smoking has enabled them to break the habit permanently. Therefore -

- 23. Only smokers who strongly desire to stop smoking will succeed in doing so.
- 24. A strong desire to stop smoking helps some people to permanently break the habit.

Go on to the next page ▶

TEST 4: INTERPRETATION

DIRECTIONS

Each exercise below consists of a short paragraph followed by several suggested conclusions.

For the purpose of this test, assume that everything in the short paragraph is true. The problem is to judge whether or not each of the proposed conclusions logically follows beyond a reasonable doubt from the information given in the paragraph.

If you think that the proposed conclusion follows beyond a reasonable doubt (even though it may not follow absolutely and necessarily), then make a heavy black mark under "CONCLUSION FOLLOWS" in the proper place on the answer sheet. If you think that the conclusion does not follow beyond a reasonable doubt from the facts given, then blacken the space under "CONCLUSION DOES NOT FOLLOW." Remember to judge each conclusion independently.

Look at the example below; the block at the right shows how the answers should be marked on the answer sheet.

EXAMPLE		Test 4	
A study of vocabulary growth in children from eight months to six years old shows that the size of spoken vocabulary increases from zero words at age eight months to 2562 words at age six years.		Conclusion	
		Does Not	
		Follows	Follow
1.	None of the children in this study had learned to talk by the age of six months. (The conclusion follows beyond a reasonable doubt since, according to the statement, the size of the spoken vocabulary at eight months was zero words.)	<input checked="" type="radio"/>	<input type="radio"/>
2.	Vocabulary growth is slowest during the period when children are learning to walk. (The conclusion does not follow since there is no information given that relates growth of vocabulary to walking.)	<input type="radio"/>	<input checked="" type="radio"/>

EXERCISES

When the United States Steel Corporation was created in 1902, it was the largest corporation America had known up to that time. It produced twice as much steel as all of its domestic competitors put together. Today, the United States Steel Corporation produces about 20 percent of the steel that is made in this country.

- 25. In 1902, the United States Steel Corporation produced not less than 66 percent of the total domestic output of steel.
- 26. Today, domestic competitors produce more than three times as much steel as does the United States Steel Corporation.
- 27. The United States Steel Corporation produces less steel today than it did in 1902.

Pat had poor posture, had very few friends, was ill at ease in company, and in general was very unhappy. Then, a close friend recommended that Pat visit Dr. Baldwin, a reputed expert on helping people improve their personalities. Pat took this recommendation and, after three months of treatment by Dr. Baldwin, developed more friendships, was more at ease, and in general felt happier.

- 28. Without Dr. Baldwin's treatment, Pat would not have improved.
- 29. Without a friend's advice, Pat would not have heard of Dr. Baldwin.

When I go to bed at night, I usually fall asleep quite promptly. But about twice a month I drink coffee during the evening, and whenever I do, I lie awake and toss for hours.

- 30. My problem is mostly psychological; I expect that the coffee will keep me awake and therefore it does.
- 31. On nights when I want to fall asleep promptly, I'd better not drink coffee in the evening.

Go on to the next page ▶

TEST 5: EVALUATION OF ARGUMENTS

DIRECTIONS

In making decisions about important questions, it is desirable to be able to distinguish between arguments that are strong and arguments that are weak, as far as the question at issue is concerned. *For an argument to be strong, it must be both important and directly related to the question.*

An argument is weak if it is not directly related to the question (even though it may be of great general importance), or if it is of minor importance, or if it is related only to trivial aspects of the question.

Below is a series of questions. Each question is followed by several arguments. *For the purpose of this test, you are to regard each argument as true.* The problem then is to decide whether it is a *strong* or a *weak* argument.

Make a heavy black mark on the answer sheet under "ARGUMENT STRONG" if you think the argument is strong, or under "ARGUMENT WEAK" if you think the argument is weak. Judge each argument separately on its own merit. *Try not to let your personal attitude toward the question influence your evaluation of the argument, since each argument is to be regarded as true.*

In the example, note that the argument is evaluated as to how well it supports the side of the question indicated.

EXAMPLE		Test 5 Argument	
Should all young men in the United States go to college?		Strong	Weak
1.	Yes; college provides an opportunity for them to learn school songs and cheers. (This would be a silly reason for spending years in college.)	○	●
2.	No; a large percent of young men do not have enough ability or interest to derive any benefit from college training. (If this is true, as the directions require us to assume, it is a weighty argument against all young men going to college.)	●	○
3.	No; excessive studying permanently warps an individual's personality. (This argument, although of great general importance when accepted as true, is not directly related to the question, because attendance at college does not necessarily require excessive studying.)	○	●

When the word "should" is used as the first word in any of the following questions, its meaning is, "Would the proposed action promote the general welfare of the people in the United States?"

EXERCISES

Should groups in this country who are opposed to some of our government's policies be permitted unrestricted freedom of press and speech?

- 32. Yes; a democratic state thrives on free and unrestricted discussion, including criticism.
- 33. No; the countries opposed to our form of government do not permit the free expression of our points of view in their territories.

Should the United States Department of Defense keep the public informed of its anticipated scientific research programs by publicizing ahead of time the needs that would be served by each program?

- 34. No; some become critical of the government when widely publicized projects turn out unsuccessfully.
- 35. Yes; only a public so informed will support vital research and development activities with its tax dollars.

Do juries decide court cases fairly when one of the opposing parties is rich and the other is poor?

- 36. No; because rich people are more likely to settle their cases out of court.
- 37. No; most jurors are more sympathetic to poor people than to the rich, and the jurors' sympathies affect their findings.
- 38. No; because rich people can afford to hire better lawyers than poor people, and juries are influenced by the skill of the opposing lawyers.

Should pupils be excused from public schools to receive religious instruction in their own churches during school hours?

- 39. No; having public school children go off to their separate churches during school hours would seriously interfere with the educational process and create friction among children of different religions.
- 40. No; religious instruction during school hours would violate our constitutional separation of church and state; those who desire such instruction are free to get it after school hours.

STOP.
You may go back and check your work.

Watson - Glaser Critical Thinking Appraisal (WGCTA) Answer Sheet / उत्तर पत्रिका

DO NOT WRITE ON THIS ANSWER SHEET UNTIL YOU ARE TOLD TO DO SO.

स्पष्ट सूचना मिळपर्यंत उत्तरपत्रिकेवर काहीही लिहू नका.

- Use a pencil Only.
फक्त पेन्सिलचाच वापर करा.
- Darken the circle completely.
वर्तूळ संपूर्णपणे काळे करा.
- Erase Clearly any marks you wish to change.
एखादे उत्तर तुम्हाला बदलायचे असेल तर पूर्वीचे तूगचे उत्तर संपूर्णपणे खोडून टाका.
- Do not make any stray mark on this Form.
या पत्रिकेवर कुठल्याही अतिरिक्त खूणा करू नका.

Correct Mark / बरोबर चिन्ह



Incorrect Mark / चूक चिन्ह



Your Name: _____

Name of the school: _____

Male _____ Female _____

Date: _____

TEST 1: / चांचणी १ : INFERENCE / अनुमान					
Q. NO. प्र. क्र.	T स	PT सं.स.	ID अ. मा.	PF सं. अ.	F चूक
1	○	○	○	○	○
2	○	○	○	○	○
3	○	○	○	○	○
4	○	○	○	○	○
5	○	○	○	○	○
6	○	○	○	○	○
7	○	○	○	○	○

TEST 2: / चांचणी २ : RECOGNITION OF / कल्पनांची ASSUMPTIONS / मान्यता		
Assumptions / कल्पना		
Q. NO. प्र. क्र.	Made गृहित धरले	Not Made गृहित धरले नाही
8	○	○
9	○	○
10	○	○
11	○	○
12	○	○
13	○	○
14	○	○
15	○	○

TEST 3: / चांचणी ३ : DEDUCTION / निष्कर्ष		
Conclusion / निष्कर्ष		
Q. NO. प्र. क्र.	Follow पाठपूरावा करणारा	Does not Follow पाठपूरावा न करणारा
16	○	○
17	○	○
18	○	○
19	○	○
20	○	○
21	○	○
22	○	○
23	○	○
24	○	○

TEST 4: / चांचणी ४ : INTEPRETATION / स्पष्टीकरण		
Conclusion / निष्कर्ष		
Q. NO. प्र. क्र.	Follow पाठपूरावा करणारा	Does not Follow पाठपूरावा न करणारा
25	○	○
26	○	○
27	○	○
28	○	○
29	○	○
30	○	○
31	○	○

TEST 5: EVALUATION / चांचणी ५ : ARGUMENTS / मुद्यांचे मूल्यांकन		
Argument / मूद्दा		
Q. NO. प्र. क्र.	Strong बळकट	Weak दुर्बल
32	○	○
33	○	○
34	○	○
35	○	○
36	○	○
37	○	○
38	○	○
39	○	○
40	○	○

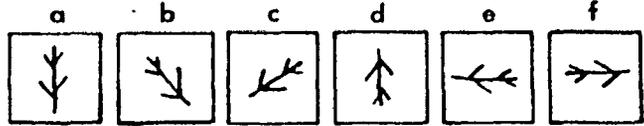
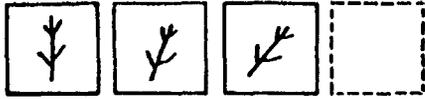
DO NOT WRITE IN THIS BOX

या जागेत काहीही लिहू नका

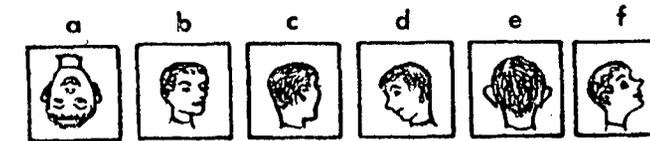
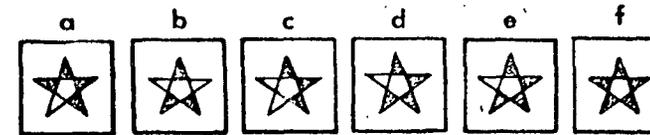
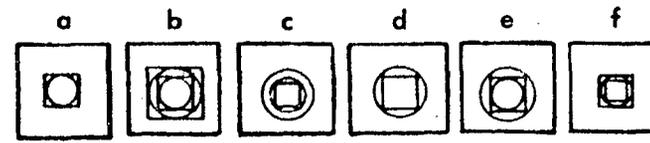
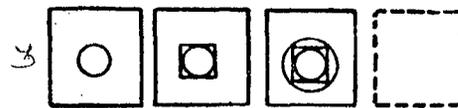
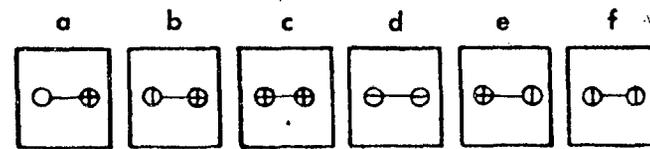
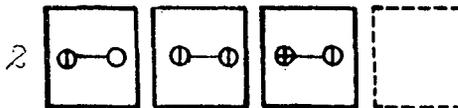
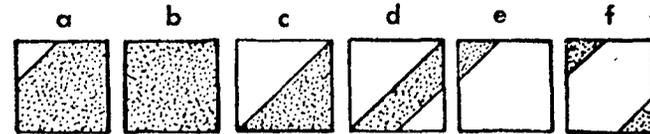
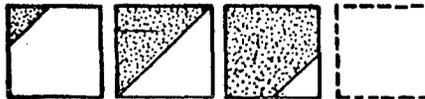
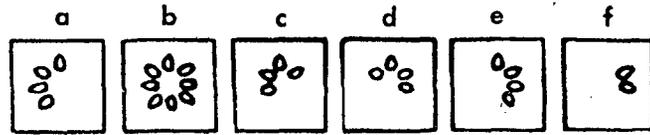
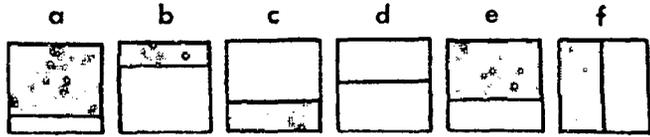
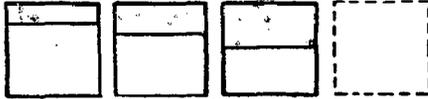
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Examples



Answers



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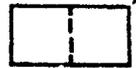
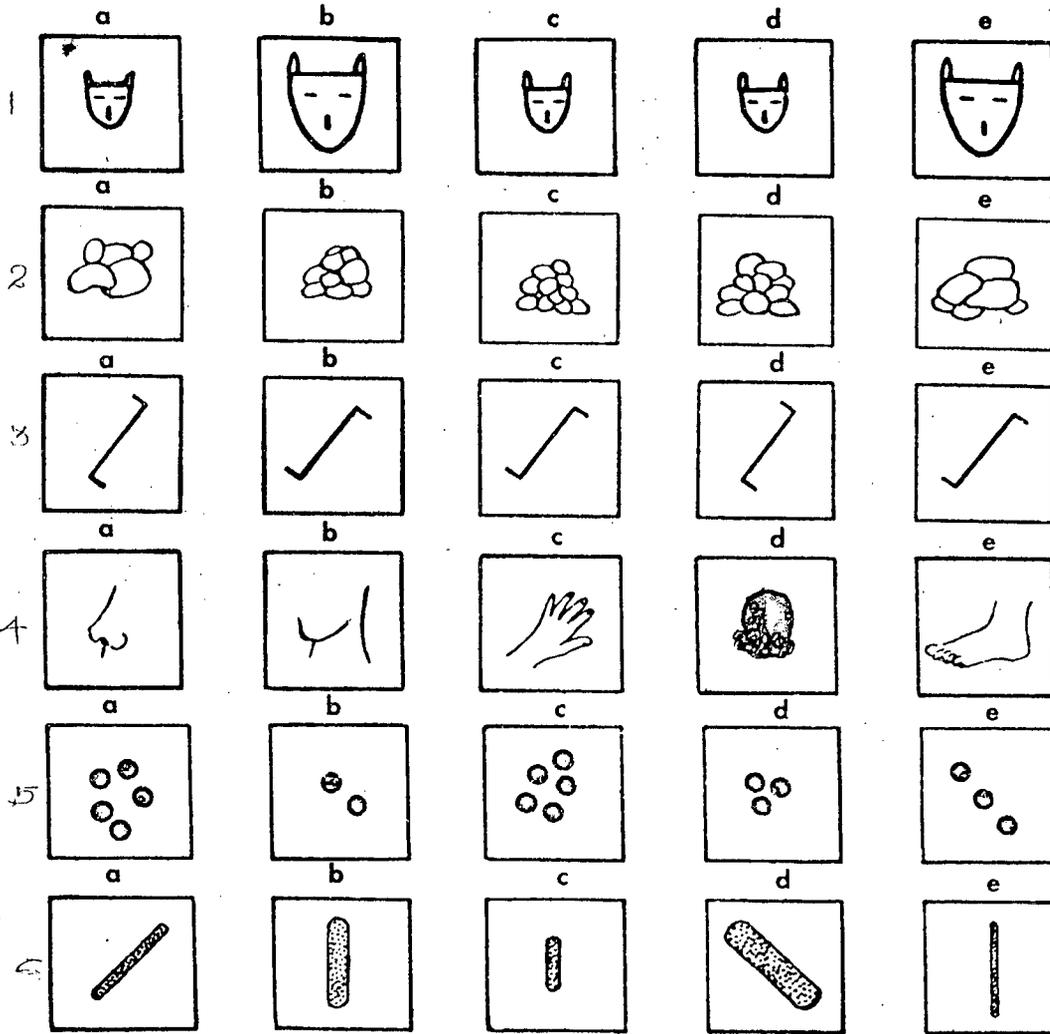
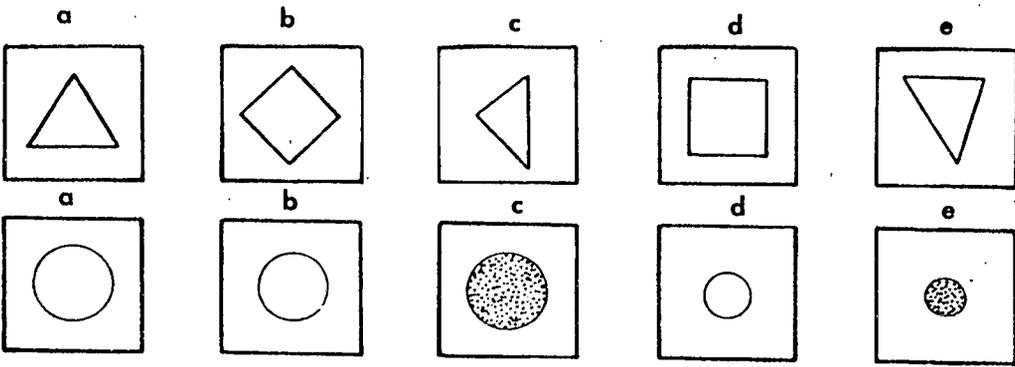
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Examples

Answers



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Answers

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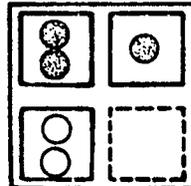
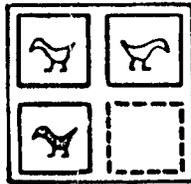
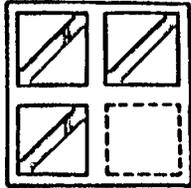
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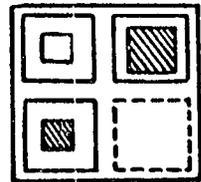
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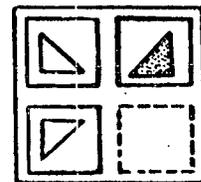
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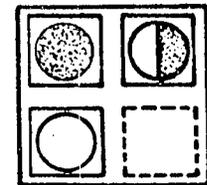
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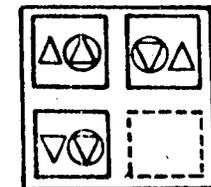
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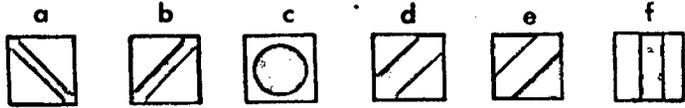
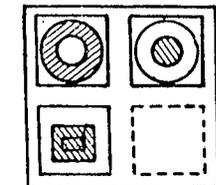
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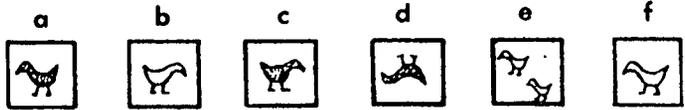
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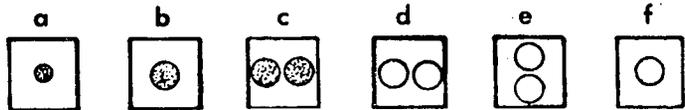
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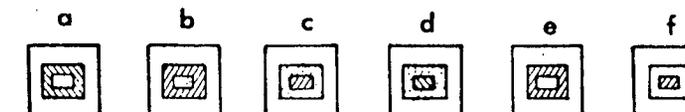
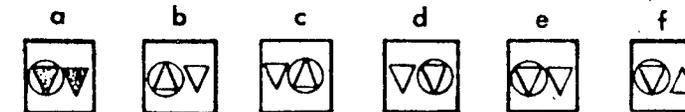
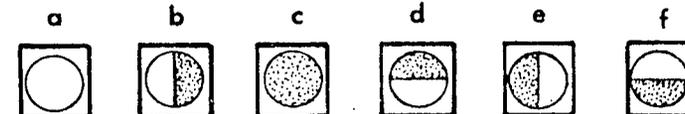
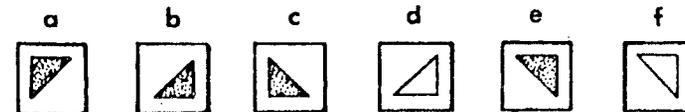
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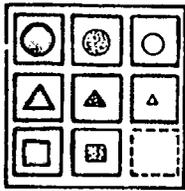
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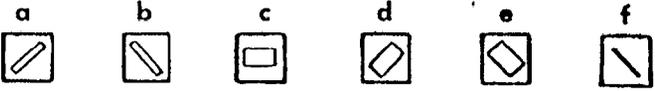
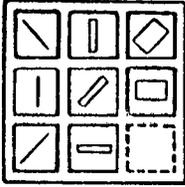
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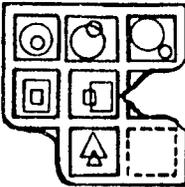
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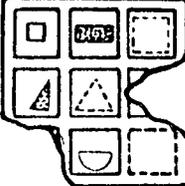
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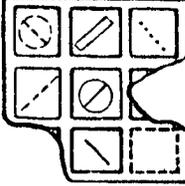
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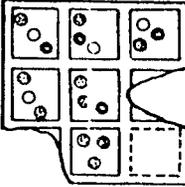
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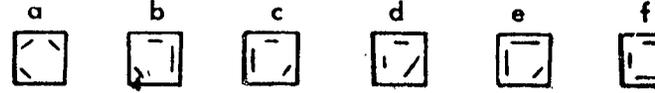
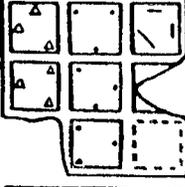
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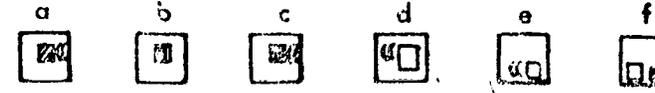
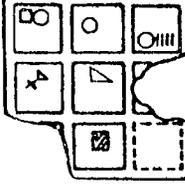
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12.



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ANSWERS

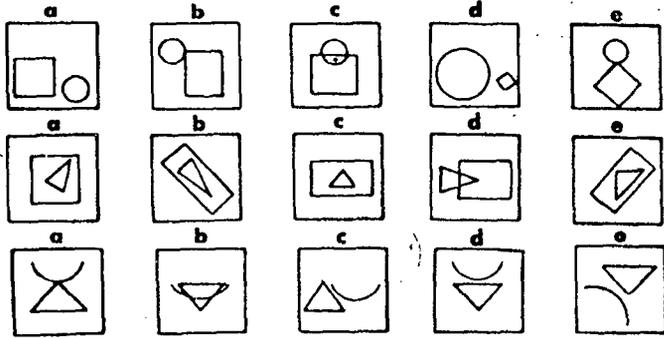
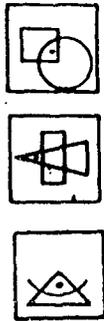


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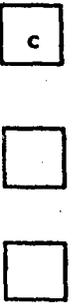
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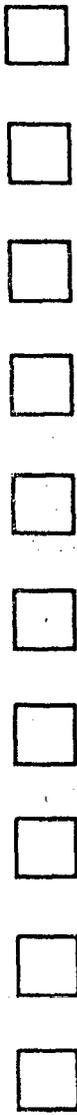
Examples



Answers



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3.		a	b	c	d	e
4.		a	b	c	d	e
5.		a	b	c	d	e
6.		a	b	c	d	e
7.		a	b	c	d	e
8.		a	b	c	d	e
9.		a	b	c	d	e
10.		a	b	c	d	e



End of Test 4

8.

APPENDIX D

35 Dimensions of Critical Thinking A Rating Scale

Name : _____ Designation: _____

Institution : _____ Date : _____

Direction : Given below are a set of 35 dimensions of Critical Thinking that should ideally be developed in the classroom. Constraints in terms of time, syllabus coverage, nature of curriculum, students and teachers potential, infrastructure facilities etc., exist in our schools. Keeping all this in view, which dimensions do you feel could the teachers develop among the secondary school children in Goa, and to what extent ? (You are not to rate keeping in mind what is happening but what is possible)

Under each dimension of Critical Thinking certain teacher behaviours are specified. These behaviours together contribute to the development of corresponding dimensions of Critical Thinking. Taking the help of these teacher behaviours please rate each of the 35 dimensions, by encircling the appropriate number out of the five numbers (representing degrees of attainability) given against each dimension using the scale given below.

- 1 - Not at all*
2 - Hardly
3 - To some extent
4 - To a great extent
5 - Very much

35 Dimensions of Critical Thinking With corresponding teacher behaviours	Rating				
	1 - Not at all	2 - Hardly	3 - To some extent	4 - To a great extent	5 - Very much
1. Thinking Independently <input type="radio"/> Encouraging students to gather and assemble information <input type="radio"/> Facilitating the use of knowledge, skills and insights by the students. <input type="radio"/> Asking students to find solution to problems on their own <input type="radio"/> Encouraging students to brainstorm ideas <input type="radio"/> Asking students to form categories and classify information <input type="radio"/> Asking students to draw and evaluate conclusions	1	2	3	4	5
2. Developing Insight into Ego centricity or Socio Centricity <input type="radio"/> Facilitating discussion of egocentric (I am 100% right) or Socio centric (we are 100% right) thought <input type="radio"/> Encouraging students to listen carefully and open - mindedly to those with whom they disagree	1	2	3	4	5

- Asking students to make their assumption explicit and critique them
- Facilitating discussion of why people think irrationally and act unfairly
- Encouraging students to recognise common pattern of ego centric thought
- Asking students to apply the same concepts in the same way to themselves and others.
- Asking students to consider every relevant fact and to make their conclusions consistent with the evidence.

3. Exercising Fairmindedness

1 2 3 4 5

- Asking students to state one another's position when disputes arise
- Giving students opportunities to correct any misunderstanding of their positions
- Asking students to explain why their fellow students see an issue differently
- Asking students for evidence and reason for what they agree and disagree on
- Asking students to consider positions from others point of view
- Asking students to compare and evaluate different points of view
- Asking questions like :
 - Why do people choose to do things differently?
 - Why do some people think their ways are best?

4. Exploring Thoughts Underlying Feelings and Feelings Underlying Thoughts.

1 2 3 4 5

- Helping students to realize the intimate connections between thought and feeling / reason and emotion
- Helping students to understand their feelings and emotions in relation to their thoughts, ideas and interpretations.
- Asking students to consider what a person might be thinking while experiencing a particular feeling in a particular situation
- Asking students to discuss various reasons for resistance to change.
- Asking students to generalize about thought behind various emotions.
- Asking questions like :
 - How did you come to feel this way?
 - Why do you feel this way?
 - How is he interpreting his situation?
 - What led him to that conclusion?
 - Would you have felt the same if you had been in his position?

5. Developing Intellectual Humility and Suspending Judgments

1 2 3 4 5

- Modelling intellectual humility by demonstrating a willingness to admit limits of his / her own knowledge.
- Using phrases like "I believe", "I am pretty sure", "I doubt", "I suspect", "perhaps", "it seems" etc.
- Helping students to distinguish what they know from what they don't know
- Making students suspend judgment until they find out the relevant information
- Encouraging students to explain what they would need to learn in order to be more certain

- | | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 6. Developing Intellectual Courage | | | | | |
| ○ Encouraging students to honestly consider or doubt any belief | | | | | |
| ○ Giving support to students who disagree with or doubt their peers or texts | | | | | |
| ○ Raising probing questions regarding unpopular ideas | | | | | |
| ○ Asking questions like : | | | | | |
| - Why is it hard to go against popular beliefs? | | | | | |
| - If everyone around you is sure of something, why is it hard to question or disagree? | | | | | |
| - Is it hard to question your own beliefs? why? | | | | | |
| ○ Modelling intellectual courage by arguing against popular ideas | | | | | |
| ○ Encouraging students to admit the truth in some ideas considered dangerous and absurd. | | | | | |
| 7. Developing Intellectual Good Faith or Integrity | | | | | |
| ○ Encouraging students to hold themselves to the same rigorous standards of evidence and proof to which they hold others | | | | | |
| ○ Encouraging students to practice what they advocate for others | | | | | |
| ○ Encouraging students to honestly admit discrepancies and inconsistencies in their own thought and action | | | | | |
| ○ Sensitive to his own inconsistencies in the application of rules and standards | | | | | |
| ○ Asking students to evaluate themselves and others using the same criteria. | | | | | |
| ○ Asking questions like : | | | | | |
| - When have you found it difficult to listen to others? | | | | | |
| - Why are people often unfair? | | | | | |
| - Would you have done otherwise? Would it have been easy? Why or Why not? | | | | | |
| 8. Developing Intellectual Perseverance | | | | | |
| ○ Raising difficult problems /issues again and again over the course of the year | | | | | |
| ○ Helping students to break a complex problem into simple components | | | | | |
| ○ Making students understand that getting answers is not the only form of progress but having better and clearer questions is also progress | | | | | |
| ○ Sympathizing with students' natural frustration and discouragement | | | | | |
| ○ Encouraging students to discuss the importance of sufficient thought regarding significant decisions and beliefs. | | | | | |
| 9. Developing confidence in Reason | | | | | |
| ○ Assisting students to solve a problem with the use of their own thinking | | | | | |
| ○ Thinking aloud on a problem in front of the students | | | | | |
| ○ Encouraging students to question the reasons behind rules, activities and procedures | | | | | |
| ○ Displaying a patient willingness to hear their reasons for their beliefs and actions | | | | | |
| ○ Clarifying the standards of good reasoning and help them to grasp why this standard makes sense | | | | | |
| ○ Making rules, assignments and classroom activities intelligible to students based on valid reasons | | | | | |
| ○ Giving students multiple opportunities to try to persuade each other and the teacher | | | | | |
| ○ Helping students feel that knowledge and reason are within their grasp | | | | | |

10. Refining Generalizations and Avoiding Oversimplifications

1 2 3 4 5

- Asking for counter examples when students or text over-generalizes
- Raising questions about various possible contributing factors for problem, event or situation
- Bringing various points of view to a given issue
- Probing in to the connection of interconnected or overlapping phenomena
- Encouraging students to qualify their statements when they have insufficient evidence to be certain
- Making distinction between useful simplification and misleading oversimplification
- Discouraging "all good" or "all bad" and "all right" or "all wrong" attitudes among students

11. Comparing Analogous Situations ; Transferring Insights to New Contexts

1 2 3 4 5

- Encouraging students to apply what they have just learned to different but analogous context
- Using similar information from different situations
- Asking students to name or find analogous situation
- Asking students to apply scientific laws / principles / concepts to situations not mentioned in the text.

12. Developing One's Perspective : Creating or Exploring Beliefs, Arguments or Theories

1 2 3 4 5

- Asking students to consider ideas from others point of view
- Asking students to compare what they say and believe, with how they act
- Asking students to explain, how what they have learned changed their thinking
- Giving time to students to reflect and arrive at tentative conclusions
- Giving opportunity for a student to explore an idea in depth
- Giving students occasions to name and describe their points of view and ways of thinking

13. Clarifying Issues, Conclusions, or Beliefs

1 2 3 4 5

- Asking students to slow down and reflect before coming to conclusions
- Asking questions like :
 - Is the issue clear?
 - What do you need to settle it?
 - What should some one who disagrees with you say?
- Encouraging for reformulation of issues in the light of new informaton.
- Helping students to distinguish facts from interpretation and opinions
- Making students ask themselves the following questions to clarify an issue
 - Do I understand the issue?
 - Do I know how to settle it?
 - Have I stated it fairly?
 - Are the words clear?
 - What facts are relevant?
 - Do I have to analyze any concept?
 - Am I evaluating anything?
- Encouraging students to settle questions only after they have developed a clear formulation of the issue

14. Clarifying and Analysing the Meanings of Words or Phrases

1 2 3 4 5

- Encouraging paraphrasing of new words or phrases
- Supplying a range of examples allowing students to add to the list
- Using analogies
- Asking for clear examples of concepts and examples of its opposite
- Discussing the implications of the concept and its opposite
- Distinguishing associations which are logically related to the concept, from those which are not
- Having the class brainstorm ideas associated with the term under discussion

15. Developing Criteria for Evaluation : Clarifying Values and Standards

1 2 3 4 5

- Asking students the purpose and criteria of evaluation
- Asking students to consider different points of view when attempting to evaluate something
- Encouraging Students develop clear criteria for evaluation and apply them consistently
- Asking questions like :
 - What are we evaluating? Why?
 - Can we generalize and list criteria?
 - Can we describe what to look for when judging an x?
 - What features does an 'x' need to have? Why?
- Asking students to continually evaluate written materials and discuss their criteria

16. Evaluating the Credibility of Sources of Information

1 2 3 4 5

- Encouraging students to check a variety of sources supporting different points of view
- Discussing the relevance of a sources past dependability
- Asking questions like :
 - Is this person in a position to know?
 - What would some one need to be in a position to know?
 - Was this person there?
 - What do we know about this person's expertise and experience?
 - Where did he get this information?
 - Is there reason to doubt him?
- Encouraging students to recognise the ways in which their own motivation affect their interpretation and description of events.

17. Questioning Deeply : Raising and pursuing Root of Significant Questions

1 2 3 4 5

- Raising general and subject - specific basic questions repeatedly and dicussing at length.
- Encouraging students to raise and discuss important issues underlying the object of study
- Asking students to draw conclusions of their own
- Asking students to form categories of their own
- Encouraging students raise thought - provoking issues
- Discussing the purpose, importance, or values of rules, institutions, activities and ideals.

18. Analysing or Evaluating Arguments, Interpretations, Beliefs or Theories

1 2 3 4 5

- Encouraging to place competing arguments, interpretations or theories in opposition to one another.
- Encouraging to argue back and forth, and modify their positions in the light of the strengths of others position
- Asking the students to make their assumption explicit and evaluate them
- Encouraging students to develop their own theories and compare them with those given in the text.

19. Generating or Assessing Solutions

1 2 3 4 5

- Making the students state the problem
- Asking the students to explore at length the causes of a problem
- Encouraging students to explore and evaluate multiple perspectives to a given problem
- Asking question like :
 - Does this solve the problem?
 - What other solutions can you think of?
 - What are the criteria for judging solutions in this case?
 - How do the solutions compare with each other?
 - If this fact about the situation were different, would it change our choice of solution? Why? or Why not?
- Encouraging students to explore the beliefs underlying various choices of solutions
- Giving problem - solving experiences in the class
- Asking students to evaluate solutions given in the text

20. Analysing or Evaluating Actions and Policies

1 2 3 4 5

- Encouraging to raise ethical questions about actions and policies of themselves and others.
- Asking questions like :
 - Why did 'x' do this?
 - What reasons were given?
 - Were those real reasons?
 - Why do you think so?
 - What are the probable causes of these actions?
 - Do you think the action was fair? Why? or why not?
- Encouraging students to evaluate the behaviour of important people of the past

21. Reading Critically : Clarifying or Critiquing Texts

1 2 3 4 5

- Encouraging students to raise questions about the materials they read
- Asking questions like :
 - What does this passage say? What does it imply?
 - Does it contradict anything you know
 - What might some one who disagrees with it say?
 - Does the text leave out relevant information?
 - Does it favour one perspective?
- Encouraging students to continually evaluate what they read
- Asking students to evaluate unit, chapter, sections, titles and headings in their texts in the light of the following points.

- What are the main points in this passage?
- What details does it give?
- What ideas do those details support, elaborate or justify?
- Is the heading accurate? Misleading?
- Could you suggest a better heading?
- Encouraging students to discuss their interpretations of what they read

22. Listening Critically : The Art of Silent Dialogue 1 2 3 4 5

- Modelling critical listening by actively and constructively listening to students response
- Encouraging students to listen to one another by asking questions like :
 - 'x', did you follow what 'y' said?
 - Could you put in your words what 'y' said?
 - Z, could you give us an example from your own experience of what 'y' has said?
- Encouraging students to ask questions like :
 - Why does he say that?
 - Give an example to illustrate that point?
 - Is s (he) using this word as I would, or somewhat differently?
 - What is the main point?
- Encouraging students to ask key questions that enable him to locate himself in the thought of another

23. Making Interdisciplinary Connections 1 2 3 4 5

- Examining a topic from the perspectives of several other subjects
- Encouraging students to compare how data is gathered and used in different subjects
- Encouraging students to use relevant concepts, knowledge and insights from many subjects to analyse an issue.

24. Practising Socratic Discussion : Clarifying and questioning Beliefs, Theories or perspectives 1 2 3 4 5

- Encouraging students to question each other and themselves
- Expressing wonder about the reasoning behind students beliefs
- Eliciting students thoughts and probing deep into them.
- Asking questions like :
 - Why?
 - If that is so what follows?
 - Are you assuming that?
 - How do you know that?
 - Is this an example of what you meant? or is that?
 - Can I summarize your point as _____
 - What is your reason for saying so? _____

25. Reasoning Dialogically : Comparing perspectives, Interpretations or theories 1 2 3 4 5

- Raising root questions and root ideas for the expression of multiple points of view
- Encouraging students to explore, how what they think about 'x' relate to what they think about 'y' and 'z'
- Making students move back and forth between points of view like :
 - Basic idea of one student with another / others

- Their own ideas and the ideas expressed in books
- Their thinking and their experience

26. Reasoning dialectically : Evaluating Prespectives interpretations or Theories

1 2 3 4 5

- Having proponents of conflicting views, argue their positions and have others evaluate
- Organising debate / discussion sessions in the classroom teaching.
- Asking questions like :
 - Was the reason a good one? Why or why not?
 - To what evidence does each side appeal?
 - Is the evidence from both sides relevant?
 - How can we know which of these conflicting assumptions is best?

27. Comparing and contrasting ideals with actual practice

1 2 3 4 5

- Asking questions like :
 - Is this a fact or an ideal?
 - Are things always this way?
 - Is this statement an expression of what people are trying to achieve?
 - Are these ideals yours? Why or why not?
 - How have people attempted to achieve this idea?
 - When did they not meet the ideal? Why?
- Facilitating general discussion of the value of achieving consistency of thought and action
- Ask questions like :
 - Have you ever thought something was true, about yourself but acted in a way that was inconsistent with your ideal?
 - Did you see yourself differently?
 - Did you make effort to change your behaviour?
 - Why is it hard to be honest about yourself and the group you belong to?

28. Thinking precisely about thinking : Using critical Vocabulary

1 2 3 4 5

- Making critical terms (infer, justify, conclude etc.) part of their working vocabulary.
- Speaking in pairs of sentences : First using the critical vocabulary, then rephrasing the sentence without the new terms
- Rephrasing students statement to incorporate the critical vocabulary.

29. Noting significant similarities and differences

1 2 3 4 5

- Encouraging students to distinguish between different meanings of the same word or phrase and recognise the different implications of each
- Asking students to compare and contrast two or more ideas, phenomena etc.
- Distinguishing general concepts from scientific concepts, e.g. work, energy
- Encouraging students to distinguish ideas by discussing the different applications and implications of the concepts

30. Examining or evaluating assumptions

1 2 3 4 5

- Encouraging students to make assumption explicit
- Asking questions that elicit the implicit elements of students claim

- Asking questions like : If this was evidence, and this is the conclusion
 - What was assumed?
- Encouraging students to question and discuss any assumption they suspect.
- Asking questions like :
 - Why do people make this assumption?
 - Have you ever made this assumption?
 - What could be assumed instead?
 - Is this belief always true? Some times true? Always false?

31. Distinguishing relevant from irrelevant facts

1 2 3 4 5

- Asking students to limit their remarks to facts which are relevant to the issue
- Helping students to see when their remarks are irrelevant
- Asking students to read text with one or more issues in mind noting relevant details
- Encouraging students to discuss the relevant details noted from the text
- Changing issue slightly and have students compare what was relevant to the first issue to what is relevant to be the second

32. Making plausible inferences, predictions or interpretations

1 2 3 4 5

- Ask to make inferences based on a wide variety of statements and action
- Encourage the class to discuss and evaluate the inferences made by group
- Helping students to distinguish observations from inferences and sound inferences from unsound ones
- Asking students to give examples from their experiences of inferring incorrectly.

33. Evaluating evidence and alleged facts.

1 2 3 4 5

- Asking for reasons of their conclusions like :
 - How do you know?
 - Why do you think so?
 - What evidence do you have?
- Asking probing questions to elicit fuller explanations
- Asking questions like :
 - On what evidence is the conclusion based?
 - Where did you get the evidence?
 - Is the source reliable?
 - How could we find out what other evidence exists?
 - What evidences are available for opposing these views?
 - Is / are the evidence/s sufficient?

34. Recognising Contradictions.

1 2 3 4 5

- Encouraging Students to practice recognising contradictions
- Asking questions like :
 - What does x say? What does y say?
 - Could both claim to be true? Why or why not?
- If one is true, must the other be false?
 - Is this behaviour consistent with these beliefs or values?
 - Where exactly do these views contradict each other? on what do they agree?

- Encouraging students to find points of agreement and specify points of contradiction
- Exploring possible ways to reconcile apparent contradictions
- Asking questions like ;
 - What did they say? What did they do?
 - Why do you say so?
 - What behaviour would have been consistent with their words?

35. Exploring implications and consequences

1 2 3 4 5

- Asking students to state the implications of material in the text
- Asking questions like :
 - What does this imply / mean?
 - If this is true, what else must be true?
 - What were , or would be the consequence of this action, policy or solution?
 - Are the consequences desirable?
- Suggesting changes and ask for consequences of changes
- Encouraging to explore the implications and consequences of their own beliefs

APPENDIX E

Critical Thinking Teaching Behaviour Inventory (CTTBI)

Guide : Dr. G. C. Pradhan

Investigator : Pally M. U.

Name of the Institution : _____ Educational Qualification _____

Subjects you teach _____

Teaching Experience (in years only) _____ Gender : Male / Female Date _____

Direction : Given below are a set of Teacher Behaviours (in statement form) which contribute to the development of critical thinking in students. Constraints in terms of time, syllabus coverage, nature of curriculum, infrastructure facilities etc., exist in our schools Keeping all this in view, please rate to what extent you are able to incorporate each of the teacher behaviours.

Each statement is followed by five responses; kindly go through each statement and give your response by ENCIRCLING the appropriate number (out of the five numbers given against each statement) using the scale given below

- 1 - Not at all
 2 - Hardly
 3 - Sometimes
 4 - Often
 5 - Very often

Teacher Behaviours	Rating				
	1 - Not at all	2 - Hardly	3 - Some times	4 - Often	5 - Very often
1. I encourage students to gather and assemble information	1	2	3	4	5
2. I facilitate the use of knowledge, skills and insights by the students.	1	2	3	4	5
3. I ask students to find solution to problems on their own	1	2	3	4	5
4. I encourage students to brainstorm ideas	1	2	3	4	5
5. I ask students to form categories and classify information	1	2	3	4	5
6. I ask students to draw and evaluate conclusions	1	2	3	4	5
7. I ask students to state one another's position when disputes arise	1	2	3	4	5
8. I give students opportunities to correct any misunderstanding of their positions	1	2	3	4	5
9. I ask students to explain why their fellow students see an issue differently	1	2	3	4	5

		Rating				
		1 - Not at all	2 - Hardly	3 - Some times	4 - Often	5 - Very often
10.	I ask students for evidence and reason for what they agree and disagree on	1	2	3	4	5
11.	I ask students to consider positions from others point of view	1	2	3	4	5
12.	I ask students to compare and evaluate different points of view	1	2	3	4	5
13.	I ask questions like ; - Why do people choose to do things differently? - Why do some people think their ways are best?	1	2	3	4	5
14.	I model intellectual humility by demonstrating a willingness to admit limits of my own knowledge.	1	2	3	4	5
15.	I use phrases like "I believe", "I am pretty sure", "I doubt", "I suspect", "perhaps", "It seems" etc.	1	2	3	4	5
16.	I help students to distinguish what they know from what they don't know	1	2	3	4	5
17.	I make students suspend judgment until they find out the relevant information	1	2	3	4	5
18.	I encourage students to explain what they would need to learn in order to be more certain	1	2	3	4	5
19.	I raise difficult problems /issues again and again over the course of the year	1	2	3	4	5
20.	I help students to break complex problems into simple components	1	2	3	4	5
21.	I make students understand that getting answers is not the only form of progress but having better and clearer questions is also progress	1	2	3	4	5
22.	I sympathize with students' natural frustration and discouragement	1	2	3	4	5
23.	I encourage students to discuss the importance of sufficient thought regarding significant decisions and beliefs.	1	2	3	4	5
24.	I assist students to solve a problem with the use of their own thinking	1	2	3	4	5
25.	I think aloud on a problem in front of the students	1	2	3	4	5
26.	I encourage students to question the reasons behind rules, activities and procedures	1	2	3	4	5
27.	I display a patient willingness to hear their reasons for their beliefs and actions	1	2	3	4	5
28.	I clarify the standards of good reasoning and help them to grasp why this standard makes sense	1	2	3	4	5
29.	I make rules, assignments and classroom activities intelligible to students based on valid reasons	1	2	3	4	5

	Rating				
	1 - Not at all	2 - Hardly	3 - Some times	4 - Often	5 - Very often
30. I give students multiple opportunities to try to persuade each other and himself / herself	1	2	3	4	5
31. I help students feel that knowledge and reason are within their grasp	1	2	3	4	5
32. I encourage students to apply what they have just learned to different but analogous context	1	2	3	4	5
33. I use similar information from different situations	1	2	3	4	5
34. I ask students to name or find analogous situation	1	2	3	4	5
35. I ask students to apply scientific laws / principles / concepts to situations not mentioned in the text.	1	2	3	4	5
36. I ask students to compare what they say and believe, with how they act	1	2	3	4	5
37. I ask students to explain, how what they have learned changed their thinking	1	2	3	4	5
38. I give time to students to reflect and arrive at tentative conclusions	1	2	3	4	5
39. I give opportunity for a student to explore an idea in depth	1	2	3	4	5
40. I give students occasions to name and describe their points of view and ways of thinking	1	2	3	4	5
41. I ask students to slow down and reflect before coming to conclusions	1	2	3	4	5
42. I ask questions like : - Is the issue clear? - What do you need to settle it? - What should some one who disagrees with you say?	1	2	3	4	5
43. I encourage reformulation of issues in the light of new information.	1	2	3	4	5
44. I help students to distinguish facts from interpretation and opinions	1	2	3	4	5
45. I make students ask themselves the following questions to clarify an issue - Do I understand the issue? - Do I know how to settle it? - Have I stated it fairly? - Are the words clear? - What facts are relevant? - Do I have to analyze any concept? - Am I evaluating anything?	1	2	3	4	5
46. I encourage students to settle questions only after they have developed a clear formulation of the issue	1	2	3	4	5
47. I encourage paraphrasing of new words or phrases	1	2	3	4	5

	Rating				
	1 - Not at all	2 - Hardly	3 - Some times	4 - Often	5 - Very often
48. I supply a range of examples allowing students to add to the list	1	2	3	4	5
49. I use analogies	1	2	3	4	5
50. I ask for clear examples of concepts and examples of its opposite	1	2	3	4	5
51. I discuss the implications of the concept and its opposite	1	2	3	4	5
52. I make the students distinguish associations which are logically related to the concept, from those which are not	1	2	3	4	5
53. I make the class brainstorm ideas associated with the term under discussion	1	2	3	4	5
54. I encourage students to check a variety of source's supporting different points of view	1	2	3	4	5
55. I discuss the relevance of a sources past dependability	1	2	3	4	5
56. I ask questions like : - Is this person in a position to know? - What would some one need to be in a position to know? - Was this person there? - What do we know about this person's expertise and experience? - Where did he get this information? - Is there reason to doubt him?	1	2	3	4	5
57. I encourage students to recognise the ways in which their own motivation affect their interpretation and description of events.	1	2	3	4	5
58. I raise general and subject - specific basic questions repeatedly and discuss at length.	1	2	3	4	5
59. I encourage students to raise and discuss important issues underlying the object of study	1	2	3	4	5
60. I ask students to draw conclusions of their own	1	2	3	4	5
61. I ask students to form categories of their own	1	2	3	4	5
62. I encourage students to raise thought - provoking issues	1	2	3	4	5
63. I discuss the purpose, importance, or values of rules, institutions, activities and ideals.	1	2	3	4	5
64. I make the students state the problem	1	2	3	4	5
65. I ask the students to explore at length the causes of a problem	1	2	3	4	5
66. I encourage students to explore and evaluate multiple perspectives to a given problem	1	2	3	4	5

	Rating				
	1 - Not at all	2 - Hardly	3 - Some times	4 - Often	5 - Very often
67. I ask question like : - Does this solve the problem? - What other solutions can you think of? - What are the criteria for judging solutions in this case? - How do the solutions compare with each other? - If this fact about the situation were different, would it change our choice of solution? Why? / Why not?	1	2	3	4	5
68. I encourage students to explore the beliefs underlying various choices of solutions	1	2	3	4	5
69. I give problem - solving experiences in the class	1	2	3	4	5
70. I ask students to evaluate solutions given in the text	1	2	3	4	5
71. I encourage students to raise questions about the materials they read	1	2	3	4	5
72. I ask questions like : - What does this passage say? What does it imply? - Does it contradict anything you know? - What might some one who disagrees with it say? - Does the text leave out relevant information? - Does it favour one perspective?	1	2	3	4	5
73. I encourage students to continually evaluate what they read	1	2	3	4	5
74. I ask students to evaluate unit, chapter, sections, titles and headings in their texts in the light of the following points. - What are the main points in this passage? - What details does it give? - What ideas do those details support, elaborate or justify? - Is the heading accurate? misleading? Inappropriate? - Could you suggest a better heading?	1	2	3	4	5
75. I encourage students to discuss their interpretations of what they read	1	2	3	4	5
76. I model critical listening by actively and constructively listening to students response	1	2	3	4	5
77. I encourage students to listen to one another by asking questions like : - 'x', did you follow what 'y' said? - Could you put in your own words what 'y' said? - Z, could you give us an example from your own experience of what 'y' has said?	1	2	3	4	5
78. I encourage students to ask questions like : - Why does he say that? - Give an example to illustrate that point - Is s (he) using this word as I would, or somewhat differently? - What is the main point?	1	2	3	4	5

	Rating				
	1 - Not at all	2 - Hardly	3 - Some times	4 - Often	5 - Very often
79. I encourage students to ask key questions that enable him to locate himself in the thought of another	1	2	3	4	5
80. I examine a topic from the perspectives of several other subjects	1	2	3	4	5
81. I encourage students to compare how data is gathered and used in different subjects	1	2	3	4	5
82. I encourage students to use relevant concepts, knowledge and insights from many subjects to analyse an issue.	1	2	3	4	5
83. I encourage students to question each other and themselves	1	2	3	4	5
84. I express wonder about the reasoning behind students beliefs	1	2	3	4	5
85. I elicit students thoughts and probe deep into them.	1	2	3	4	5
86. I ask questions like : - Why? - If that is so what follows? - Are you assuming that? - How do you know that? - Is this an example of what you meant? or is that? - Can I summarize your point as _____ - What is your reason for saying so? _____	1	2	3	4	5
87. I encourage students to distinguish between different meanings of the same word or phrase and recognise the different implications of each	1	2	3	4	5
88. I ask students to compare and contrast two or more ideas, phenomena etc.	1	2	3	4	5
89. I make students distinguish general concepts from scientific concepts. e.g. work, energy.	1	2	3	4	5
90. I encourage students to distinguish ideas by discussing the different applications and implications of the concepts	1	2	3	4	5
91. I ask students to limit their remarks to facts which are relevant to the issue	1	2	3	4	5
92. I help students to see when their remarks are irrelevant	1	2	3	4	5
93. I ask students to read text with one or more issues in mind noting relevant details	1	2	3	4	5
94. I encourage students to discuss the relevant details noted from the text	1	2	3	4	5
95. I change issue slightly and have students compare what was relevant to the first issue to what is relevant to the second	1	2	3	4	5

	Rating				
	1 - Not at all	2 - Hardly	3 - Some times	4 - Often	5 - Very often
96. I ask students to make inferences based on a wide variety of statements and action	1	2	3	4	5
97. I encourage the class to discuss and evaluate the inferences made by the group	1	2	3	4	5
98. I help students to distinguish observations from inferences and sound inferences from unsound ones	1	2	3	4	5
99. I ask students to give examples from their experiences of inferring incorrectly.	1	2	3	4	5
100. I ask for reasons of their conclusions like : - How do you know? - Why do you think so? - What evidence do you have?	1	2	3	4	5
101. I ask probing questions to elicit fuller explanations	1	2	3	4	5
102. I ask questions like : - On what evidence is the conclusion based? - Where did you get the evidence? - Is the source reliable? - How could we find out what other evidence exists? - What evidences are available for opposing these views? - Is / are the evidence/s sufficient?	1	2	3	4	5
103. I ask students to state the implications of material in the text	1	2	3	4	5
104. I ask questions like : - What does this imply / mean? - If this is true, what else must be true? - What were , or would be the consequence of this action, policy or solution? - Are the consequences desirable?	1	2	3	4	5
105. I suggest changes and ask for consequences of changes	1	2	3	4	5
106. I encourage exploring the implications and consequences of their own beliefs	1	2	3	4	5



APPENDIX F

HOME BACKGROUND DATA SHEET (HBDS)

Dear Student,

What is in your hand is a home background data sheet. Kindly go through each item carefully and mark your response in the space provided. You are free to take the help of your family members or any elders in case you find any difficulty in giving your responses. This is purely for a research work and the information supplied by you will be kept confidential and used only for my research purpose. I look forward to receiving the filled-up data sheet at the earliest.

With good wishes,

(Paily M. U.)

Place : Ponda

Date

Paily M. U.

Lecturer

G. V. M's College of Education

Ponda - Goa - 403 401

HOME BACKGROUND DATA SHEET

I. General Information

1. Name of the Student : _____
2. Name of the School : _____
3. Class and Division : _____
4. Age : _____
5. Gender (Male /Female) : _____
6. Religion : _____
7. Caste : _____
8. State to which you belong : _____
9. Mother tongue : _____
10. The place of residence (Rural / Urban) : _____
11. Language/s Known
 - a) Spoken _____
 - b) Spoken & Written _____

II. Details of Family Members

1. Type of family (Nuclear / Joint) : _____
2. Total members in the family including yourself : _____
3. Number of brothers (staying in the family) : _____

(Specify the details about each in order in the table given below)

Relationship (Brother)	Age	Educational / Professional Qualification	Occupation	Salary / income (Monthly)
First Brother				
Second Brother				
Third Brother				
Fourth Brother				

Total Assets (in Rupees) _____				

4. Number of Sisters (staying in the family): _____

(Specify the details about each in order in the table given below)

Relationship (Sister)	Age	Educational / Professional Qualification	Occupation	Salary / income (Monthly)
First Sister				
Second Sister				
Third Sister				
Fourth Sister				

Total Assets (in Rupees) _____				

5. Parents (please give the details below)

	Age	Qualifications	Occupation	Salary / income (monthly)	Total Assets (in Rs.)
Father					
Mother					

6.

i) Does your father hold any responsible position in the community? Yes / No _____
If yes please specify the details

ii) Does your mother hold any responsible position in the community? Yes / No _____
If yes please specify the details

iii) Do your brothers or sisters hold any responsible position in the community? Yes / No _____
If yes please specify the details

7. Any other members staying in the family (please supply the following details)

Sl No.	Relationship	Age	Qualifications	Occupation	Salary/ income (monthly)	Total Assets (in Rs.)	How long he/ she has been staying

8. Do the above members have any responsible position in the community? Yes / No _____
If yes please specify the details

III. Facilities Available At Home

1 a. Do you have a T.V. at home ? Yes / No _____

b. If yes, Name the programmes you watch on T. V.

c. Do you discuss with your parents / elders after watching a particular programme on T. V.

Always / Sometime / not at all _____

d. If always / sometimes, which programmes and what aspects do you discuss?
(Please mention in brief)

2 a. Do you have a radio at home? Yes / No _____

b. If yes, what are the programmes you hear?

c. Do you discuss with your parents / elders after listening to a particular programme?
 Always / sometimes/ not at all _____

d. If always / sometimes, which programmes and what aspects do you discuss?
 (Please mention in brief)

3 a. Do you have a tape recorder at home? Yes / No _____

b. If yes, what types of cassettes do you hear?

c. Other than entertainment for what other purpose do you use the tape recorder (Please specify)

4 a. Do you have a telephone at home? Yes / No _____

b. If yes, do you use/s attend the telephone at home?
 Always / Sometime / not at all _____

c. If always / sometimes, what are the various purposes for which you use your telephone?
 (Please specify)

5 a. Do you have a computer at home ? Yes / No _____

b. If yes, do you use the computer? Yes / No _____

c. If yes, what are the various purposes for which you use your computer? (Please Specify)

6 a. Do you get news paper(s) at home? Yes / No _____

b. If yes mention the name of the news paper (s)

c. Do you read news paper (s) at home? Yes / No _____

d. If yes, what are the types of news you read daily? (Please specify)

e) Do you discuss with your parents / others various news items?
Always / Sometimes / not at all. _____

f) If always / sometimes please specify the nature of news items and aspects of it.

7 a. Does your family subscribe for any magazine ?Yes / No _____

b. If yes, mention the names of the magazines?

c. Do you read those magazines? Yes / No _____

d. If yes what are the types of articles you read? (Please specify)

e. Do you discuss with your parents/elders/others various articles that you have read
always/sometimes/not at all _____

f. If always/sometimes what aspects do you discuss? (Mention in brief)

8 a. Do you have a collection of books (home library) at home? Yes / No _____

b. If yes mention the types of books that you have at home? (fiction, educational, general etc.)

- 9 a. Do you have any facilities other than the above available at your home? Yes / No _____
 b. If yes, please specify the types of facilities available.

- c. Do you use these facilities? If yes how do you use them? (Mention in brief)

IV Practices at home

1. Language (s) spoken at home _____

2. Do you help your family members / community after school hours and on holidays?
 (Please specify the details of help)

Sl No.	Members	Nature of help (please specify)	Often	sometimes	rarely
1.	Father				
2.	Mother				
3.	Brother /s				
4.	Sister / s				
5.	Community (specify)				

3. Do family members help you in your studies after school hours and on holidays?
 (Please specify the details below)

Sl No.	Members	Nature of help (please specify)	Often	sometimes	rarely

4. What activities are you involved in after school hours and on holidays ?
 (Specify the details below including the appropriate time spent on these activities)

Sl No	Activities	Your involvement		If yes, approximate time spend	
		Yes	No	on regular days	on holidays
1.	Studying				
2.	Discussion of general matters with parents and elders				
3.	Entertainment				
4.	Household work				
5.	Games and sports (specify)				
6.	Computer class				
7.	Music class				
8.	Tutions				
9.	Dance class				
10.	Reading				
11.	Prayer				
12.	Religious instructions				
13.	Any other (please specify) _____ _____				

5. a. What festivals are celebrated at your home? (Please Specify)

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

b. Do you participate in these festivals ? Yes / No _____

If yes please specify the role you play / the way you participate.

6 a. Do all of you family members sit at home during leisure hours and casually discuss various matters?
Yes / No _____

b. If yes, please specify the matters and the nature of your participation

Matters	Nature of Participation

7 a. Do you visit you neighbours and relatives? Yes / No _____

b. If yes, whether [often] / [sometimes] / [rarely] (Tick mark (✓) which ever is applicable)

c. What do you do during such visits (Please explain in brief)

8 Do your parents encourage you questioning various practices (like customs, traditions, rules, norms etc.) at home and society? Yes / No _____

9 Do your parents and elders ask you to follow everything without you questioning about it? Yes / No _____

10 Do your parents encourage you to discuss your problems / difficulties freely with them? Yes / No _____

11 With whom do you feel most free and least free to discuss your problems / difficulties?

- a) Father
 - b) Mother
 - c) Brother
 - d) Sister
 - e) Grand parents
 - f) Uncle
 - g) Aunt
 - h) Cousins
- Ans. i) Most Free _____
- ii) Least free _____

12 Do your parents / elders value your opinion on various matters? Yes / No _____

13 Do you get immediately everything / most of the things you ask for? Yes / No _____

V Facilities and practices in the home surroundings

1. Do you have a library in your community? Yes / No _____
2. If yes, do you go to the library for reading? Yes / No _____
3. What types of books, magazines and newspaper(s) do you have in library (please mention in brief)

Books	Magazines	News Papers

4. Do you have any clubs in your community? Yes / No _____
5. If yes, please specify the nature and functions of this club (s).

6. Are you a member of this club? Yes / No _____
7. If yes, a) how long have you been the member? b) What is your role?

8. If no, do you take part in the activities of the club without being the member?
Yes / No _____

9. What are some activities of the club that you have taken part in ?

10. Any other facilities available in the community? (Please give details)

11. What are the various activities usually organised in your community?
Do you take part in these activities? (please specify below)

Sl No.	Programmes	Organised		your participation		Explain briefly your role in these programmes
		Yes	No	Yes	No	
1.	Literary programme					
2.	Cultural programme					
3.	Health camp					
4.	Community survey					
5.	Film show					
6.	Talk by experts					
7.	Developmental activities (roads, house etc)					
8.	Environment building activities (cleaning, planting trees etc.)					
9.	Any other					

Any Additional information on any of the above

-: Thank You :-

APPENDIX - G

INFORMATION SCHEDULE

1. Name and Address of the School :
2. Location of the School :
3. Type of School : Government/Private
4. Achievement Score :

Sr. No.	Name of Student	Achievement Score			
		Language Studies	Social Studies	Mathe- matics	Science Total

APPENDIX - H

Weightages given to the items (Occupation) in the Socio-economic Status Scale.

Occupation	Weightage
a) If in Medicine	
- Professor in a Medical College	46
- MBBS in Govt. Medical Services	44
- Psychological/Homeopath/Diploma holder	32
- Compounder/ Nurse	14
b) If a Government Officer	
- Commissioner/District Magistrate	24
- Civil Judge/Administrator	17
- IAS/ equivalent Post	15
c) If in Education and a principal	
- P.G./Graduate/Engineering/Medical	37
- Intermediate/Higher Secondary or equivalent	23
- High School	10
- Primary School	5
d) If in Indian Army:	
- Air Force { Commissioned	21
Non-Commissioned	11
- Ground Force { Commissioned	17
Non-Commissioned	7

	-	Navy Force	{	Commissioned	15
				Non-Commissioned	5
	-	C.R.P./B.S.F./Police	{	Officer	8
				Subordinate	2
e)		If an Officer:			
	-	Income Tax/Railway/Education/Forest			19
f)		If a lawyer:			17
g)		If a teacher:			
	-	College lecturer			17
	-	Intermediate/H.S.			12
	-	School-Junior & Primary			7
h)		If an author:			
	-	Literature			18
	-	Text-books			10
	-	Notes/guide etc.			7
i)		If a Trader:			
	-	Owner of a big factory			21
	-	Owner of a small factory			13
	-	Chemist/Cloth Merchant/Pharmacist			12
	-	Hotel/Restaurant/General Merchant/ Book-seller/Gold Smith/Food material			9
	-	Carpet/Vessel ware/Foot ware industries			7
j)		If an Artist:			
	-	Musician			12
	-	Dancer/Artist/Dramatist			8
k)		If an Engineer:			
	-	Civil/Electrical/Mechanical			11
	-	Architect			6

- l) If a leader:
- Minister/M.P. 14
 - M.L.A./M.L.C./Unions/Professional 10
 - Student/Accidental 7
- m) If a manager:
- Trade/Bank 10
 - Farm/Dairy/Cinema 6
- n) If a farmer:
- Owner of a farm 10
 - Less land cultivator 7
 - Agricultural labourer 6
- o) Are you/your parents any of these ?
- Contractor/Selling and purchasing officer 5
 - Insurance Corporation/Bank employee 4
 - Accountant
 - Craftsman/Peon 2
 - Labourer 1