CHAPTER II

Review of related literature and Researches

Review of related literature and Researches is first and for most pre requisite of any research work. Any research cannot be a single step in research fields; but it is a link in a stream of research; every research should be based on all the relevant thinking and the research that has preceded it. It is the abstract or a brief summary of previous researches, which provides evidence for researcher what is already known and what is still unknown and untested. So any new research is built upon or adds to what is known up to that print of time.

“A literature review is a systematic explicit and reproductive method for identifying evaluating and interpreting the existing body of recorded work produced by researcher’s scholars and practitioners.”

(Fink, 1998)

According to Ary et al;(1972). Organizing related literature is like proposing an expedition, by mapping out the known territory and pointing the way to the unknown territory one proposes to explore. If the study has several aspects or is investigating more than a single hypothesis this is done separately for each facet of the study. One should avoid the temptation to present the literature as a series of abstracts. Rather, it should be presented in such a way as to lay a systematic foundation for the study (P.67)

J.W. Best in his book ‘Research in Education’ says that, “ Review of the literature and research provides and background for the development of the present study and brings the reader up to date since good research is based upon everything that is known about problems this part of the report gives evidence of the investigations knowledge of the field.”
“The student should find, analyze and evaluate critically every pertinent search report dealing with his chosen problem, anything less than this will be neither sensible nor scientific.”

(Whitney)

The review of literature promotes a greater understanding of the problem and its crucial aspects and ensures the avoidance of necessary duplication.

This part of research report provide a background for the development of the present study and bring the reader up to date since good research is based upon everything that is known about the problem, this part of the report gives evidence of investigator’s knowledge of the field.

First find out everything everybody has done and then begin where they left off.

**Objectives of related literature and researches:**

1. To avoid unnecessary duplication
2. To know suitable and appropriate research methods and techniques
3. To aware the status of the issue
4. To acquaint himself/herself with the current knowledge in the area in which he/she is going to conduct research and thereby select suitable problem.
5. To know about the tools and instruments, which provide to be useful and promising in the previous studies and to provide in to statistical methods.
6. It helps to know about stating objectives, assumptions and hypothesis.
7. It helps to understand about the theories and procedure.
8. To know about the use of statistical measures and interpretation.
9. It helps to enrich our knowledge of research.

**Main objectives of review of literature are mentioned below -**

1. Cataloging variables significant for research –

   When researcher makes a careful review of the literature, he becomes aware of the significant and insignificant variables in the concerned area of research. A careful review also helps researcher in selecting the variables falling within the scope of researcher’s interest, in defining and operationalizing variables falling and identifying variables, which are conceptually and virtually significant.

2. Avoidance of repetition:

   A review of the literature helps researcher in evading any duplication of work done earlier. A careful review always aims at understanding previous studies and signifying their efficacy for the intended study. Thus, previous studies serve as a strong base for the intended studies. In some cases, the duplication or repetition of previous studies becomes unavoidable. This is especially true when researcher has reviewed the lot of literature and got confused. In such a situation, too, a careful review helps researcher in getting familiar with the quantity and quality of researches related to the intended research whose validity is being reviewed always. Thus a literature review forms a focused and carefully structured outline of what others have done in the area that has been studied and produced to set researches on their own research outline with a new aims and objectives.
3. Amalgamation of previous studies

   A careful literature review facilitates researcher to bring together and amalgamate previous studies related to the intended study. This in turn, helps researcher in developing a better viewpoint for proposed research. A synthesized compilation of previous studies also helps a researcher to recognize and categorize the considerable overlaps and gaps in the previous works.

4. Determining importance and relationship in relevant variables

   An evaluation of the literature permit researcher in finding out significant variables a perfect literature review contributes behind the stage of simply listing variables to offer an analytical study on the chosen area.

   No duplication should take place otherwise not only researcher; but also subject may get a bad name. Every literature survey must be followed by two page write up which must include the following.

1. Title of the book/ journal/ report
2. Authors name, details of publication
3. Aim and objective of the study
4. Research questions and answers
5. Details of data collection, analysis and interpretation
6. Result and conclusions
7. Limitation of the study
Nature -

A literature review is systematic, explicit and reproducible method for identifying, evaluating and interpreting the existing body of recorded work produced by scholars. A literature review is an assessment of the range of existing materials dealing with knowledge and understanding in a given field. Any scientific investigation starts with a review of the literature, which enables researcher to place his work in the context of what has already been searched and what has not been searched, exhibiting comparison as well as provides a framework for future direction and further research.

A summary of the writings of recognized authorities and of previous research provides and evidence that the researcher is a familiar with what is already known and what is still unknown and untested. Because effective research is based on past knowledge, this steps helps to eliminate the duplication of what has been done and provides useful hypothesis and helpful suggestions for significant investigation, citing studies that shows substantial agreement and those that seem to present conflicting conclusions helps to sharpen and define understanding of existing knowledge in the problem area, provides a background for the research project, and makes the reader aware of the status of the issue. Parading a long list of annotated studies relating to the problem is ineffective and inappropriate. Only those studies that are plainly relevant, competently executed and clearly reported should be included.

In searching related literature the researcher should note certain important elements

1. Reports of studies of closely related problems that have been investigated.
2. Design of the study, including procedures employed and data gathering instruments used.
3. Populations that were sampled and sampling methods employed
4. variables that were defined
5. extraneous variables that could have affected the findings
6. faults that could have been avoided
7. Recommendations for further research.

Related literature includes books, dissertations, Ph.D. thesis, Research reports, Reference books, encyclopedia, journals etc.

**Importance of related literature and researches:**
1. It helps to find out ‘research gap’ and to plan research to fill up the existing research gap.
2. It helps to inculcate the skills necessary for conducting research
3. It helps to enhance the knowledge of research
4. It helps to understand the plan and procedure of research
5. It helps to fix the limitations and delimitations of the research.
6. It helps for economy of the time and effort.
7. It enhances researcher’s confidence.
8. It helps to eliminate the duplication of what has been done and provides useful hypothesis and helpful suggestions for significant investigation, listing studies that seem to present conflicting conclusions help to sharpen and define understanding of existing knowledge in the problem area provides a background for the research project and makes the reader aware of the issue.

It is challenging task for the researcher to carry out the suitable/appropriate/relevant review of related literature and researches. It
is not only just listing the researches from selected specialized area. But also create the insight into the research. The researcher has reviewed the literature for this study to find out what others have found in their study, for review purpose researcher visited different institutions and also surfed internet.

**Bloom, Benjamin** and others have classified the educational objectives into three domains. They are the cognitive, the affective and the psychomotor domains. The cognitive domain includes the objectives dealing with recall or recognition of the knowledge as well as development of intellectual abilities and skills. The affective domain deals with objectives related to interest, attitudes and appreciations. The skills at bodily levels come under the psychomotor skills. The Directorate of Extension Programs for Secondary Education, Government of India has stated in its report on Evaluation in General Science that one of the objectives of teaching General Science in Secondary Schools as the pupils should adopt the scientific attitude in making statements accepting information and forming beliefs.

The central Science workshop, established under the NCERT suggested developing low-cost kits for the primary and the middle school stages.

The Secondary Education Commission (1952-53) recommended a ‘general science’ course for the middle stage and a reoriented specialized science course with Physics, Chemistry and Biology as independent subjects at the high school stage. The commission studied the secondary educations through different angles and made important suggestions. It suggested that, ‘Teaching of General Science, as a compulsory subject should be taken up in secondary and higher secondary school’. After
1952-1953 the science subject began to be taught as a compulsory subject at various levels of school education including primary level.

The Indian Education Commission (1964-66) stated that there is an urgent need to raise the quality of Science teaching to promote the deepening of understanding of basic principles, to develop problem solving and analytical skills and to promote the spirit of enquiry, experimentation and accurate observation.

State Institutes of Science Education have been set up in all the states to improve the quality of Science Education in the schools. These institutes are aimed to provide in service training to science teachers, to prepare instructional materials in science, to conduct research studies in Science Education to schools, to take up innovative programs in Science Education.

Jean Piaget proposed the developmental stages of an individual. According to him, there are four stages of development of an individual. These developmental stages are sensor motor stage, pre-operational stage, concrete operational stage and formal operational stage. The peculiar characteristics of these stages are different. The sensor motor stage lasts from birth to about the age of two. At this stage, the principal task of the individual is, to construct a world of permanent objects. The preoperational stage lasts for 2 to 6 or 7 years. In this period the child acquires the language, discovers symbolic play and experiences his first dream. The age group 7 to 12 comes under the stage concrete-operational stage. During this period, interrelationship of classes, relations and members gets established. The concrete operational stage is also called as ‘stage for searching for relations’. The formal operational stage is the last stage of development and is characterized by the own thinking of the individual. This stage is also called as ‘stage of searching for
comprehension’. These stages can be paralleled with the stages that characterize the development of any Science. They are observation may be paralleled with the sensor motor stage naming and labeling (pre-operational stage) formal classification and quantification (concrete operational stage) controlled experimentation and theory building (formal operational stage). Thus, the Science teacher should consider the stages of development of the individual learner during Science teaching in the classroom.

The technological instruments should be used during the Science teaching - learning process. This will help to change the monotonous environments in the classroom created due to the lecture method used by Science teachers. Programmed Learning Materials (PLMs) developed on the basis of Skinner’s Theory of Operant Conditioning may be useful in Science classroom.

Now-a-days, various audio-visual aids like television, print media film strips, tape recorder, computer etc. are being used in Science classroom. But the pace of their use is very slow.

**Literature review**

Limon, Margarita in their article on The Domain Generality--Specificity of Epistemological Beliefs: A Theoretical Problem, a Methodological Problem or Both? Discussed that Research on epistemological beliefs has clearly increased in the last decade. Even though the construct is clearer and relevant data are being collected, there are important theoretical and methodological issues that need further clarification. One of them is the debate about the domain generality-specificity of epistemological beliefs. I argue that there are both theoretical and methodological difficulties that hinder a more fruitful
approach of the domain generality specificity debate. Differences in goals and scope of the diverse conceptualizations about epistemological beliefs and how they devise the role of content-domain and context are a major source of difficulties. Methodological problems such as whether such epistemological beliefs can be measured "in isolation"--free of content and context influence--or the impossibility of collecting direct measures of epistemological beliefs may influence how the domain generality-specificity question is approached. Some suggestions about how these difficulties may be overcome are developed. The relevance of exploring epistemological beliefs across domains and across contexts is emphasized.

Black, Susan in this article on Teaching Students to Think Critically stresses that teachers need to teach their students to think critically and to reason their way. One prerequisite for teaching critical thinking is a classroom climate of high expectations, teacher warmth and encouragement, and pleasant physical surroundings. Schools should see to it that students become progressively more disciplined in their reasoning, and more self-critical and self directed in the process and products of their thinking as they advance through the grades. She also states that the students need opportunities to analyze their own thinking according to standards of clarity, accuracy, relevance, logic, and fairness.

Moreover, she notes that teachers should give necessary information and thinking tools to solve problems that focus more on affective and cognitive features of learning; and for students to become good critical thinkers, teachers must be good thinkers themselves. Furthermore, she discusses some of the possible things that a teacher should do in order to develop the students' thinking skills.
van Gelder, Tim in this article on Teaching Critical Thinking: Some Lessons from Cognitive Science draws six key lessons from cognitive science for teachers of critical thinking. The lessons are: acquiring expertise in critical thinking is hard; practice in critical-thinking skills themselves enhances skills; the transfer of skills must be practiced; some theoretical knowledge is required; diagramming arguments ("argument mapping") promotes skill; and students are prone to belief preservation. The article provides some guidelines for teaching practice in light of these lessons.

Nosich, Gerald M. in the article on Problems with Two Standard Models for Teaching Critical Thinking discussed Two common models of teaching critical thinking in a discipline fail to do justice to the essential role critical thinking plays in all learning or to its role in the discipline as a whole. This chapter describes a model that emphasizes a more central role for critical thinking in shaping all course activity and in focusing on the most fundamental and powerful discipline-based concepts.

Powell, Gwynn M. in the article on If X, Then Y: Teaching Critical Thinking Skills discussed that Thinking Skills Offers advice to camp professionals on teaching critical thinking skills to staff. Lists components of teaching critical thinking and the characteristics and skills of a critical thinker. Describes staff orientation activities that emphasize critical thinking: role playing in an "if, then" format; discussing developmental stages and needs; interpreting parent responses; modeling decision making; and using training videos. (CDS) Theme issue title: "Staff Development.":
Bailin, Sharon; Case, Roland; Coombs, Jerrold R.; Daniels, Leroi B. In their article on **Common Misconceptions of Critical Thinking** Analyzes three widely-held conceptions of critical thinking: as one or more skills, as mental processes, and as sets of procedures. Considers each a misconception and offers alternative proposals for teaching critical thinking. (CMK)

Bailin, Sharon; Case, Roland; Coombs, Jerrold R.; Daniels, Leroi B. In their article on **Conceptualizing Critical Thinking** Provides a conception of critical thinking and the critical thinker, who is characterized by five intellectual resources: background knowledge, operational knowledge of good thinking, knowledge of critical concepts, effective heuristics, and habits of mind. Explains, with examples, each intellectual resource. Discusses the task of teaching critical thinking. (CMK)

Paul, Richard; Elder, Linda in their article on **Critical Thinking: Teaching Students To Seek the Logic of Things** said that Advocates teaching critical thinking through showing students the logic of a subject. Uses one example of instruction in history that allows students to think their way through the logic of the subject rather than memorize bits and pieces of someone else's thought (never grasping its logic). (VWC)

Halpern, Diane F. in his article on **Teaching Critical Thinking for Transfer across Domains: Dispositions, Skills, Structure Training, and Metacognitive Monitoring** Presents the four-part empirical model for teaching and learning critical thinking. Model consists of dispositional
or attitudinal component, instruction in and practice with critical-thinking skills, structure-training activities designed to facilitate transfer across contexts, and metacognitive component used to direct and assess thinking. Contains 24 references. (MMU)

**Dyrud, Marilyn A.; Worley, Rebecca B.** in their article on *Focus on Teaching: Critical Thinking*. Discusses Bloom's Taxonomy of Cognitive Skills and presents a table that outlines and defines its six skill levels. Introduces articles in this journal describing assignments for business communications which involve the these higher-order thinking skills. (SR)

**Brown, Elizabeth A.** in his article on *Effectively Teaching Critical Thinking Skills to High School Students* said that Today's highly technical information society is marked by constant change. To be competent, functional, and prepared to deal with the future, students need to be able to analyze, question, and evaluate information critically. Therefore, the educational community has renewed interest in teaching critical thinking. Unfortunately, educational practices often concentrate on rote knowledge of facts while neglecting problem solving skills. This paper addresses the effectiveness of classroom debate as a tool to teach problem solving skills. The strategies given enable high school teachers to prepare their students for classroom debate.

**Wilen, William W.; Phillips, John Arul** in their article on *Teaching Critical Thinking: A Metacognitive Approach* Asserts that a primary goal of social studies is to prepare students to make informed decisions on public and political issues. Maintains that the most effective
approach to teaching critical thinking is through infusion—teaching thinking skills in the context of subject matter. (CFR)

Rush Cosgrove in his article on *Critical Thinking in the Oxford Tutorial Abstract* says that Critical thinking is widely lauded as one of the most vital educational goals today. Oxford’s tutorial system, in turn, is a historically celebrated and influential approach to teaching. Yet, to date, little is known with regards to which critical thinking skills and traits, if any, are being systematically fostered by teachers and learned or developed by students in the tutorial. The primary purpose of this study is to break ground in this important and under-researched area. It is a small scale exploratory study based on qualitative interviews with three tutors and seven students, including four tutorial observations within the Department of Politics.

The tentative results show that, with regards to critical thinking, tutors are primarily concerned with students’ ability to clarify central questions, define key terms, and question important assumptions within the writing of their tutorial essays. Participating tutors seem less focused on students’ approach to evaluating important intellectual treatises or constructs, with the manner in which they understand and learn new ideas, or with their development of intellectual traits of mind, all of which tutors seemed to believe would develop naturally.

Students, for their part, articulated their approach to writing essays, including clarifying central questions, defining key terms, and questioning important assumptions. They expressed no clear approach to intellectual evaluation or the understanding of new ideas, nor did they appear to have deeply considered the intellectual traits they considered most important. The main provisional hypothesis is that students appear
to internalize that which is explicit and required, and to largely miss those aspects which are more implicit and optional. This suggestion, if justified, has implications for tutorial pedagogy.

Paul Everett Thomas in his article on Critical Thinking Instruction in Greater Los Angeles Area High Schools explained, The purpose of this study was to determine to what extent and under what conditions high school teachers articulate and demonstrate elements of critical thinking in their instruction. The design of the study was to interview high school teachers and to observe them in their classrooms with regard to critical-thinking instruction. Forty teachers were interviewed from six public high schools in the greater Los Angeles area. Thirty-three of these teachers were observed during a class period of instruction.

Some of the information was analyzed quantitatively. Profiles of teachers who were strong and weak in critical-thinking instruction were reported.

This study was a partial replication of the Commission on Teacher Credentialing Study done by Paul, Elder, and Bartell (1997). The results of this study appear consistent with the results of that study. A large percentage of teachers do not articulate a clear understanding of what constitutes critical-thinking instruction. They have little vocabulary to talk about standards of critical thinking, what critical thinking looks like when it is done correctly, how they would reconcile covering content with fostering critical thinking, or what specific critical thinking skills they would like their students to develop.
This study’s observation component yielded examples of exemplary practice in critical thinking in high school instruction. Students in honors classes are better served by critical-thinking instruction than those in lower achievement levels. Most teachers who demonstrated exemplary practice in critical thinking did not learn how to do it in their teacher preparation programs.

The major implications of the dissertation are the following:

1) All teachers need to be educated in the philosophy, vocabulary, standards, intellectual traits, skills, and processes of critical thinking in their pre-service and in-service education.

2) A concerted effort needs to be made to assure that all students, regardless of achievement level, be given the opportunity to learn to think critically.

3) Critical thinking should become an organizing core for other school reforms.

4) Textbooks need more critical thinking language and open-ended questions so as to encourage independent cognitive development and reasoning skills in students.

Rush Cosgrove in the article Critical Thinking: Lessons from a Continuing Professional Development Initiative in a London Comprehensive Secondary School reports on a small-scale exploratory study focusing on the effects on teaching and learning of a continuing professional development project in a London comprehensive secondary school. The research design included multiple interviews and
observations of the classes of two teachers, as well as interviews with their students.

Now in the fifth year of a voluntary and internally guided initiative, Lampton School has chosen a model of critical thinking developed by the Foundation for Critical Thinking to be at the heart of their attempts to bring critical thinking more explicitly and systematically into the classroom. The purpose of this study was to investigate the nature of this CPD initiative (its structure, processes, and theory), as well as its effect on teachers’ and students’ values, conceptions, and application of critical thinking, and its effect on motivation.

Teachers reported that, though critical thinking had been given lip service in their teacher training courses, they did not understand how to teach for it until the CPD project at Lampton, during which they were introduced to an explicit and systematic framework for critical thinking. Students’ notions of critical thinking were found to rely solely on the extent to which their teachers had introduced it in an explicit, systematic, and sustained manner in the classroom.

Both teachers and students were found to value critical thinking in several directions. Teachers and students evinced various levels of understanding and application of critical thinking, as is to be expected. Those with the most developed conceptions seemed to value critical thinking more highly and articulated more rewards and benefits as a result of its use. Both participating teachers indicated that national assessment measures are not in line with the goal of fostering critical thinking.
Dr. Richard Paul, Dr. Linda Elder, and Dr. Ted Bartell in their article on To Determine Faculty Emphasis on Critical Thinking In Instruction says that On September 29, 1994 Governor Wilson signed legislation authored by Senator Leroy Greene (SB1849) directing the Commission on Teacher Credentialing to conduct a study of teacher preparation programs to assess the extent to which these programs prepare candidates for teaching credentials to teach critical thinking and problem-solving skills in elementary and secondary schools.

During the spring of 1995, Commission staff began to conceptualize a study design that would yield descriptive information on course content and teaching practices being employed by postsecondary faculty to train teacher candidates. With assistance from the Center for Critical Thinking at Sonoma State University, an interview protocol was designed for use in telephone interviews with a cross-section of education and subject matter faculty in both public and private colleges and universities in California.

During the study planning process, a decision was made to design respondent selection procedures in such a way as to assure that information collected would be generalizable to all faculty preparing teachers across the state. To accomplish this objective, two statewide probability samples were designed: a sample of teacher education faculty, and a separate sample of Arts and Sciences faculty teaching courses in Commission-approved subject matter programs.

There were three major objectives in this study. The first was to assess current teaching practices and knowledge of critical thinking among faculty teaching in teacher preparation programs in California.
The second was to identify exemplary teaching practices that enhance critical thinking. The third was to develop policy recommendations based on the results of the study. The study included 38 public colleges and universities and 28 private ones.

The concept of critical thinking and problem solving used in this study is "minimalist," that is, one which captures the essential dimensions of the concept reflected the following: its etymology and dictionary definition, major definitions and explanations in the literature, a brief history of the idea, major tests of critical thinking, and the basic values it presupposes.

This minimalist concept of critical thinking is embedded not only in a core body of research over the last 30 to 50 years but also derived from roots in ancient Greek. The word 'critical' derives etymologically from two Greek roots: "kriticos" (meaning discerning judgment) and "kriterion" (meaning standards). Etymologically, then, the word implies the development of "discerning judgment based on standards." In Webster's New World Dictionary, the relevant entry reads "characterized by careful analysis and judgment" and is followed by the gloss: "critical, in its strictest sense, implies an attempt at objective judgment so as to determine both merits and faults." Applied to thinking, then, we might provisionally define critical thinking as thinking that explicitly aims at well-founded judgment and hence utilizes appropriate evaluative standards in the attempt to determine the true worth, merit, or value of something.

The tradition of research into critical thinking reflects the common perception that human thinking left to itself often gravitates toward prejudice, over-generalization, common fallacies, self-deception, rigidity,
and narrowness. The critical thinking tradition seeks ways of understanding the mind and then training the intellect so that such "errors", "blunders", and "distortions" of thought are minimized. It assumes that the capacity of humans for good reasoning can be nurtured and developed by an educational process aimed directly at that end. It assumes that sound critical thinking maximizes our ability to solve problems of importance to us by helping us both to avoid common mistakes and to proceed in the most rational and logical fashion.

For example, those who think critically typically engage in intellectual practices of the following sort: monitoring, reviewing, and assessing; goals and purposes; the way issues and problems are formulated; the information, data, or evidence presented for acceptance, interpretations of such information, data, or evidence; the quality of reasoning presented or developed, basic concepts or ideas inherent in thinking, assumptions made, implications and consequences that may or may not follow; points of view and frames of reference. In monitoring, reviewing and assessing these intellectual constructs, those who think critically characteristically strive for such intellectual ends as clarity, precision, accuracy, relevance, depth, breadth, and logicalness. Each of these modes of thinking help us to accomplish the ends for which we are thinking and hence to solve the problems inherent in pursuing those ends.

Debra Connerly in the article on Teaching Critical Thinking Skills to Fourth Grade Students Identified as Gifted and Talented said that In this action research study, gifted elementary students benefited from the involvement in critical thinking activities. The gifted education community has frequently discussed the development of our learners’ thinking skills. As an educator of elementary gifted students, I have often been frustrated with the lack of depth I find in my students’
thinking, as well as the lack of challenge they experience in their regular classrooms. My goal for this action research study was to move a group of fourth grade students identified as gifted and talented from being naïve and self absorbed about their thinking to taking ownership of their thoughts. The primary materials used for this study were from The Miniature Guide to Critical Thinking for Children (Elder, 2002). The study focused on a combination of affective and cognitive skills, and applied the intellectual standards of clarity, accuracy, relevance, logic, and fairmindedness to students’ thinking. Activities that did not use the above materials are not mentioned in this modified text.

The characters of Selfish Sam, Naïve Nancy, and Fairminded Fran (Elder, 2002) allowed learners to become aware of and understand both positive and negative thinking behaviors in themselves and others. All students commented about personal application of the standards. In addition to understanding each standard, students saw the interrelatedness of the standards. Pre- and post-surveys showed an increased understanding and personal application of the standards.

More work must be done to help all teachers understand and teach critical thinking skills to their learners. Teachers of gifted students need to create classrooms where critical thought is taught, practiced, and expected. The findings of this study would also suggest elementary classroom teachers, as a whole, are not comfortable with teaching and recognizing the intellectual standards of critical thought. Only when the language and practice of critical thinking are incorporated into daily use, will it become internalized by our young thinkers.

Since the completion of this action research study, I have continued to use the language of critical thinking in my classroom. I am more aware of
the standards and work to incorporate them into my lesson planning. This unit of study will become the initial unit for my fourth grade gifted learners each year and will be incorporated into my fourth and fifth grade lessons.

**Linda Elder, Gerald Nosich, or Enoch Hale** in their article on *Critical Thinking as Essential to Skilled Reasoning in Any Subject or Discipline*...explained that One conceptual set that we will focus on is the elements of reasoning, or parts of thinking. The elements or parts of reasoning are those essential dimensions of reasoning that are present whenever and wherever reasoning occurs —independent of whether we are reasoning well or poorly. Working together, these elements shape reasoning and provide a general logic to the use of thought. They are presupposed in every subject, discipline, and domain of human thought.

A second conceptual set we will focus on is universal intellectual standards. One of the fundamentals of critical thinking is the ability to assess reasoning. To be skilled at assessment requires that we consistently take apart thinking and examine the parts with respect to standards of quality. We do this using criteria based on clarity, accuracy, precision, relevance, depth, breadth, logicalness, and significance. Critical thinkers recognize that, whenever they are reasoning, they reason to some purpose (element of reasoning). Implicit goals are built into their thought processes. But their reasoning is improved when they are clear (intellectual standard) about that purpose or goal. Similarly, to reason well, they need to know that, consciously or unconsciously, they are using relevant (intellectual standard) information (element of reasoning) in their thinking. Furthermore, their reasoning improves if and when they make sure that the information they are using is accurate (intellectual standard).
A third conceptual set in critical thinking is intellectual virtues or traits. Critical thinking does not entail merely intellectual skills. It is a way of orienting oneself in the world. It is a way of approaching problems that differs significantly from that which is typical in human life. People may have critical thinking skills and abilities, and yet still be unable to enter viewpoints with which they disagree. They may have critical thinking abilities, and yet still be unable to analyze the beliefs that guide their behavior. They may have critical thinking abilities, and yet be unable to distinguish between what they know and what they don’t know, to persevere through difficult problems and issues, to think faimindedly, to stand alone against the crowd. Thus, in developing as a thinker, and fostering critical thinking abilities in others, it is important to develop intellectual virtues – the virtues of faimindedness, intellectual humility, intellectual perseverance, intellectual courage, intellectual empathy, intellectual autonomy, intellectual integrity, and confidence in reason.

Dr. Richard Paul in his article on Foundations of Critical Thinking –Going Deeper explains a glossary of critical thinking concepts — which participants will subsequently assess by comparing their formulations to model formulations. The session is advanced in that it assumes that participants have (previous to the conference) developed the ability to orally state, explain, and exemplify basic critical thinking concepts (namely the elements of reasoning, intellectual standards and intellectual virtues). In this session, participants will be expected to state, explain, and exemplify key critical thinking terms both orally and in writing (so clearly, accurately, and precisely that it would be adequate for insertion in a Critical Thinking Glossary of fundamental concepts.) This session is designed for returning conference registrants.
Dr. Gerald Nosich in his article on Engaging Students in Taking Ownership of Content Through Thinking... reports that A key insight into content (and into thinking) is that all content represents a distinctive mode of thinking. Math becomes intelligible as one learns to think mathematically. Biology becomes intelligible as one learns to think biologically. History becomes intelligible as one learns to think historically. This is true because all subjects are: generated by thinking, organized by thinking, analyzed by thinking, synthesized by thinking, expressed by thinking, evaluated by thinking, restructured by thinking, maintained by thinking, transformed by thinking, LEARNED by thinking, UNDERSTOOD by thinking, APPLIED by thinking. If you try to take the thinking out of content, you have nothing, literally nothing, remaining. Learning to think within a unique system of meanings is the key to learning any content whatsoever. This session, in other words, explores the intimate, indeed the inseparable relationship between content and thinking.

Dr. Enoch Hale in his article on Helping students understand the role of skilled questioning in close reading... said that Educated persons are skilled at and routinely engage in close reading. Through the ability to read closely, to comprehend and apply what one reads, students can begin to master a subject. Skilled readers do this through intellectually interacting with an author as they read. This deep form of engagement with an author presupposes the asking of insightful and relevant questions while reading. Through the concepts and principles of critical thinking, these questions can be made explicit to students and, through practice, become part of their intellectual toolbox. Through these questions, students can better understand what they read, integrate important ideas with other important ideas, and,
assess the quality of an author’s reasoning. Thus this session will explore ways and means for helping students develop the ability to ask critical questions while reading.

**Dr. Richard Paul** in article on *Critical Thinking: Many Things to Many Persons…* discussed that At the core of critical thinking is a robust insight. However, that insight plays itself out in a myriad of ways in a myriad of contexts. We bring critical thinking most effectively into our classrooms and our lives by respecting both its core idea and its myriad forms. In this session, the theoretical ground will be laid for the unity and diversity of critical thinking. Participants will leave this session with greater insight into how to help diverse learners use critical thinking more effectively in their special fields with their special concerns and priorities. Some questions learners ask should derive from the core concept of critical thinking. Others derive from discipline-specific ideas or principles. Both should help them take command of the content fields they are studying. Both should reflect their unique background as individuals.

**Dr. Linda Elder** in her article on *Exploring Diverse Frameworks for Thinking; Suggesting the Paulian Framework as the center point of critical thinking as an academic discipline…* Said that If we are to create societies in which fairminded critical thinking is the norm, it is imperative that we embrace critical thinking throughout schooling and human societies. For more than 2400 years, beginning with Socrates, the idea of critical thinking has been developing and to some extent influencing thought and action. But it has not yet taken root. One primary reason for this is that we lack a shared framework for critical thinking in education. Though the concept of critical thinking is well-
established, frameworks for critical thinking vary, and in many cases, diverge. In 1980, Richard Paul introduced a framework for critical thinking which has since been further developed and integrated by Paul and others. In this session, the Paulian framework will be assessed in reference to other frameworks for thinking and for critical thinking. Dr. Elder will argue for the importance of establishing critical thinking as a discipline in its own right and suggest the Paulian approach as the core of this new discipline.

**Dr. Linda Elder** in her article on *How to develop a successful long-term staff development plan that fosters critical thinking*... says that Critical thinking, deeply understood, provides a rich set of concepts that enable us to think our way through any subject or discipline, through any problem or issue. With a substantive concept of critical thinking clearly in mind, we begin to see the pressing need for a staff development program that fosters critical thinking within and across the curriculum. As we come to understand a substantive concept of critical thinking, we are able to follow-out its implications in designing a professional development program. By means of it, we begin to see important implications for every part of the institution – redesigning policies, providing administrative support for critical thinking, rethinking the mission, coordinating and providing faculty workshops in critical thinking, redefining faculty as learners as well as teachers, assessing students, faculty, and the institution as a whole in terms of critical thinking abilities and traits. We realize that robust critical thinking should be the guiding force for all of our educational efforts. This session presents a professional development model that can provide the vehicle for deep change across the curriculum, across the institution.
Gerald Nosich in his article on To Think Is To Question. To Think Critically Is To Ask Critical Questions. What Are Some Critical Questions Students Should be Asking To Learn at higher and higher levels?... concludes that It is not possible to be a good thinker and a poor questioner. Questions define tasks, express problems, and delineate issues. They drive thinking forward. Answers, on the other hand, often bring an end to thought. Only when an answer generates further questions does thought continue as inquiry. A mind with no questions is a mind that is not intellectually alive. No questions (asked) equals no understanding (achieved). Superficial questions equal superficial understanding, unclear questions equal unclear understanding. If your mind is not actively generating questions, you are not engaged in substantive learning.

So the question is raised, “How can we teach so that students generate questions that lead to deep learning?” In this session we shall focus on practical strategies for generating questioning minds---at the same time, of course, that students learn the content that is at the heart of the curriculum.

Dr. Enoch Hale in their article on Helping students understand the connection between skilled questioning and substantive writing... explained that Skilled writing presupposes skilled reflection while writing. Unlike the impressionistic mind, the reflective mind seeks meaning, monitors what it writes, draws a clear distinction between its thinking and the thinking of its audience. The reflective mind, being purposeful, adjusts writing to specific goals. Being integrated, it interrelates ideas it is writing with ideas it already commands. Being critical, it assesses what it writes for clarity, accuracy, precision, relevance, depth,
breadth, logic, significance, and fairness. Being open to new ways of thinking, it values new ideas and learns from what it writes.

The reflective mind improves its thinking by thinking (reflectively) about it. Likewise, it improves its writing by thinking (reflectively) about writing. It moves back and forth between writing and thinking about how it is writing. It moves forward a bit, and then loops back upon itself to check on its own operations. It checks its tracks. It makes good its ground. It rises above itself and exercises oversight. This applies to the reflective mind while writing — or reading or listening or making decisions.

All of these abilities in reflection presuppose abilities in asking relevant and important questions while writing.

Dr. Richard Paul in his article on The skilled learner as skilled questioner... said that A process for designing instruction that emphasizes the skilled thinker as a skilled questioner will be the focus of this session. All participants will experiment with designs of instruction with the view to putting the students as questioner at the core of all activities and assignments. The result should be a higher level of mastery of content by the students and a foundation for transferable question-handling skills essential to life-long learning. The session will explore critical thinking and the design of instruction at an advanced level. It will presuppose familiarity with the elements of reasoning, intellectual standards, and abilities of critical thinking. These terms, and the distinctions they imply, will be used as common background concepts for this session. This session is designed for returning conference registrants.
Dr. Enoch Hale in his article on *A Quick Look at the Whole: The power of the thinker’s guide library...* said that for ten years they have been developing the thinker’s guide library, beginning in 1999 with the Miniature Guide to Critical Thinking Concepts and Tools. The Thinker’s Guide library provides convenient, portable references that students and faculty can use to improve the quality of studying, learning, and teaching. All conference participants will receive the full library at the conference. In this session, participants will work through a number of activities which will introduce them to each of the guides in the series and help them determine which guides will be most useful in their work with students.

Dr. Gerald Nosich in their article on *Teaching Students to Ask Multilogical Questions within a Field or Discipline...* says that in some disciplines, the experts rarely disagree; in others, disagreement is common. The reason for this is found in the kinds of questions they ask and the nature of what they study. Mathematics and the physical and biological sciences primarily fall into the first category. They mainly study phenomena that behave consistently under predictable conditions and they pose questions that can be expressed clearly and precisely, with virtually complete expert agreement. The disciplines dealing with humans, in contrast—all the social disciplines, the Arts, and the Humanities—primarily fall into the second category. What they study is often unpredictably variable.

Gerald Nosich in his article on *Developing a Substantive Approach to Socratic Questioning Through Critical Thinking...* said that Socratic questioning is disciplined questioning that can be used to pursue thought in many directions and for many purposes, including: to
explore complex ideas, to get to the truth of things, to open up issues and problems, to uncover assumptions, to analyze concepts, to distinguish what we know from what we don’t know, and to follow out logical implications of thought. The key to distinguishing Socratic questioning from questioning per se is that Socratic questioning is systematic, disciplined, and deep, and usually focuses on foundational concepts, principles, theories, issues, or problems.

Teachers, students, or indeed anyone interested in probing thinking at a deep level can and should construct Socratic questions and engage in Socratic dialogue. When we use Socratic questioning in teaching, our purpose may be to probe student thinking, to determine the extent of their knowledge on a given topic, issue or subject, to model Socratic questioning for them, or to help them analyze a concept or line of reasoning. In the final analysis, we want students to learn the discipline of Socratic questioning, so that they begin to use it in reasoning through complex issues, in understanding and assessing the thinking of others, and in following-out the implications of what they, and others think.

The art of Socratic questioning is intimately connected with critical thinking because the art of questioning is important to excellence of thought. Both critical thinking and Socratic questioning share a common end. Critical thinking provides the conceptual tools for understanding how the mind functions (in its pursuit of meaning and truth); and Socratic questioning employs those tools in framing questions essential to the pursuit of meaning and truth.

Linda Elder in her article on Weeks to Better Thinking and Better Living: Using the Tools of Critical Thinking to Take Charge of Your Life... says There is nothing we do as humans that does not involve thinking. Our thinking
tells us what to believe, what to reject, what is important, what is unimportant, what is true, what is false, who are our friends, who are our enemies, how we should spend our time, what jobs we should pursue, where we should live, who we should marry, how we should parent. Everything we know, believe, want, fear, and hope for, our thinking tells us.

It follows, then, that the quality of our thinking is the primary determinant of the quality of our lives. It has implications for how we go about doing literally everything we do. The quality of your work is determined by the quality of your thinking as you reason through the problems you face as you work. The quality of your relationships is determined by the thinking you do about and in those relationships.

Therefore, learning to think at the highest level of quality, or to think critically, is too important to leave to chance. Critical thinking is the disciplined art of ensuring that you use the best thinking you are capable of in any set of circumstances. Through developed critical capacities, you can take command of the thinking that commands you. In this preconference session, we will use the book: 25 Days to Better Thinking and Better Living (by Elder and Paul) as a launching pad for taking command of the thinking that is guiding everything we do, and all the ways in which we experience life.

Rush Cosgrove and Richard Paul in their article on Three Historical Approaches to Critical Thinking and Their Significance for the Design and Assessment of Post-Secondary Curriculum… discussed three historical approaches to the history of critical thinking will be explored – with special emphasis on their significance for the design and assessment of the post secondary curriculum. The first historical analysis will focus on the relation of criticality to the political
and social struggle for power in human history. We all share the experience of social indoctrination and acculturation, the result being that we are all raised to uncritically accept as true the beliefs and values of our society. Recognizing the pervasiveness of this shaping of our life and thought heightens our awareness of the need to teach and learn in such a way as frees the mind from its social, cultural and political intolerance. The second historical analysis will focus on the history of the disciplines. The third historical analysis will focus on some of the great thinkers who have both challenged the paradigms that have limited the disciplines and developed insights that shifted the paradigms towards a more rational perspective. The session will also focus on the significance of these historical analyses to how substantive critical thinking can be fostered in the curriculum and assessed academically. This session, like all conference sessions, will be highly interactive. Participants can expect to leave this session not only with a network of insights into the role of critical thinking in human history, but also with a richer grasp of practice-oriented theory.

Enoch Hale in his article on How to Work Together with Colleagues to Deepen Your Understanding of Critical Thinking Through Extended Book Studies... explained that A key ingredient of professional development in critical thinking entails working together with colleagues to deepen your understanding of critical thinking. One potentially powerful way to do this is through book studies that focus on the theory and application of critical thinking. In this session, participants will experience our book study concept, using thinker’s guides to critical thinking, as well as other readings. Participants will explore effective methods for leading book studies with colleagues.
Gerald Nosich in his article on *Teaching Students to Think Within a Field or Discipline*... says that One of the main goals of instruction is to help the student internalize the most basic concepts in the subject and to learn to think through questions in everyday life using those concepts. Critical thinking in biology is biological thinking. Critical thinking in anatomy is anatomical thinking. Critical thinking in literature is thinking the way a knowledgeable, sensitive, reasonable reader thinks about literature. A discipline is more than a body of information. It is a distinctive way (or set of ways) of looking at the world and thinking through a set of questions about it. It is systematic and has a logic of its own. In this session, participants will think through the logic of a discipline of their choosing. They will also focus on teaching the logic of their discipline so students internalize the way of thinking inherent in the subject as a life-long acquisition.

Richard Paul in his article on *What are Intellectual Traits and How Does One Teach for Them?*... said that Critical thinking is not just a set of intellectual skills. It is a way of orienting oneself in the world. It is a way of approaching problems that differs significantly from that which is typical in human life. People may have critical thinking skills and abilities, and yet still be unable to enter viewpoints with which they disagree. They may have critical thinking abilities, and yet still be unable to analyze the beliefs that guide their behavior. They may have critical thinking abilities, and yet be unable to distinguish between what they know and what they don’t know, to persevere through difficult problems and issues, to think faimindedly, to stand alone against the crowd. This session focuses on designing instruction that transforms the mind, instruction that fosters the development of faimindedness, intellectual humility, intellectual perseverance, intellectual courage, intellectual
empathy, intellectual autonomy, intellectual integrity, and confidence in reason.

**Linda Elder** in her article on *Understanding the Relationship Between Critical Thinking and Emancipating the Mind*… explained that Most people are trapped in their beliefs. They use ideas in their thinking that they are unaware of and have never examined for quality. They have developed a world view which influences much of their behavior, but of which they have little or no understanding. They are using assumptions accumulated throughout their lives which lead to their inferences and conclusions, but which they themselves have little or no awareness of. They are trapped in egocentric narrow-mindedness and sociocentric vested interest.

In short, the mind can be trapped in unexamined beliefs, concepts, assumptions, and world-views, or it can be freed through intellectual self-discipline and cultivation. This session will focus on the multiple ways that critical thinking can help us become more independent, and hence more free, in our thinking. It will focus on understanding the concepts and principles of critical thinking in ways that encourage students to “emancipate” their minds.

**Enoch Hale** in their article on *Fostering Critical Thinking in the Secondary Classroom*… said that Bringing critical thinking into the high school classroom entails understanding the concepts and principles embedded in critical thinking and then applying those concepts throughout the curriculum. It means developing powerful strategies that emerge when we begin to understand critical thinking. In this session we will focus on strategies for engaging the intellect at the high school level.
These strategies are powerful and useful, because each is a way to get students actively engaged in thinking about what they are trying to learn. Each represents a shift of responsibility for learning from the teacher to the student. These strategies suggest ways to get your students to do the hard work of learning.

Rush Cosgrove in his article on ‘On the potential of the critical vocabulary of the English language as an academic lingua franca’...

Explains the potential implications for teaching, learning, and research of a shared academic language based on the critical vocabulary of the English language (consisting in those general terms in the language that function as intellectual constructs relevant to the appropriate analysis or evaluation of thought, irrespective of its content or domain). This approach to teaching and learning should facilitate more effective and efficient communication among academic groups, making it easier to think and work together more productively and creating innovative possibilities for teaching, learning, and research.

The basic premises are these: that, at present in academia, we do not maximize our potential to think and work together; that much of the reason is due to history and tradition, but much is a result of specialized academic discourse which, while having clear advantages, necessarily excludes those who are not conversant in that particular scholarly dialect; that this exclusion results in numerous negative implications (some being that students often find it difficult to enter into new fields; that teachers often find it difficult to share experiences and improve practice; and that cross-disciplinary and cross-methods research, the kind which, historically, produces highly fruitful innovations, is relatively rare); that a cross-disciplinary and shared academic language would ameliorate many
of these limitations; that the critical vocabulary of the English language is an intriguing prospective candidate for laying the foundations of such an intra-disciplinary academic dialect; and that developing this language, on any foundation, would be beneficial in countless directions.

In fact, we already do use this common language, though we often do so implicitly and inefficiently. In virtually every field we question for clarity and accuracy, for relevance, depth, breadth, and significance. In every field there are assumptions and questions, conclusions and concepts, information and implications, purposes and points of view. Furthermore, success in academia worldwide is dependent upon intellectual perseverance as well as a certain degree of intellectual empathy and open-mindedness. By making these concepts more explicit, by focusing on them as conceptual tools to be used for interrogation and communication, academic discourse might become more efficient and effective, opening up new and exciting possibilities for teaching, learning, and research.

Gerald Nosich in his article on *The Role of Administration in Creating Critical Thinking Communities*... said that Critical thinking, deeply understood, provides a rich set of concepts that enable us to think our way through any subject or discipline, through any problem or issue. With a substantive concept of critical thinking clearly in mind, we begin to see the pressing need for a staff development program that fosters critical thinking within and across the curriculum. As we come to understand a substantive concept of critical thinking, we are able to follow-out its implications in designing a professional development program. By means of it, we begin to see important implications for every part of the institution – redesigning policies, providing administrative
support for critical thinking, rethinking the mission, coordinating and providing faculty workshops in critical thinking, redefining faculty as learners as well as teachers, assessing students, faculty, and the institution as a whole in terms of critical thinking abilities and traits. We realize that robust critical thinking should be the guiding force for all of our educational efforts. This session presents a professional development model that can provide the vehicle for deep change across the curriculum, across the institution.

Linda Elder in her article on *Using Peer Review on a Typical Day to Foster Substantive Critical Thinking*... discussed that To acquire substantive knowledge, students need: 1) engagement in the active construction of knowledge and 2) constructive feedback for that construction. This session will focus on the second half of this need: the reception of constructive feedback. Students can learn how to improve their own thinking and that of others by learning simple techniques for giving constructive feedback. This session will focus on how to get students to give constructive feedback that helps others as they expand their knowledge and insight by getting constructive feedback from those others. Through this process, students can learn how to help other students think more clearly, accurately, precisely, relevantly, deeply, broadly, logically, and fairly (as they learn how to do so themselves).

Richard Paul in his article on *Teaching Students to Distinguish Strong and Weak Sense Critical Thinking*... said that Strong-sense critical thinkers are fundamentally concerned with reasoning at the highest level of skill, considering all the important available evidence, and respecting all relevant viewpoints. Their thought and behavior is characterized primarily by intellectual virtues or habits of mind. They
avoid being blinded by their own viewpoints. They recognize the framework of assumptions and ideas upon which their own viewpoints are based. They realize the necessity of putting their assumptions and ideas to the test of the strongest objections that can be leveled against them. Most importantly, they can be moved by reason; in other words, they are willing to abandon their own ideas when other ideas prove more reasonable or valid.

Weak sense, or unethical critical thinkers, on the other hand do not hold themselves or those with whom they ego-identify to the same intellectual standards to which they hold opponents. They do not reason empathically within points of view or frames of reference with which they disagree; They tend to think monologically (within one narrow perspective). They do not genuinely accept, though they may verbally espouse, the values of fairminded critical thinking. They use intellectual skills selectively and self-deceptively to foster and serve their selfish interests at the expense of truth. They use critical thinking skills to identify flaws in the reasoning of others and sophisticated arguments to refute others’ arguments before giving those arguments due consideration. They routinely justify their irrational thinking through highly sophisticated rationalizations. They are highly skilled at manipulation.

Enoch Hale in the article named Fostering Critical Thinking in the Social Disciplines… says that The social disciplines include academic courses that foster understanding of the individuals, groups and institutions that make up human society. They study how humans live together in groups in such a way that their dealings with one another affect their common welfare. In this session, we focus on fostering
critical thinking within the social disciplines – within history, anthropology, geography, economics, political science, psychology and sociology.

**Enoch Hale** in the article on *Using the Tools of Critical Thinking to Teach Students How to Study and Learn…* said that

To study well and learn any subject is to learn how to think with discipline within that subject. It is to learn to think within its logic, to:

- raise vital questions and problems within it, formulating them clearly and precisely.
- gather and assess information, using ideas to interpret that information insightfully.
- come to well-reasoned conclusions and solutions, testing them against relevant criteria and standards.
- adopt the point of view of the discipline, recognizing and assessing, as need be, its assumptions, implications, and practical consequences.
- communicate effectively with others using the language of the discipline and that of educated public discourse.
- relate what one is learning in the subject to other subjects and to what is significant in human life.

To become a skilled learner is to become a self-directed, self-disciplined, self-monitored, and self-corrective thinker who has given assent to rigorous standards of thought and mindfull command of their use. Skilled learning of a discipline requires that one respect the power of it, as well as its, and one’s own, historical and human limitations. This session will offer strategies for helping students begin to take learning seriously.
These strategies are rooted in a vision of instruction implied by critical thinking and an analysis of the weaknesses typically found in most traditional didactic lecture/quiz/test formats of instruction. This session, then, focuses on some basic instructional strategies that foster the development of student thinking, and strategies that require students to think actively within the concepts and principles of the subject.

Richard Paul in the article on *Why Transfer of Learning is a Common Consequent of Teaching for Critical Thinking*… explained that Transfer of learning is sometimes seen as an elusive process. But when we have command of the concepts and principles of critical thinking, we see them as the logical means for transfer of knowledge and ideas. For instance, when we understand that all reasoning entails assumptions, we can begin to look for assumptions within any field or discipline; we can relate the assumptions within disciplines to one another. When we understand that all reasoning entails concepts, we can begin to identify and connect concepts within and among disciplines. When we understand that all high quality reasoning entails the consistent use of intellectual standards, we can explicitly identify the intellectual standards relevant to thinking well within any field or discipline; we can identify the intellectual standards relevant to good reasoning within all disciplines. This session will thus explore the concepts and principles of critical thinking in relationship with transferring knowledge and learning.

Gerald Nosich in the article on *Teaching for Intellectual Humility and Intellectual Courage*… said that Intellectual Humility means having a consciousness of the limits of one’s knowledge, including a sensitivity to circumstances in which one’s native egocentrism is likely to function self-deceptively; sensitivity to
bias, prejudice and limitations of one’s viewpoint. Intellectual humility depends on recognizing that one should not claim more than one actually knows. It does not imply spinelessness or submissiveness. It implies the lack of intellectual pretentiousness, boastfulness, or conceit, combined with insight into the logical foundations, or lack of such foundations, of one’s beliefs.

Intellectual Courage means having a consciousness of the need to face and fairly address ideas, beliefs or viewpoints toward which we have strong negative emotions and to which we have not given a serious hearing. This courage is connected with the recognition that ideas considered dangerous or absurd are sometimes rationally justified (in whole or in part) and that conclusions and beliefs inculcated in us are sometimes false or misleading. To determine for ourselves which is which, we must not passively and uncritically “accept” what we have “learned.” Intellectual courage comes into play here, because inevitably we will come to see some truth in some ideas considered dangerous and absurd, and distortion or falsity in some ideas strongly held in our social group. We need courage to be true to our own thinking in such circumstances. The penalties for non-conformity can be severe. This session thus focuses on fostering these virtues in student thinking.

Linda Elder in her article on **Sociocentric Thinking as a Barrier to Cultivating the Intellect** explained that Many of the most deep seated habits that humans acquire come from the process of being socialized or enculturated. Almost everything we think or do, we have been taught to think or do by the social groups that have shaped us. Those who want to free themselves from indoctrination, to become intellectually emancipated, must understand this problem as a significant barrier to their development and begin to see its influence on their daily thinking.
Living a human life entails membership in a variety of human groups. This typically includes groups such as nation, culture, profession, religion, family, and peer group. We find ourselves participating in groups before we are aware of ourselves as living beings. We find ourselves in groups in virtually every setting in which we function as persons. What is more, every group to which we belong has some social definition of itself and some usually unspoken “rules” that guide the behavior of all members. Each group to which we belong imposes some level of conformity on us as a condition of acceptance. This includes a set of beliefs, behaviors, and taboos.

For most people, blind conformity to group restrictions is automatic and unreflective. Most effortlessly conform without recognizing their conformity. They internalize group norms and beliefs, take on the group identity, and act as they are expected to act—without the least sense that what they are doing might reasonably be questioned. Most people function in social groups as unreflective participants in a range of beliefs, attitudes, and behaviors analogous, in the structures to which they conform, to those of urban street gangs.

This conformity of thought, emotion, and action is not restricted to the masses, or the lowly, or the poor. It is characteristic of people in general, independent of their role in society, independent of status and prestige, independent of years of schooling. It is in all likelihood as true of college professors and their presidents as students and custodians, as true of senators and chief executives as it is of construction and assembly-line workers. Conformity of thought and behavior is the rule in humans, independence the rare exception.

Gerald Nosich in his article Teaching Students Fundamental and Powerful Concepts… said that Concepts are ideas we use in
thinking. They enable us to group things in our experience in different categories, classes, or divisions. They are the basis of the labels we give things in our minds. They represent the mental map (and meanings) we construct of the world, the map that tells us the way the world is. Through our concepts we define situations, events, relationships, and all other objects of our experience. All our decisions depend on how we conceptualize things. All subjects or disciplines are defined by their foundational concepts. Cell versus mitochondria is an example. Cell is a much more fundamental and powerful concept in biology than is mitochondria. Students who achieve a deep understanding of the concept of a cell will be able to think though and gain insight into a very large number of topics in biology. It will give them a powerful entrance into thinking biologically. Not only that, but a good grasp of the concept cell will enable students to think critically about a range of topics they will encounter outside the course. By contrast, a student who achieves a good grasp of the concept mitochondria will not, thereby, gain insight into nearly as large a range of other biology topics.

When students master foundational concepts at a deep level, they are able to use them to understand and function better within the world. Can you identify the fundamental concepts in your discipline? Can you explain their role in thinking within your discipline? How can you help students take command of these concepts?

Linda Elder in her article on Why I am Ashamed to Belong to the Human Species... says that Humans often engage in irrational behavior. We fight. We start wars. We kill. We are self-destructive. We are petty and vindictive. We act out when we don’t get our way. We abuse our mates. We neglect our children. We rationalize, project, and
stereotype. We act inconsistently, ignore relevant evidence, jump to conclusions, and say and believe things that don’t make good sense. We deceive ourselves in many ways. We are our own worst enemy. In this session, we will explore some of the many problems caused by human thought and action. We will begin to address these questions: Why do humans behave in these irrational and unreasonable ways? What are the root causes of these problems? And what, if anything, can be done about them?

Richard Paul in his article on What I Think of When I Design Instruction… said that he is not only one of the leading theoreticians in critical thinking; he is also a distinguished teacher. Both his workshops and his classes are designed to foster intensive intellectual engagement of every student in every class. In this two-day preconference session, Dr. Paul will take you through his design of instruction, bringing you into how he thinks about instruction and how he contextualizes his knowledge of critical thinking in his classes. Dr. Paul will demonstrate how to devise ways of teaching class sessions that progressively build on each other. Paul’s teaching strategies reflect insights implicit in successful Oxford tutorials and Cambridge supervisions. Of course, they are adapted to much larger student numbers (than that of the Oxford don teaching one or two students) and to students, on the whole, significantly less advanced. As part of the process, Paul will model the art of teaching critical reading, writing, and speaking.

Enoch Hale in the article The Art of Close Reading and Substantive Writing… explains that Educated persons are skilled at and routinely engage in close reading and substantive writing. When reading, they seek to learn from texts; they generate questions as they read and
seek answers to those questions by reading widely and skillfully. In short, they seek to become better educated through reading. They do this through the process of intellectually interacting with the authors they read, as they read. They come to understand what they read by paraphrasing, elaborating, exemplifying, and illustrating what they read. They make connections as they read. They evaluate as they read. They bring important ideas into their thinking as they read.

Substantive writing, in turn, consists in focusing on a subject worth writing about and then saying something worth saying about it. It enhances our reading. It develops the more subjects we read and write about and the more points of view we use as tools for discovering important points. Whenever we read to acquire knowledge, we should write to take ownership of that reading. Furthermore, just as we must write to gain an initial understanding of the primary ideas of a subject, so also must we write to begin to think within the subject as a whole and to make interconnections between ideas within and beyond the subject. Quite remarkably, many of our students have never read a text closely, nor written a substantive paper in all their years of schooling. Instead, they have developed the habit of skirting by with superficial and impressionistic reading, writing, and listening. This session will explore ways and means for developing student skills in close reading and substantive writing in content areas

Rush Cosgrove in his article on Practical Ideas for Improving Student Learning . . . says that substantive teaching and learning can occur only when students take ownership of the most basic principles and concepts of the subject. The teaching strategies recommended are rooted in a vision of instruction implied by critical thinking and an analysis of the weaknesses typically found in most traditional didactic
lecture/quiz/test formats of instruction. The session will utilize the Thinker’s Guide on How to Improve Student Learning, which highlights strategies that require students to think actively within the concepts and principles of the subject. An important uniqueness of this session is that it will be facilitated by an insightful student skilled in critical thinking and will thus highlight a student perspective on teaching and learning.

Linda Elder in her article on The Role of Administration in Establishing a Critical Thinking Community . . . explained that Critical thinking, deeply understood, provides a rich set of concepts that enable us to think our way through any subject or discipline, through any problem or issue. With a substantive concept of critical thinking clearly in mind, we begin to see the pressing need for a staff development program that fosters critical thinking within and across the curriculum. As we come to understand a substantive concept of critical thinking, we are able to follow-out its implications in designing a professional development program. By means of it, we begin to see important implications for every part of the institution – redesigning policies, providing administrative support for critical thinking, rethinking the mission, coordinating and providing faculty workshops in critical thinking, redefining faculty as learners as well as teachers, assessing students, faculty, and the institution as a whole in terms of critical thinking abilities and traits. We realize that robust critical thinking should be the guiding force for all of our educational efforts. This session presents a professional development model that can provide the vehicle for deep change across the curriculum, across the institution.

Richard Paul in his article on Teaching Critical Thinking in the Professional Fields . . . discussed that Everyday professionals make
decisions that have important implications for human and animal life – medical professionals, engineers, social workers, lawyers, judges, prosecutors, activists, and many others. Critical thinking is essential to thinking well within all the professions. This session will thus explore the concepts, principles, and tools that critical thinking brings to the professions.

**Dr. Gerald Nosich** in their article on *Socratic Questioning* . . . said that All thinking is driven by questions. Good questions generate good thinking. Bad questions generate bad thinking. Deep questions, deep thinking. No questions, no thinking. To think well about thinking we need to learn how to ask questions that take thinking apart and reveal to us how the parts of our thinking are functioning together. In this session, Gerald Nosich will provide an introduction to the theory and practice of Socratic Questioning, through emphasis on the analysis and assessment of reasoning. Participants will be engaged in Socratic dialogue, and will gain introductory experience in Socratic questioning, that with practice can lead to an increasingly richer understanding of the power inherent in disciplined questioning as a tool of both teaching and learning.

**Suzanne Borman and Joel Levine** in their article on *Infusing Critical Thinking into Elementary Instruction:* Explained the strategies for fostering critical thinking at the elementary level. Special emphasis will be placed on helping students understand what it means to be a fair-minded critical thinker and how they can achieve this goal by learning to take their thinking apart, evaluate it and then improve it. To this end, Drs. Borman and Levine will focus on strategies for teaching elementary students the Elements of Thinking and the Universal Intellectual Standards and how to use these concepts to evaluate
thinking. Participants will have an opportunity to develop learning activities designed to foster student comprehension of specific critical thinking concepts.

**Enoch Hale** in their article on *The Art of Close Reading and Substantive Writing* . . . said that Educated persons are skilled at and routinely engage in close reading and substantive writing. If we have the ability to read closely, to comprehend and apply what we read, we can — in principle — master a subject from books alone, without benefit of lectures or class discussion. Indeed, if we read widely and skillfully, we may become educated through reading alone. Skilled readers do this through the process of intellectually interacting with the authors they read as they read. They actively question. They come to understand what they read by paraphrasing, elaborating, exemplifying, and illustrating what they read. They make connections as they read. They evaluate as they read. They bring important ideas into their thinking as they read.

Substantive writing, in turn, consists in focusing on a subject worth writing about and then saying something worth saying about it. It enhances our reading. It develops the more subjects we read and write about and the more points of view we use as tools for discovering important points. Whenever we read to acquire knowledge we should write to take ownership of that reading. Furthermore, just as we must write to gain an initial understanding of the primary ideas of a subject, so also must we write to begin to think within the subject as a whole and to make interconnections between ideas within and beyond the subject. Quite remarkably, many of our students have never read a text closely nor written a substantive paper in all their years of schooling. Instead they have developed the habit of skirting by with superficial and impressionistic reading, writing, and listening. This session will explore
ways and means for developing student skills in close reading and substantive writing in content areas.

Richard Paul in the article on Creating a Critical Society . . . explained The critical habit of thought, if usual in society, will pervade all its mores, because it is a way of taking up the problems of life. Men educated in it cannot be stampeded by stump orators ... They are slow to believe. They can hold things as possible or probable in all degrees, without certainty and without pain. They can wait for evidence and weigh evidence, uninfluenced by the emphasis or confidence with which assertions are made on one side or the other. They can resist appeals to their dearest prejudices and all kinds of cajolery. Education in the critical faculty is the only education of which it can be truly said that it makes good citizens.

It is becoming increasingly clear that the survival and well-being of humans largely depends on our ability to work together successfully and productively, to reach out to one another, to help one another. Yet, problems of nationalism and ethnocentrism are pervasive across the world. People are raised to see their country, or their group, as better than other countries or groups. They tend to favor the groups to which they belong. This is a natural tendency of the human mind. And it is a tendency fostered within most, if not all, cultures across the world.

If we are to create a world that advances justice for the vast majority of people across the globe, we must become citizens of the world. We must denounce nationalism and ethnocentrism. We must think within a global, rather than national, view. We must take a long-term view. We must begin to relegate the interests of any given country, including our own, to that of one of many: no more worthy, no more
needy, no more deserving of the world’s resources than anyone else on the planet. We must see the lives of people in other countries as no less precious than the lives of people in our own country. We must oppose the pursuit of narrow selfish or group interests. Integrity and justice must become more important to us than national advantage and power. This session will focus on these essential ingredients of a critical society and briefly explore the possibilities for the creation of such a society in the future.

Rush Cosgrove in his article on Learning the Physical and Life Sciences: a Student Perspective . . . said that To study well and learn any science is to learn how to think scientifically within that subject. It is to learn to

- raise vital scientific questions and problems within it, formulating them clearly and precisely,
- gather and assess scientific data and information, using scientific theories and principles to interpret those data insightfully,
- come to well-reasoned scientific conclusions and solutions, testing them against relevant scientific criteria and standards;
- adopt the point of view of the science, recognizing and assessing, as need be, its assumptions, implications, and practical consequences;
- communicate effectively with others using the language of the discipline and that of educated public discourse; &
- relate what one is learning in the science to other sciences and to what is significant in human life.

To become a skilled scientist is to become a self-directed, self-disciplined, self-monitored, and self-corrective thinker, who has given
assent to rigorous standards of thought and mindful command of their use. Yet most scientific instruction falls far short of fostering disciplined thinking. In this session, Rush Cosgrove, a college student, will share his experiences as a student in physical and life sciences, discussing methods that have fostered his intellectual development and those that have hindered his development. Participants will come away with instructional strategies which they can use in the classroom to help students think more deeply in the physical and life sciences.

Linda Elder in her article on Teaching Critical Thinking in the Social Disciplines . . . says that The social disciplines include academic courses that foster understanding of the individuals, groups and institutions that make up human society. They study how humans live together in groups in such a way that their dealings with one another affect their common welfare. In this session, we focus on fostering critical thinking within the social disciplines – within history, anthropology, geography, economics, political science, psychology and sociology.

Gerald Nosich in his article on Teaching Critical Thinking in the Arts and Humanities . . . noted that Painting, sculpture, architecture, dance, music, drama, and literature as art forms are all attempts to create something that goes beyond simple skill or demonstrable knowledge. They represent modes of seeking to express what is “beautiful,” “deep,” “insightful,” and/or “profound” in nature or in human life. They attempt to transcend or transform the “ordinary,” “obvious,” or mundane. In this session, we focus on fostering critical thinking within
the arts and humanities, including those mentioned above, as well as philosophy and religious studies.

Suzanne Borman and Joel Levine in their article on Infusing Critical Thinking into Elementary Instruction discussed that Building on the foundational concepts covered in the first session, this session will continue to focus on infusing critical thinking in elementary instruction throughout the curriculum and within student relationships. Participants will be engaged in applying the elements of reasoning and intellectual standards within content areas including math, language arts, and social studies. Classroom management issues will also be addressed through application of critical thinking strategies.

Richard Paul in his article on Fairmindedness Test he discussed that A Foundation for Critical Thinking machine-scorable test focused on determining the extent to which students are likely to think fairmindedly, to think empathically, to consider alternate ways of looking at complex issues will be the focus of this session. Participants will take and then score the test.

Richard Paul in his article on Critical Thinking Reading and Writing Test: Levels Three-Four and International Critical Thinking Test . . . The first third and fourth levels of the Critical Thinking Reading and Writing Test, as well as the International Critical Thinking Test, will be the focus of this session. The overlapping nature of these two tests will be discussed. Participants will get brief practice in analyzing and assessing reasoning, the two main processes targeted in these tests.
Gerald Nosich in the article on Analytic Reasoning Test . . . said that a new machine-scorable Foundation for Critical Thinking test focused on assessing one’s ability to analyze reasoning will be the focus of this session. Participants will take and score the test.

Richard Paul in the article on Teaching Students to Construct Knowledge… said that Students do not gain knowledge until they construct it in their minds. As teachers, we must develop multiple strategies for ensuring that students are continually involved in the construction of knowledge. We must abandon the notion that rote memorization of bits and pieces of the textbook or of lectures can substitute for the forms of construction that lead to understanding and true knowledge. The two goals of this session, then, are: a) to cultivate insight into the principle that genuine knowledge presupposes the active “construction of knowledge” and b) to devise practical teaching strategies that result in students genuinely constructing knowledge.

Gerald Nosich in the article on Intellectual Virtues: Essential to the Educated Mind… discussed that Critical thinking is not just a set of intellectual skills. It is a way of orienting oneself in the world. It is a way of approaching problems that differs significantly from that which is typical in human life. People may have critical thinking skills and abilities, and yet still be unable to enter viewpoints with which they disagree. They may have critical thinking abilities, and yet still be unable to analyze the beliefs that guide their behavior. They may have critical thinking abilities, and yet be unable to distinguish between what they know and what they don’t know, to persevere through difficult problems and issues, to think fairmindedly, to stand alone against the crowd. This session focuses on designing instruction that transforms the mind, instruction that fosters the development of fairmindedness, intellectual
humility, intellectual perseverance, intellectual courage, intellectual empathy, intellectual autonomy, intellectual integrity, and confidence in reason.

Linda Elder in her article on The Role of Administration in Establishing a Critical Thinking Community… explained that Critical thinking, deeply understood, provides a rich set of concepts that enable us to think our way through any subject or discipline, through any problem or issue. With a substantive concept of critical thinking clearly in mind, we begin to see the pressing need for a staff development program that fosters critical thinking within and across the curriculum. As we come to understand a substantive concept of critical thinking, we are able to follow-out its implications in designing a professional development program. By means of it, we begin to see important implications for every part of the institution – redesigning policies, providing administrative support for critical thinking, rethinking the mission, coordinating and providing faculty workshops in critical thinking, redefining faculty as learners as well as teachers, assessing students, faculty, and the institution as a whole in terms of critical thinking abilities and traits. We realize that robust critical thinking should be the guiding force for all of our educational efforts. This session presents a professional development model that can provide the vehicle for deep change across the curriculum, across the institution.

Enoch Hale in this article on Engaging Students in Active and Cooperative Learning … said that Although bringing critical thinking into the classroom ultimately requires serious, long-term development, you can immediately begin to make important changes in your teaching. Many simple, straightforward, yet powerful strategies can be implemented right away in the classroom to improve the quality of
student learning. In this session we focus on a number of such suggestions. They are powerful and useful, because each is a way to get students actively engaged in thinking about what they are trying to learn. Each represents a shift of responsibility for learning from the teacher to the student. These strategies suggest ways to get your students to do the hard work of learning.

Linda Elder in the article on Analyzing and Assessing Reasoning… discussed Analysis and evaluation are recognized as crucial skills for all students to master for good reason. They are required in learning any significant body of content in a non-trivial way. Students are commonly asked to analyze poems, mathematical formulas, biological systems, chapters in textbooks, concepts and ideas, essays, novels, and articles—just to name a few. Yet what student can explain what analysis requires? What students have a clear conception of how to think it through? Which of our graduates could complete the sentence: “Whenever I am asked to analyze something, I use the following model.”

This session focuses on the most fundamental concepts in critical thinking – the analysis and assessment of reasoning.

Richard Paul in his article on Questions that Analyze and Evaluate Thinking… discussed that Asking powerful analytic questions is vital to excellence in thought. When we analyze thinking, we break it down into its component parts. We do this because problems in a “whole” are often a function of problems in one or more of its parts. Success in thinking depends, first of all, on our developing an analytic questioning mind. This involves skill in questioning the structures that define the “parts” of thinking: goals and purposes, problems and issues, information and data, inferences and conclusions, concepts and theories, assumptions and beliefs, implications and consequences, viewpoints and perspectives.
Universal intellectual standards are the standards by which thinking is judged by educated and reasonable persons. Yet most people rarely use these standards explicitly in their thinking. These standards include, but are not limited to, clarity, precision, accuracy, relevance, depth, breadth, logicalness, and fairness. Skilled thinkers explicitly question using these standards.

Gerald Nosich in his article on Transforming the Mind Through Close Reading… said that Educated persons are skilled at and routinely engage in close reading and substantive writing. Through the ability to read closely, to comprehend and apply what one reads, students can master a subject from books alone, without benefit of lectures or class discussion. Indeed, through well-developed reading abilities, it is possible to become educated through reading alone. Skilled readers do this through intellectually interacting with the author as they read. They actively question as they read. They seek to deeply understand what they read. They make connects as they read. They evaluate as they read. They bring important ideas into their thinking as they read. This session will explore ways and means for developing student skills in close reading.

Linda Elder in her article on Developing the Questioning Mind… explained that It is not possible to be a good thinker and a poor questioner. Questions define tasks, express problems, and delineate issues. They drive thinking forward. Answers, on the other hand, often signal a full stop in thought. Only when an answer generates further questions does thought continue as inquiry. A mind with no questions is a mind that is not intellectually alive. No questions (asked) equals no understanding (achieved). Superficial questions equal superficial understanding, unclear questions equal unclear understanding. If your mind is not actively generating questions, you are not engaged in
substantive learning. So the question is raised, “How can we teach so that students generate questions?” In this session we shall focus on practical strategies for generating questioning minds---at the same time, of course, that students learn the content that is at the heart of the curriculum.

Richard Paul in his article on Evaluating Educational Fads Through Critical Thinking… explained The history of schooling is also the history of educational panaceas, the comings and goings of quick-fixes for deep-seated educational problems. This old problem is not being reduced. Rather, it is dramatically on the increase. This results in intensifying fragmentation of energy and effort in the schools - together with a significant waste of time and money. Many teachers become increasingly cynical and jaded.

It is time to recognize that education will never be improved by simplistic educational fads. Fads by their nature are fated to self-destruction. Teachers and administrators need to understand the problem of educational fads so that they can effectively distinguish substantive efforts at educational reform from superficial ones.

All educational trends or fads have their roots in reasonable ideas. Trends become fads when a reasonable idea is applied unreasonably. All reasonable ideas enhance education when integrated into a substantive concept of education. They fail when imposed upon instruction through a non-substantive, fragmented, conception of education. In this session, we focus on some of the current educational trends or fads in schooling today.

We focus on each trend or fad in three ways. We describe in turn,

- the essential idea behind the trend or fad,
• the proper educational use (when integrated into a substantive concept of education), and
• the likely misuse (when the idea is unreasonably applied).

It is not our goal to provide a full and complete explication of any particular fad or trend. Our goal is to provide a foundation for determining the proper use of any educational idea for reform.

Gerald Nosich in their article on Teaching Students to Master Content Through Thinking… said that A key insight into content (and into thinking) is that all content represents a distinctive mode of thinking. Math becomes more intelligible as one learns to think mathematically. Biology becomes more intelligible as one learns to think biologically. History becomes more intelligible as one learns to think historically. This is true because all subjects are: generated by thinking, organized by thinking, analyzed by thinking, synthesized by thinking, expressed by thinking, evaluated by thinking, restructured by thinking, maintained by thinking, transformed by thinking, LEARNED by thinking, UNDERSTOOD by thinking, APPLIED by thinking. If you try to take the thinking out of content, you have nothing, literally nothing, remaining. Learning a unique system of meanings is the key to learning any content whatsoever. This session explores the intimate relationship between content and thinking.

Linda Elder in her article on Fostering Ethical Reasoning… said that Ethics is the study of decisions or behavior that benefits or harms persons and creatures. Human behavior can be either praised ethically (if someone acts to benefit the welfare of others) or criticized (when someone acts so as to harm others). Ethics is not to be confused with social convention, law, or religious beliefs. For any action to be unethical,
it must deny another person or creature some inalienable right. Social convention and laws, as well as religious beliefs vary enormously along national and cultural lines. But ethical concepts and principles are universal. All educated persons, properly so called, are fundamentally ethical persons because they realize that ethical questions must be answered using ethical concepts and principles. They do not confuse ethics with other modes of reasoning. This session will focus on fostering ethical reasoning abilities in students.

Richard Paul in his article on Using Student and Faculty Interviews To Assess the Depth of Student and Faculty Understanding of Critical Thinking.... Discussed that Many questions have been raised about the best way to assess the depth of student and faculty knowledge of critical thinking. At the Center and Foundation for Critical Thinking, we are familiar with most of the assessment strategies (including tests) that have been traditionally used for that purpose. We are agreed that one of the most powerful ways to assess a person’s knowledge of critical thinking is not through a “test,” but rather through an extended interview protocol. We have used such a protocol in conducting the largest assessment of critical thinking in instruction yet undertaken: an assessment of faculty knowledge of critical thinking at 28 private and 38 public universities. This protocol has been adapted for use in assessing both faculty and student knowledge of critical thinking. Providing students and teachers with sample interviews is an effective way to motivate students and faculty to gain knowledge of critical thinking. In this session, Richard Paul will interview a student. After the interview, the attendees will be invited to direct questions either to the student interviewed or to Richard Paul.
Gerald Nosich in his article on Transforming the Mind Through Substantive Writing... explained that Substantive writing consists in focusing on topic worth writing about and saying something worth saying about it. But all knowledge exists in “systems” of meanings, with interrelated primary, secondary, and peripheral ideas. Imagine a series of circles beginning with a small core circle of primary ideas, surrounded by concentric circles of secondary ideas, moving to an outer circle of peripheral ideas. The primary ideas, at the core, explain the secondary and peripheral ideas. Whenever we read to acquire knowledge we must write to take ownership, first, of the primary ideas, for they are a key to understanding all the other ideas. Furthermore, just as we must write to gain an initial understanding of the primary ideas, so also must we write to begin to think within the system as a whole and to make interconnections between ideas. The sooner we begin to think, and therefore write, within a system, the sooner the system becomes meaningful to us. This session will explore ways and means for developing student skills in substantive writing in content areas.

Enoch Hale in his article on Designing High School Social Studies Courses Through Critical Thinking... discussed that Social studies courses are those courses that foster understanding of the individuals, groups and institutions that make up human society. They study how humans live together in groups in such a way that their dealings with one another affect their common welfare. The social disciplines focus on gaining and applying knowledge about human relationships and interactions between individuals and their families, religious or ethnic communities, cities, governments, and other social groups.
Social studies courses are an important part of every high school curriculum. In this session, Enoch Hale, former high school teacher and current Fellow of the Center for Critical Thinking, will share his experiences in placing critical thinking at the heart of the social studies curriculum, with emphasis on meeting state standards while also fostering critical thinking skills, abilities, and dispositions.

Linda Elder in her article on Cultivating Emotional Intelligence... said that To develop emotional intelligence is to achieve command of the workings of our minds. It is our minds that generate our thought, feelings, and desires. It is our students’ minds that control not only how they study and learn but how they make decisions and conduct their lives. Part of understanding the role of critical thinking is enabling us to understand the relationship between thoughts and emotions. To be in command of one’s emotional life is to have command of the faculties of mind that determine it: thoughts, emotions, and desires working together. Student emotions play an important part in their lives as students. When they bring learned indifference, irrational fears, acquired hostility, and inflexible ideas into the classroom, their learning is limited to the superficial.

Richard Paul in his article on Teaching Students Primary Concepts & Ideas... explained that All subjects or disciplines are defined by their foundational concepts. When students master concepts at a deep level, they are able to use them to understand and function better within the world. Can you identify the fundamental concepts in every subject you teach or study? Can you explain their role in thinking within your discipline? Can you help students take command of core concepts? These are some of the questions we will explore in this session.
Concepts are tools we use in thinking. They enable us to group things in our experience in different categories, classes, or divisions. They are the labels we apply to things in our minds. They represent the mental map (and meanings) we construct of the world, the map that tells us the way the world is. Through our concepts we define situations, events, relationships, and all other objects of our experience. All of our decisions depend on how we conceptualize the world. Each subject gives us a unique vocabulary of concepts to use in thinking within the field that the discipline represents.

**Dr. Linda Elder** in her article on *An Introduction to the Fundamentals of Critical Thinking* . . . discussed that Foundational concepts in critical thinking will be covered in this session, while more specific dimensions of critical thinking, or a more advanced approach, will be the focus of International Conference sessions. This session, then, lays the foundation for the other sessions. It will introduce you to the basic components of critical thinking, ways to build those components into the design of what you teach, and ways to make that design effective. In all conference sessions, we understand critical thinking not as something additional to content, but rather as skills, insights, and values integral to it. We focus, therefore, on illustrating how students can come to see what they are learning not as random bits and pieces of information to be memorized, but as a system with a definite set of logical relationships, an organized structure of concepts, principles, and understandings they must think their way through in order to learn content.

**Dr. Gerald Nosich** in his article on *Teaching Students Fundamental and Powerful Concepts* . . . explained that Concepts are ideas we use in thinking. They enable us to group things in our
experience in different categories, classes, or divisions. They are the basis of the labels we give things in our minds. They represent the mental map (and meanings) we construct of the world, the map that tells us the way the world is. Through our concepts we define situations, events, relationships, and all other objects of our experience. All our decisions depend on how we conceptualize things. All subjects or disciplines are defined by their foundational concepts. Cell versus mitochondria is an example. Cell is a much more fundamental and powerful concept in biology than is mitochondria. Students who achieve a deep understanding of the concept of a cell will be able to think though and gain insight into a very large number of topics in biology. It will give them a powerful entrance into thinking biologically. Not only that, but a good grasp of the concept cell will enable students to think critically about a range of topics they will encounter outside the course. By contrast, a student who achieves a good grasp of the concept mitochondria will not thereby gain insight into nearly as large a range of other biology topics.

When students master concepts at a deep level, they are able to use them to understand and function better within the world. Can you identify the fundamental concepts in your discipline? Can you explain their role in thinking within your discipline? How can you help students take command of these concepts? These are some of the questions that will be explored in this session.

Dr. Gerald Nosich in his article on Using Critical Thinking Strategies to Assess Students Learning and Thinking Within a Discipline . . . said that number of interrelated ways to assess the extent to which students are thinking critically within a discipline. Each strategy will emphasize reasoning through what is most central and important in the discipline. For example, asking students to write a response to central
questions in the discipline serves as an excellent pre- and post-test for learning to think critically within the discipline. In a science course, it might well be “How does the physical world operate?” In an economics class, it might be “How are goods and services distributed and consumed within a given society? How should they be?” In answering fundamental questions, we can require students to organize a well-thought-through way of fitting the key insights in the course together as a whole. This session will focus on a variety of examples within multiple subjects (disciplines) that highlight assessment strategies aimed at deep learning. A holistic approach will be taken to the assessment process, with emphasis on both analysis and synthesis.

**REVIEW OF RESEARCH STUDIES CONDUCTED IN INDIA**

**Thakur, T (1974)** had undertaken a research study entitled, “The Academic Achievement of high school boys”. This research study was funded by SIE Assam. The main purpose of this study was to find out how far the school had been able to help the boys to keep up their level of achievement through out their high school career. This research study was conducted on 97 students of class VIII studying in ‘The Best Higher Secondary School, Jorhat Town’. A questionnaire was used to collect personal data and the ability and aptitude of the students for a particular study. The tetra choric correlation was used to study the student’s ability and aptitude for school subjects and ‘t’ test was used to find to the significance of difference between the means.

The major findings of this study included that, (1) Academic achievement, as a whole was not quite satisfactory. (2) In language, there had been satisfactory progress of all the groups but mathematics presented in unsatisfactory picture. A downward trend of the achievement was observed. (3) Boys with less aptitude for a subject failed to achieve
satisfactorily in that subject. Those who had aptitude but disliked a subject did not show significant achievement. (4) Students who liked a subject found it easy, some found the subject difficult though they liked the subjects. (5) None of the groups gained in the subject through three years of teaching. (6) There was a positive correlation between aptitude and ability in mathematics.

Das, N.C. (1975) had conducted a research study for the Degree of Doctor of science in Psychology at Calcutta University. The study entitled “A Psychometric study of Low Achievement of School Final Candidates in General Science”. Some of the major objectives of this study were; (1) To find out factors responsible for low achievement in general science in school final examination. (2) To compare the intelligence and anxiety of the school final candidates who succeeded and who failed in general science in school final examination and determine the interrelationship among these variables in order to see to what extent intellectual and emotional factors affected scholastic achievement in general science at this stage of education. (3) To analyze the syllabus and the question items of the general science question paper and to suggest measures for the improvement of teaching and learning of general science in high schools.

This study was conducted on 985 students from 61 high schools belonging to six districts of west Bengal. The sample of science teachers both male and female was drawn from 567 high schools. The method of systematic sampling was adopted to collect the samples of teachers and students. The marks obtained by the students in mathematics and general science in school final examination ‘1968’ were also collected. The tools used to collect the data included. The IPAT culture- Free intelligence Test
(scale 3-From B) of cattell and cattell, and the IPAT Anxiety scale questionnaire of Cattell and Scheier, as adopted by Rao and Roy, were used to measure the intelligence and anxiety of students. A questionnaire seeking information regarding different aspects of low achievement of students in general science in school final examination was also developed. The statistical techniques used to analyze the data included, the centroid method and the method of principal components along with varimax rotation for identifying the factors were applied.

The major findings of this study were; (1) The syllabus for general science of the school final examination was in adequate, Physics was over emphasized, chemistry and botany were neglected; astronomy and geology were not included in the syllabus. There was no scope for practical work by the students. Out of 37 concepts included in the syllabus of general science, only 19 were covered by the question-paper. The knowledge aspect was tested, but the application aspect was neglected. (2) Students who passed in general science, possessed higher IQ than those who failed in the subject. A positive correlation existed between intelligence and achievement in general science. (3) There was no significant difference between anxiety scores of those passing in general science and those failed in the subject. (4) Pupil personality turned out to be the most powerful component responsible for performance in general science. (5) Students who passed in general science obtained higher marks in mathematics than those who failed in the subject. (6) IQ marks in mathematics and general science showed highly significant inter-correlation. (7) Students’ personality was considered by the teachers as contributory to low achievement. (8) Pupils’ personality; teachers’ incompetence and socioeconomic factors
were the primary factors responsible for low achievement in general science.

**Kohli (1976)** has studied the characteristic behavioral and environment correlates of Academic Achievement of over and under achievers at different levels of intelligence. The findings of this study were: (i) The single factor, combination of factors and factors constellations were not capable in themselves of clearly separating over achievers and under achievers. (ii) Certain factors were common to those groups, which differed widely in achievement.

**Barua, U. C. (1981)** had undertaken a Ph.D. level research study in Education, entitled, *“Influence of capacity of Memorization on Scholastics Achievement”* at Calcutta University. The objectives of this study were: (i) To determine common relations if any among different kinds of memory, (ii) to ascertain the nature of sex differences if any in memory abilities, (iii) to obtain the relation between memory and intelligence, (iv) to find out the relative influence at different kind of memory on scholastic achievements, (v) to consider the position of memory and intelligence as determiners of academic performance. This research study was conducted on a sample of 200 students i.e. 100 boys and 100 girls of age 9-11 years of class VI of two high schools. The tools used to collect data were a test of memory for story, sentence, design and digits, the intelligence test developed and standardized by G.B. Kapat and Socio-Economic status scale by Kuppuswamy. The statistical techniques used to analyze the data included factor analysis with varimax rotation and regression analysis.

The major findings of this study were: (1) Boys and girls were not different with respect to memory for story, sentence design, digits and
total memory. (2) Memory for digits had a definite but small relationship with memory for a story. (3) Memory for digits had a very low relationship with intelligence also memory tended to be independent of intelligence. (4) Boys and girls were not different with respect to intelligence and total scholastic achievement. (5) If learning materials were so presented as to appeal both to intellective and non-intellective aspects of the educed, they would engender better learning and achievement. (6) Children of age-group 9-11 years understood design more meaningfully than stories. (7) Meaningful learning occurred through meaningful visual aids or iconic signs.

**Patel, S. (1986)** had undertaken a Ph.D. level study in Education, entitled, “A Psychological study of high achievers ” at Gujarat University. The main purpose of this study was to find out whether there was any relationship (positive or negative) between the high achievement on one side and study habits, intelligence, neuroticism, anxiety and socio-economic status on the other.

The researcher conducted this study on 170 students (94 boys and 76 girls) studying in two medical colleges of Ahmadabad city. The students varied from different social background, different economic strata and also from different castes and religions. The tools that were used to collect the required data were J.A. Taylor’s Manifest Anxiety scales, Eysenck’s Neuroticism inventory, Advanced progressive Matrices-sets I and II by J.C. Raven, a socio-economic status scale, study habit inventory by C.J. Wrenn and the investigator developed a Questionnaire on study habit by himself.

Chi square test was used to analyze the data collected the researcher found that (1) No-relationship was found between anxiety and
achievement. (2) There was no relationship between neuroticism and high achievement. (3) The results of the entire sample showed that higher the socio-economic status, the higher was the academic achievement. 4) The better and greater the number of good study habits, the higher was the academic achievement. (5) The Advanced Progressive Matrices score of the total sample showed that the mean IQ of the sample was above 120. (6) No relationship was found between the percentage of marks at SSC examination and passing or repetition of a semester for the entire sample. (7) More time being allotted to a difficult subject did influence the passing or failing of the students in the subjects. (8) A separate room for studies influenced the passing or failing of students in examination. (9) Concentrated study as well as the study of the whole course did influence the passing or failing of the total sample of medical students.

Singh, B. (1986) conducted a Ph.D. level study in Education entitled, “A study of some possible contributing factors to high and low Achievement in Mathematics of the High school students of Orissa” at Sambalpur University. This research study was conducted on 370 students studying in XI class. The researcher used Cattell’s Culture Fair Intelligence Test scale 3 (Form A to Form B), Samals’ vocational interest inventory (VII), Minnesota counseling inventory (MCI), survey of study habits and attitudes (SSHA) form H and an achievement test in Mathematics developed by the researcher were used to collect the required data. Correlation and multiple regression analysis were used as the statistical techniques to analyze the data collected.

The researcher found that (1) Achievement in Mathematics was positively significant and related with intelligence, SES, and study attitudes. (2) Achievement in Mathematics was not related with
scientific interest, mechanical interest, and interest in agriculture, interest in business, interest in social service, interest in art, interest in office activities, interest in administrative activities, family relations, social relationship, emotional stability, conformity, adjustment, mood, leadership and study habits. (3) Regression analysis showed that study habits and interest in agriculture were significantly correlated with achievement in Mathematics. (4) High achievers scored high in the study attitude survey. While low achievers scored low, high achievers were more intelligent than the low achievers and high achievers in general were of higher SES than low achievers.

Joshi, Anuradha (1991) has studied the influence of Treatment, personality and their interaction on achievement. The findings of this study were: (1) In the group activity the extraverts by their nature might have dominated and therefore, learnt more than their counterparts. (2) Extraverts are bold by nature so they took the advantage of all activities they were provided.

Subramanyan and Ramadevi (1991) has studied some differential characteristics of high and low achievers in secondary schools. The findings of this study were; (1) The high achiever possesses higher level of mental ability and low achiever possesses low intelligence. (2) The scholastic attainment and creative talent are related to each other in a positive direction. (3) The high achievers possessed better reading skills compared to low achievers. (4) The high achievers motivated towards achievement. (5) School is the proper place to make use of intellectual ability to nurture the creative potential in pupils to improve reading skills,
to inculcate good and healthy attitudes towards education and goals of life.

Ghosh, G.P. (1985) carried out a study for Ph.D. Course in Education, entitled, “A Study of Achievement of the Students in Chemistry and Finding Relationships with Some of its Determinants.” The major findings of this study are - (1) Urban Students did not show better performance in Achievement Test in Chemistry (ATC) than Rural Students. (2) Boys did not show superiority in ATC over girls.

Kumar, Udaya Sam (1991) investigated into the problem, “The Teaching of General Science and the Development of Scientific Attitude in Secondary school Students in Relation to Achievement in General Science.” for M.Phil. Course. The main finding of this study was that, there was a significant difference between the mean score of boys in the average effective group in respect of perception of teaching of science.

Vaidya, N (1991) had undertaken an independent research study entitled, “Developing Teaching-Learning Strategies for Enhancing Student Achievement in Science.” The findings of this study were; (1) It was possible to accelerate thought under certain conditions such as arranging thought provoking problems in their hierarchical order but abstract Piagetion schemes of thought were difficult to crack. (2) It was very much possible for children to help themselves in their day to day teaching-learning provided, the teacher did not insist on the right answer.
The wrong answers, in fact revealed the evolving structures of their logical thought.

**Nelliappan, N.O. (1992)** investigated into the problem. “A Study of Scientific Attitude and Interests among Higher Secondary Biology students in Relation to their Learning Environment.” This research study was undertaken at Ph.D. level in Education. The findings of this study were; (1) there was a strong relationship between the high and low total learning environment of the higher secondary biology students and their scientific attitude and scientific interests. (2) The high and low total learning environment groups of the higher secondary students significantly differed in their scientific attitude and scientific interest.

**Chauhan, Poonam (1993)** had undertaken a research study for Ph.D. Course in Education, entitled, “Relative Contribution of Some Socio-Cultural and Financial Variables to Over and Under Achievement in Science at Class VIII Level.” The findings of this study were; (1) the correlation between achievement in Science and general intelligence was found to lie between 0.29 to 0.60. (2) About one-third of the student population constitute over and underachievers. (3) The correlation coefficients between intelligence and most of the socio-cultural and familial variables were found to be statistically significant. (4) Family income, Parent education, family occupation and socio-cultural background had significant correlations with achievement in science. (5) In case of boys, over achievement was mainly determined by family income. (6) Underachievement in boys were mainly determined by family income and parent education. (7) In case of girls, overachievement in science was determined by socio-cultural background and family
occupation. (8) Overachievement in Science for combined sample of boys and girls was determined by family occupation alone. (9) Underachievement in Science for combined sample of boys and girls was determined by family income and parental education.

**Begum, Khatija H. (1990)** studied the problems of teaching new science syllabus for standard VII in Andhra Pradesh and their impact on pupils achievement. Her study revealed that more than 60% of the teachers found the content in the recent syllabus, new as well as overloaded. Dictation of notes by teachers was the dominant method of getting exercises done by the students. Lack of facilities for science teaching continued to bother teachers a lot. It was observed that achievement in science favored significantly those students, whose teachers had attended an in-service education program. It is proposed that school conditions need to be improved through, say supply of science kits and hand-books for teachers so that pupils may participate in the teaching-learning process by practicing processes of science such as classifying, inquiring and experimenting, etc.

**Kumar Uday Sam (1991)** conducted research on the teaching of general science and the development of scientific attitude in secondary school students in relation to achievement in general science. It was observed that there was a significant difference between the mean scores of boys in the average effective group in respect of perception of teaching of science. The urban and rural pupils of average group differed in respect of perception of teaching of science. There was no significant difference between the mean scores of scientific attitude of secondary school students of boys and girls in the high effective group in respect of perception of teaching science. There was no significant difference
between the mean scores of perception of teaching of pupils of urban and rural areas in the high group.

**Prasad B.A. (1977)** for his Ph.D. level work on ‘A study of the impact of social reinforcement of academic achievement’ found that experimental group was significantly higher in academic achievement than control group, which showed that social reinforcement was favorable to academic achievement. Experimental group was always superior to control group in individual tests also. Socially reinforced group was also superior significantly in comparison to non-reinforced group in week to week progress.

**Sarah Shanta Kumari, Williams (1983)** for her Ph.D. thesis on ‘A study of the attitude of high school pupils towards general science and its relationship with achievement in the subject’ found: 1. The pupils' achievement was poor, in general, in respect of understanding and application, compared to their achievement in respect of the skills and knowledge objectives of teaching general science in high schools. 2. The attitude of the high school pupils towards science and science education in Tamilnadu was generally favorable but there was a wide disparity in their attitudes. 3. When the effects of pupils' attitude towards science and their attitude towards science education were studied, the coefficient of correlation between their achievement and socio-economic status was found to be 0.1164 and it was significant at 0.01 level. 4. When the effects of pupils' attitude towards science as well as their socio-economic status were studied, the coefficient of correlation between their attitude towards science education and achievement was found to be 0.4062 and it was significant at 0.01 level. 5. When the effects of the pupils' attitude towards science education and their socio-economic status were studied,
the coefficient of correlation between their attitude towards science education and their achievement was found to be 0.07661 and it was not significant. 6. It was found that about 30 per cent of the variance in science achievement was accounted for by one's attitude towards science, one's attitude towards science education and one's socio-economic status.

**Sahani Kadambini (1985)** for her M. Phil. Dissertation at DAVV, Indore on ‘A study of effectiveness of non-directs model in pupils achievement in comparison to traditional teaching’ found: 1. Relationship between intelligence and non-verbal creativity was negligible. 2. Relationship between intelligence and non-verbal creativity was negative and non significant even at .05 level. 3. Relationship between intelligence and academic achievement was positive and highly significant.

**Darchingpui (1989)** at the Ph.D. level research on ‘A study of science achievement, science attitude and problem solving ability among secondary school students in Aizawal’ found: 1. The study indicated significant relationships between scores on scientific attitude and achievement in science. 2. Significant sex difference in achievement in science and problem solving ability existed. 3. High socio-economic status, family facility and type of school attended favored achievement in sciences, scientific attitudes and problem solving ability.

**Dhar, Dubey R. N. (1989)** for his Ph.D. studied the ‘Effect of school environment and approval motive on memory and achievement’ found: 1. The means of arts students in academic achievement and in Hindi were found to be below 50% of the aggregate marks.
2. The mean performance of science students in academic achievement as well as in Hindi were found to be satisfactory. The majority of science students secured 50% of the aggregate marks.

3. The mean performance of arts students on recall tests of memory was above 50% of the aggregate marks.

4. The mean performance of science students on recall memory was above the average.

5. The distribution of scores of students in four selected variables. i.e. school environment approval motive academic achievement and memory scores on different recall tests were found to be approximately normally distributed.

6. The main effects of all the three treatments i.e. school location school environment and approval motive were found to be significant on academic achievements of arts students.

7. In the case of science students also the main effects of all the three variables were significant.

Irudayaraj M. (1989) for his M.Phil. level research on ‘A study of creativity and scholastic achievement in science of standard X students in Devakottai District’ found:

There was no significant relationship between science achievement and creativity of high school students.

Singh S. (1984) had undertaken a Ph.D. level study in Psychology entitled, “A Relationship of Home Environment, Need for Achievement and Achievement Motivation with Academic Achievement” at Magadh University. The main purpose of this study was to find out the relationship of home environment, need for
achievement and academic motivation with academic achievement. This research study was conducted on 300 students (201 boys and 99 girls) studying in different classes. The students were selected from seven schools of Barh subdivision of Patna District. The researcher had used Mcclelland’s Thematic Apperception Test for need Achievement, Academic inventory, Ojhas parental Attitude scales and problems checklist as tools to collect the required data. Mean, standard deviation, inter correlation, analysis of variance etc were used as statistical techniques to analyze the data collected.

The researcher found that (1) Aggregate marks were significantly and positively related to average marks and self concept of academic ability. (2) Self-concept of academic ability was significantly and positively related to academic motivation. (3) Sex differences were statistically effective in all the four areas of home environment. Males had significantly higher mean score on school economic, recreation and home problems. There was a sex difference in respect of permissive, loving, protecting and rejecting behaviors of father, restrictive and rejecting behaviors of mother and academic motivation. Boys demonstrate the behavior as like their fathers and girls as like their mothers. (4) Sex differences were unrelated to self-concept of academic ability and need for achievement motivation. (5) School differences were significant in the area of school economic and have problems of home environment and behavior patterns.

**Dixit, Mithilesh Kumari (1985)** had conducted a Ph.D. level study in Education, entitled, “A Comparative Study of Intelligence and Academic Achievement of Adolescent Boys and Girls studying in
classes IX and XI.” This research study was designed as a comparative study of the academic achievement and intelligence of adolescent boys and girls studying in classes IX and XI. The sample for this research study consisted of 800 students studying in classes IX and XI. The researcher selected 400 boys and 400 girls. Jalotas’ group General Mental Ability Test was administered to the students to get an idea about their mental ability and marks obtained by them in the annual examination were taken as the criterion of academic achievement.

The major findings of this study included (1) Among class XI students there was no difference in the academic achievement of intellectually superior and intellectually very superior boys and girls. (2) At all other intellectual levels the academic achievement of the girls was superior to that of the boys. (3) Among class IX students there was no difference in the academic achievement of intellectually very superior and intellectually superior boys and girls. (4) At all other intellectual levels the academic achievement of the girls was superior to that of the boys. (5) In general the intelligence test scores of the boys were higher than those for the girls. (6) In case of the boys, there was very high correlation between intelligence test scores and academic achievement. (7) In case of girls, there was an average correlation between intelligence test scores and academic achievement.

Jagannathan, K. (1985) conducted a Ph.D. level research study in Education, entitled, “The effects of certain socio-Psychological factors on the Academic Achievement of children studying in classes V to VIII.” The objectives of this study were; (1) to identity some of the personal and situational variables influencing academic achievement. (2) To identify some of the socio-Psychological variables affecting academic
achievement. (3) To examine the difference in academic achievement among the sub-groups of the personal and situational variables. (4) To examine the differences in the academic achievement of the sub-groups of socio-Psychological variables. (5) to measure the magnitude of individual and cumulative relationship of these socio-Psychological variables in academic achievement, and (6) to formulate equations to predict academic achievement with the help of socio-Psychological variables under the study.

The researcher had developed Achievement Test in Telgu, Mathematics, General science and social studies as well as a Questionnaire for pupils and their teachers to measure ‘pupils’ role expectations. A questionnaire to measure pupils’ perception of school environment was also developed by the researcher.

The multi stage random sampling procedure was followed to select the sample. This study was conducted in 42 schools (12 primary 18 upper primary, 12 high school) from 3 districts of Andhra Pradesh. The sample comprised 1200 students selected randomly, representing the three classes, both sexes and also rural and urban areas.

The main findings of this study included; (1) the three levels of school environment, via, low perception, moderate perception and high perception indicated 43.74 percent, 47.72 percent and 51.66 percent of mean academic achievement respectively. The results of F-Test revealed that the mean differences were found significant at 0.01 level. However Krammers’ test showed that only high group differed significantly from the middle and low groups. The zero order correlation between the pupils perception of school environment and academic achievement yield a positive correlation 0.184 on the whole sample and 0.26 on the sub-sample and they were significant at 0.01 level. The relationship between
the two variables for boys (0.154) and girls (0.232) separately also produced positive and significant correlation. The partial correlation between the two variables when the other independent factors were held constant were not significant on the whole sample and on the sub sample. Inter-correlations among the independent factors indicated that school environment had a positive and significant relationship with socio-economic status, academic motivation, role expectations and home environment. However, all the correlations were low except with role expectations. School environment and intelligence were not found to have a significant relationship. (2) On the basis of the congruence between pupils and teachers expectations on the ‘ideal pupils role’, it was categorized in three levels incongruent, moderately congruent, and congruent. The mean academic achievements of the three groups were found to be 42.51, 46.23 and 55.6 respectively. The mean differences were found to be highly significant beyond 0.01 level. But the means between moderate and incongruent groups did not differ significantly. The simple correlation between the role expectations and academic achievement was found to be 0.309 for the boys and girls were 0.285 and 0.351 respectively. All the correlations were found significant beyond 0.01 level.

Jahan, Q (1985) had undertaken a Ph.D. level study in Education, entitled, “A Study of Profiles of Students of Science, Arts and Commerce at the Higher Secondary level of Education in Relation to Their Academic Achievement” at Aligarh Muslim University.

The major objective of this study was to compare the personality profiles of over and underachieving students studying in science, arts and commerce streams in Pre University classes. The sample comprised 758
male and female students. The tools used for collecting the necessary data were; (1) Cattell’s High school Personality Questionnaire (HSPQ) (2) Composite of marks obtained in different subjects of science, arts, and commerce streams served as measures of personality and academic achievement. (3) Thorndike’s method of identifying over-achievers and under-achievers on the basis of discrepancies between actual achievement and that predicted on the basis of intelligence was employed. The ‘t-test’ was applied as statistical technique to ascertain the significance of difference the means of scores on the fourteen dimensions of HSPQ secured by the overachievers and under achievers.

The major findings of this study included (1) the over achievers of science were more reserved, intelligent, emotionally stable, excitable, obedient, sober, conscientious, shy, self-assured, controlled and relaxed as compared to the underachievers. (2) The over-achievers of arts faculty were more warm-hearted, intelligent, affected by feelings, undemonstrative, assertive, enthusiastic, conscientious, zestful, apprehensive and tense as compared to the underachievers. (3) The over achievers of commerce stream were more reserved, intelligent, affected by feelings, sober, conscientious and self-assured as compared underachievers.

Das, S. (1986) had undertaken a research study for Ph.D. degree in Education at Maharaja Sayajirao University. The study entitled, “Peer Influence and Educational Aspiration of secondary school students, A study in relation to Their Academic Achievement.”

The major objectives of this study were; (1) to study the effects of area of institution, nature of institution and their interaction on peer influence of students, (2) to study the effects of intelligence and socio-
economic status and their interaction on peer influence of the students, (3)
to study the effects of area of institution, nature of institution and their
interaction on educational aspirations of students, (4) to study the effects
of intelligence, socio-economic status, and their inter-action on
educational aspiration of students, (5) to establish the regression equation
for the academic achievement in relation to intelligence, socio-economic
status, peer influence and educational aspirations for different sample
groups. The tools used to collect the required data were, Bora’s group
verbal Examination of General intelligence Test, Narain Rao’s socio-
economic rating scale, an Adapted version of Mathur’s Educational
Aspiration scale; the investigator had prepared the peer influence scale
and used in the study examination scores of the HSLC examination were
recorded. This research study was conducted on 820 students of class X
belonging to 20 schools in Assam state. The statistical techniques used to
analyze the data collected included Analysis of variance and regress
analysis.

The major findings of this study were; (1) Peer influence was
stronger among the students of rural schools in comparison with those of
urban schools. (2) Peer influence was strongest among students of boys’
schools and least in the girls’ schools. (3) The educational aspiration of
students belonging to urban schools was higher than that of students of
rural schools. (4) The high intelligence group had higher educational
aspiration than the students of low intelligence group. (5) Students of
high socio-economic status group had higher educational aspiration than
the students of low socio-economic status group. (6) Intelligence was the
most powerful predictor of academic achievement, contributing 40.26
percent of total variance. (7) Educational aspiration was the second most
powerful predictor bearing 8.58 percent of variance. (8) More
predictability was observed in the rural group in comparison with urban group. (9) The highest predictability was observed in coeducational school group, which accounted as 67.22 percent of variance in comparison with the boys group (56.61 percent) and the girls school group (47.35 percent).

**Jena Sumati (1985)** for her M. Phil. Dissertation at DAVV, Indore on ‘A study of prediction of academic achievement with the help of aptitude and intelligence’ found: 1. Students were average and a little above in academic, aptitude and intelligence. 2. The relationship between intelligence and achievement was found satisfactory i.e. highly significant at .01 level. The null hypothesis rejected. 3. Relationship of achievement with eight types of aptitudes (DATs) was all satisfactory. 4. Relationship of achievement with intelligence was of varying nature.

**Mehna V.H. (1986)** at the Ph.D. level research on ‘An investigation into some factors affecting academic achievement in science of standard IX students of greater Bombay’ found that the pupils’ performance in science subjects can be improved: 1. Six variables viz. Verbal intelligence, motivation for learning general science, scientific knowledge and aptitude, numerical ability, liking for teachers of science and interest in medicine were significant predictors of achievement of class IX students in general science (R=0.5773). 2. If teachers succeed in generating a feeling of liking for them among pupils. 3. If teachers develop aptitude for science among children by providing scientific information and 4. If teachers can motivate children to learn science subjects. This needs adequate training for teachers in making science
teaching interesting and in training them in the techniques of arousing pupils motivation for learning science.

**Mehrotra S. (1986)** for his Ph.D. on ‘A study of the relationship between intelligence, socio-economic status, anxiety, personality adjustment and academic achievement of high school students’ found: 1. Both for the boys and the girls there was an inverse relationship between level of anxiety and academic achievement. 2. Both for the boys and the girls there was a positive relationship between socio-economic status of the family of the students and academic achievement. 3. There was a positive relationship between intelligence and academic achievement. 4. There was a positive relationship between level of adjustment and academic achievement. 5. In general, the girls had a comparatively higher level of anxiety than the boys.

**Mohanty R. (1986)** at the M. Phil. Level research at DAVV, Indore ‘A study of creativity in relation to intelligence, academic achievement and problem solving ability of students’ found: Students scores in all subject and total score (AA) were found reliable. Students were found comparatively high in Sanskrit and Hindi medium in science, social studies and low in Maths and English.

**Dalbekere L. (1987)** at the M. Phil. Level research at DAVV, Indore on ‘A co-relational study of students intelligence, personality, problem solving ability, academic achievement and socio-economic status’ found: 1. The co-relation among those variables. 2. Intelligence, personality, problem solving ability and socio economic status was found contributing for academic achievement. 3. Intelligence, personality, SES
and academic achievement were found contributing for problem solving ability.

**Narang R.H. (1987)** at the Ph.D. level research on ‘A comparative study of the socio-economic and home factors affecting the academic achievement of boys and girls (10 and 11 years) in the Urban and Rural Areas’ found: 1. Socio-economic status did not affect academic performance in the city, town and village areas. 2. The number of siblings seemed to affect performance. Most high achievers had only one sibling. In the village areas most of the respondents among all categories of achievers had three siblings. 3. The exposure to mass media or the extent of exposure did not affect school achievement. 4. Regularity in doing homework helped achievement while copying it from others hindered performance. 5. The relationship with the principal did not affect academic achievement. 6. In the city area, the relationship with the teacher affected the achievement of Marathi medium girls. In the town area, achievement was affected by the ability of the respondent to go to the teacher with problems. 7. Where the non-academic program of the school was concerned, participation in co-curricular activities was related to high achievement. However, the type of activities or hobbies pursued or the type of games played did not affect it. 8. The time spent on house work, the type of house, household chores performed, and the way free time was spent did, not affect achievement. However, the amount of free time affected the achievement of only girls. 9. The relationship with friends with special reference to the number of close friends, visits to friends, frequency of visiting them, leisure activities and friction with classmates did not affect achievement. 10. Low achievement was related to being frequently scolded by the parents.
Arora, Reeta (1988) for her Ph.D. on the ‘Role of parent-child relationship and teacher student relationship in the academic achievement of higher secondary school student of both sexes’ found: 1. No significant relationship existed between educational achievement of students and parent child relationship. 2. Educational standard of students and teacher student relationship were found to be significantly related.

Manral, Bheema (1988) at her Ph.D. level research studied ‘The impact of emotional maturity and prolonged deprivation on indiscipline behavior among university students in relation to their academic achievement’ found: 1. EM was related to 18. Out of five dimensions of EM, emotional instability was related to behavior in classroom. Student union activities and behavior in miscellaneous situations. Emotional regression was related to student union activities. Indiscipline behavior was also related to PD. The emotional instability was related to home environment. Economic sufficiency. Rearing experience. Parental characteristics. interaction with parents. motivational experiences. emotional experiences and total score of PD. 2. All the dimensions of 18 were highly related to Ach. 3. EM and PD contributed towards IB when differentiated on the basis of Ach. 4. There was no significant difference between male and female students on EM, behavior in classroom and library, behavior related to sports and cultural activities and miscellaneous situations. But males and females differed on PD, Ach, behavior in hostel, behavior related to students' union activities and IB. 5. High maturity group differed significantly on PD, Ach., behavior in hostel, behavior related cultural activities and sports and IB when compared with low maturity group. 6. High deprived students differed from low deprived students on EM, behavior in library, behavior in examination arid TB. 7. High achievers differed from low achievers on
EM and all variables of IB. 8. High indiscipline students differed significantly on PD, EM and Ach., from low indiscipline students.

Sood, Ramana (1988) at the Ph.D. level research on ‘Cartel’s personality factors as predictors of academic achievement in some selected professional courses’ found: 1. Personality factors of shrewdness, social awareness (N) and high intelligence (B) contributed positively but group adherence (Q2), praxarnia practical (M) and conservatism of temperament (Q1) contributed negatively to academic achievement in the engineering course. 2. Personality factors of high ergic tension (Q4), stronger super-ego strength (Q4), radicalism (Q I), tender minded pretension (hard to fool) (L) and high intelligence (8) contributed positively but personality factors of untroubled adequacy (0), and artlessness (N) contribute negatively to academic achievement of medical students. 3. Personality factors of pretension (hard to fool) (L), radicalism, free thinking, liberal (QI), high ergic tension (Q4), stronger super-ego strength (0), socially bold (Cl) and self-sufficiency (Q2) contributed positively but personality factors of alertness (N), tough minded (I), reserved (A), self-assured (0) and serious (F) contributed negatively to academic achievement of M8A students. 4. Personality factors of high intelligence (B), stronger super- ego strength (G), pretension (hard to fool) (L), higher ego strength, (C) and self-sufficiency (Q2) contributed positively but practical (M), serious (F), serene (O), submissive (E), and genuine but socially clumsy (N) contributed negatively to the academic achievement of law students.
Khan Md. Ataur Rahman (1989) for his Ph.D. research on ‘Perceived justice and related factors affecting academic performance and satisfaction: A case study of Delhi University’ found that

1. The analysis demonstrated that boys and girls in both the subjects in the four zones of Delhi University were perhaps comparable in the extent of perceived justice in academic performance assessment.
2. The effects of sex and subject were however found to be insignificant for locus of control but zone (institution) dimension was found significant.
3. On academic performance, only the difference in the effect of subject was noted to be significant.
4. The other main and interaction effects were found to be most significant.
5. The perceived justice predicted academic performance significantly.
6. The subject was found to be a significant predictor of the academic performance and explained an additional four per cent of the variance.
7. The analysis revealed that the perceived justice was the best predictor of student’s satisfaction.
8. The overall results of regression analysis demonstrated that sex, subject, zone, perceived justice and locus of control together predicted academic performance and satisfaction better than each of these taken separately. The determinants of academic performance and satisfaction were multiple, interrelated and interactive.

Khatri P. K. (1989) studied for his M. Phil. Level research at DAVV, Indore the ‘Prediction of academic achievement with the help of aptitudes, intelligence and achievement motivation’ found that
1. Mean academic achievement score of girls was significantly higher than the boys.

2. It has been found that the co-efficient of correlation of academic achievement with verbal reasoning (7 DATs), IQ and AM was significant and positive.

3. It has been found that the variable of DAT, IQ and AM together has 76% contribution in predicting the AA of the IX class students.

   Academic Achievement is significantly related to all DATs

   **Cherian V.I. (1990)** tried to find out Relationship between punishment of pupils and their academic achievement. There was a significant relationship between the frequency of punishment experienced by pupils and their academic achievement found in the study.

   **Deb Madhu and Grewal, Hirdai Pal (1990)** in their research article on the ‘*Relationship between study habits and academic achievement of undergraduate home science final year students*’ and found:

   1. Home environment of the students and planning of schedule was significantly related to their academic achievements.
   2. Suggestions and comments were related to academic achievement.
   3. The relationship between concentration for examination and academic achievement was significant.
   4. Significant relationship between study habits and academic achievement was found.
   5. Students’ habits and interests also influenced their academic achievement.
   6. College environment was related to study habits.
Devi, Ujjwala A. (1990) studied the ‘Pupils’ academic achievement in relationship to their intelligence, neuroticism and locus of control’ at the M.Phil. level and found:
1. Girls had a significantly higher academic achievement than boys.
2. There was no significant difference in the intelligence levels of boys and girls.
3. Boys showed a higher neurotic tendency than girls.
4. There was no difference between boys and girls in the locus of control.
5. Academic achievement showed a positive and significant correlation with intelligence.
6. Academic achievement was negatively correlated with neuroticism.
7. Intelligence showed a negative relationship with neuroticism and a positive relationship with locus of control.

Shah J. H. (1990) in his research article on ‘A study of relationship among intelligence, self concept and academic achievement of pupils of standard X of semi urban and rural areas of Sihore Taluka’ found:
1. There was no sex difference in SC either in semi-urban or rural areas.
2. There was no sex difference in DIQs (Deviation IQ) either in semi-urban and rural areas.
3. There was significant difference in AA, in favor of boys, in both semi urban and rural areas.
4. There were positive and linear correlation among SC, DIQs and AA in both types of areas.
5. Intelligence was more related to AA than SC.
Thilagavathi T. (1990) in her research on ‘Academic achievement in relation to intelligence, creativity and anxiety at M.Phil. level found that

1. Teaching competencies of science teachers were related to the academic achievement of high school students.
2. Teacher personality was not related to student's academic achievement in science.
3. Both male and female science teachers were similar in their teaching competencies and personality, human relation and interpersonal skills.

Wanjari, Shashi (1990) for his Ph.D. on ‘A study of effects of serum uric acid and serum cholesterol on academic achievement of school going children’ found that in arts, science and commerce, the serum uric acid was significantly related with their academic achievements. Serum cholesterol showed a positive but not significant relationship with academic achievement in science faculty. In commerce rural male and urban male, the cholesterol was negatively and significantly related to achievement, while the relationship was highly positive and significant in urban female. In arts the relationship between serum cholesterol and academic achievement was positive and significant in urban boys.

Padhi J.S. (1991) studied the effects of creativity and classroom environment on pupil academic self concept and academic achievement. The study revealed that the correlation between CE and AA was not significant, CR and AA was significant, ASC and AA in different school subjects was significant, CR and CE was non-significant, CE and CR
with ASC were significant. The main effects of CR and CE and AA were significant. The main effects of CR and CE on ASC were significant. The interaction effects of CR x CE on AA was found to be non-significant. Family size had differential effects on AA, there were no differences in CE, CR, ASC and AA attributable to birth order. Fathers' occupation had influence on the ASC of their children. Educational qualification of the father had significant influences on the AA, ASC and CR of their children. The same result was also found with the mothers' education.

Chhaganlal, Nandani Mansukhbhai (1992) for her Ph.D. on ‘A study of the value, adjustment, attitude towards the teaching profession and academic achievement of teachers children as compared to non-teachers children found that non-teachers children were significantly better than teachers' children in social value, whereas teachers' children and non-teachers' children were found equal in power value, religious value. Aesthetic value, theoretical value and economic value. Non-teachers' children were at a higher level 'than teachers' children in academic achievement.

Harikrishnan, M. (1992) in his research on ‘A study of academic achievement of the students of the higher secondary stage in relation to achievement motivation and socio-economic status’ at M. Phil. level found that girls obtained a higher mean in achievement than boys. Socio-economic status was significantly related to academic achievement. Achievement was not related to achievement motivation.

Kanakarajan R. (1992) studied the effect of non directive teaching on some selected personality characteristics and academic achievement of lower secondary students found that the non-directive teaching technique
significantly increased the following characteristics of personality: self-concept, autonomy, personal integration, creativity. Mean gain scores of students taught through non-directive teaching were significantly higher than those of students taught through directive teaching in the following characteristics: self-concept, autonomy, personal integration, and creativity. Under non-directive technique (a) girls achieved better than boys in self-concept. (b) Boys achieved better than girls in autonomy. (c) No significant difference was seen between boys and girls in personal integration, and (d) boys achieved better than girls in creativity. Under non-directive teaching there was no interaction of levels of achievement and sex on gain scores for the following characteristics: self-concept, autonomy, personal integration, and creativity. The mean achievement score of students taught through non-directive teaching was higher than that of the students taught through directive teaching.

Kaur Parvinder (1992) studied the relationship among creativity, intelligence and academic achievement in different subjects of X Graders. Her findings revealed that for males intelligence was positively correlated with fluency, flexibility, originality and composite creativity. 1. (a) For males fluency, flexibility, originality and composite creativity were positively related with achievement in Punjabi, Hindi, English, Mathematics and general science and originality and composite creativity were also related with achievement in social studies. (b) For females as well as the total sample. Fluency, flexibility, originality, and composite creativity were positively and significantly related with achievement in each of the five subjects. 2. For males when intelligence was partially out (a) fluency was positively related with achievement in Punjabi but negatively with social studies but not with the other subjects, (b) flexibility was not related with achievement in any of the six subjects. (c)
Originality was positively related with achievement in Punjabi, and mathematics. (d) Composite creativity was related with achievement in Punjabi and mathematics but not with the other four subjects. 3. For females when intelligence was partially out (a) fluency was positively related with achievement in all the subjects except general science. (b) flexibility was related with achievement in the three languages but not with the other three subjects, (c) originality as well as composite creativity were related with achievement in all the six subjects. 4. For the total sample when intelligence was partially out fluency was related with achievement in Hindi, and English originality was related with achievement in the three languages and general science, composite creativity was related with achievement in all subjects (r from 0.11 to 0.16) except social studies. 5. For males as well as females intelligence was positively related with achievement in all the subjects; the same was true for the total sample. 6. For both males and females, when the effect of creativity or its dimensions was partially out all the inter-correlations between intelligence and achievement ranged from 0.1.6 to 0.61 and from 0.28 to 0.50 for the total sample. 7. Intelligence was found to be a better predictor than fluency. Flexibility and originality of achievement in all subjects, Intelligence was also a better predictor of achievement in all subjects than the total creativity except in the case of females where achievement in English and Hindi was slightly better predicted by composite creativity. 8. The prediction of achievement in school subjects when made on the basis of conjoint effect of creativity and intelligence was higher than if made on the basis of each variable separately.

Verma B.P. (1992) in his research article on ‘Relationship between temperament and academic achievement’ found that the correlation’s between traits of 'sociability', 'ascendant', 'secretiveness',
'reflective', 'impulsivity', 'placid', 'accepting', 'vigorous', 'co-operative', 'persistence', 'warmth', 'aggressiveness', 'tolerance' and 'tough-minded', on the one hand, and academic achievement, on the other, were not found to be significant. Relationship of 'responsible' trait of temperament and academic achievement was positive and significant. High and low achieving groups did not show any significant difference in the mean scores of 'sociability', 'ascendant', 'secretiveness', 'reflectiveness', 'impulsivity', 'placid', 'accepting', 'vigorous', 'co-operative', 'persistence', 'warmth', 'aggressiveness', 'tolerance' and 'tough-minded' traits of temperament. High achieving groups of students had significantly higher value of mean scores of 'responsible' trait than low achieving group of students. Out of 15 traits of temperament only one trait, i.e. 'responsible' was found to be significantly related with academic achievement.

Gurubasappa H. D. (2005) this study examines the relationship between adjustment and mental ability as correlates of academic achievement of secondary school students of Tumkur district of Karnataka state. It was found that students with different levels of adjustment and mental abilities differed in academic achievement. Also it was found that there exists a significant positive high correlation between academic achievement and adjustment and mental ability.

Deshpande S. P. (1991) for her M.Phil. Dissertation on ‘Relationship between scientific attitude and academic achievement of adolescents at different levels of intelligence – A Study’ found that the academic achievement of three groups is equal. There is no relation between academic achievement of adolescence and level of scientific attitude. The academic achievement of boys is higher than the academic achievement of girls. There is no interaction effect between sex and
scientific attitude on academic achievement of the adolescent. The academic achievement of adolescents with high IQ is higher than the academic achievement of adolescents with Low IQ. There is scientific attitude and intelligence.

Mane D. H. (1999) for his M.Phil. Dissertation on ‘The Effect of Teaching aptitude and graduate academic achievement on the theory performance of B. Ed. Students with science method – A study’ found that B.Ed. performance of students is independent of their teaching aptitude. B.Ed. performance of student is independent of their graduate academic achievement. Low, Average and High B.Ed. performance is Independent of the different levels of graduate academic achievement and teaching aptitude. There IS no sex difference among student teachers in their teaching aptitude. Teaching aptitude is independent of students academic qualifications and the university from which they hall. B.Ed. students of all the 24 colleges have low teaching aptitude.

Sonawane S. A. (2001) for his M.Phil. Dissertation on ‘Effect of educational interest and study habits on the academic achievement of urban XI standard students – A Study’ found that in the Excellent grade of study habit there are more number of Commerce faculty students than the Science and Arts faculty students. In the Good grade and unsatisfactory grade of study habits there are more numbers of Science faculty students than the Arts and Commerce faculty students. In the Average grade and Very Unsatisfactory grade of study habits there are more number of Arts faculty students than the Science and Commerce faculty students. The total number of students of the Excellent and Good grade of study habits put together is more than the total number of students of Unsatisfactory and Very Unsatisfactory grade put together.
However, the highest percentage of students is in the Average grade category of study habits. Hence, it can be concluded that the majority of the adolescents have Average grade study habits, though the study habits grade category differ faculty-wise. Arts faculty students are more interested in Agriculture, Fine Arts, Home Science and Humanities areas of educational interest than Science and Commerce faculty students. Science faculty students are more interested in Science and Technology areas of educational interest than the Arts and Commerce faculty students. Commerce faculty students are more interested in Commerce educational interest area than Science and Arts faculty students. For the Arts faculty students there exist a negative relationship between their educational interest areas of Science, Technology and Commerce with their academic achievement. For the Science faculty students there exist a negative relationship between their educational interest areas of Fine Arts, Humanities and Commerce with their academic achievement. For the Commerce faculty students there exist a negative relationship between their educational interest areas of Agriculture and Technology with their academic achievement. There exists a significant relationship between study habits and academic achievement of the XI standard adolescents of all the three faculties. The study habits of the XI standard adolescents of the faculties of Arts, Science and Commerce do not differ. Whereas the educational interest (Agriculture, Commerce, Fine Arts, Home Science, Humanities, Science and Technology) of the XI standard adolescents of the faculties of Arts, Science and Commerce differ.

Sonar M.S. for his Ph.D. thesis on An Analytical study of the use of the filmstrips in Teaching science in upper primary grades. Found that 1. Foreign filmstrips have English captions. Indian filmstrips also
have English captions. Few filmstrips have Hindi captions. Not a single filmstrip is there which have a Marathi caption. 2. Suitable captions make the filmstrip more meaningful. 3. Arrangement of topics in Syllabus and arrangement of chapters in the text book do not correlate. 4. Difficult concepts which need visualization have been dropped from the text book.

SAHAJAHAHAN, N.M. for his Ph.D. thesis on An experimental study of teaching science in standards VI and VII through modules. Worked on following Objectives 1. To design and develop modules for teaching science in standards VI and VII. 2. To study the effectiveness of the modules as an instructional method with respect to the conventional method. 3. To study relationship between the student achievement through modules and the attitude of students towards the module as well as academic motivation of the students. 4. To compare the achievements through modules of high achievers and low achievers, boys and girls, high academic motivation and low academic motivation.

Found that 1. The modular way of learning was more effective than the conventional method in the case of some modules while in the case of other modules it was found as effective as the conventional method. 2. The teacher’s reactions to modular approach to instruction were favorable. 3. While learning through modules, no significant difference was found between the achievement of extremely high and extremely low achievers and between boys and girls.

SIVADASAN, K.R., (1981) in his Project on developing science kits and self instructional software for audio tutorial system, have Objectives: 1. To prepare materials for individualized instruction. 2. To test them for their efficiency as learning strategy.
Found that 1. The audio tutorial system was an effective strategy for learning. 2. In the audio tutorial system the guided discovery approach was possible and effective. 3. Students could learn at their own pace under this system. 4. The teacher’s role was minimized in the audio-tutorial system. 5. The ray box could be used as a small science kit.

BARVE, M.V.; (1986) at his Ph.D level research on Preparation and testing of filmstrips for the teaching of science – a course in std.IX and a study of their comparative effectiveness in the teaching learning process as compared to the traditional practice; have Objectives: 1. To prepare filmstrips on selected topics from the science course of std.IX. 2. To teach the selected units of the science course of std. IX by using these filmstrips. 3. To compare the effectiveness of teaching with the help of filmstrips and the traditional practice of teaching science in terms of the achievement of learner.

Found that 1. Filmstrips was more effective than the traditional method for teaching the facts, principles and concepts in science. 2. Filmstrip and traditional methods were equally effective for teaching abstract concepts in science. 3. It is more effective method for both sexes.

AGNIHOTRI, S.K.; (1987) at his Ph.D. degree on Study of influence of some of the methods of teaching Physics on the achievement in Physics of class X students in Delhi, have following Objectives -

1. There is no significant difference between the mean achievement in physics of different groups of students taught by different methods.
2. The interaction between teaching methods and different schools is not significant.
3. The interaction between teaching methods and different levels of students is not significant.

Found that
1. The traditional method or the lecture cum demonstration method followed by the verification type of laboratory work was more effective than the assignment cum discussion method but this method was less effective than the programmed instruction method for the teaching of physics.

2. If all the four methods selected for this investigation were ranked with report to achievement in physics systematically designed by the investigation was the first the programmed investigation modified by the investigator for the teaching of Physics was the second and traditional methods or the lecture demonstration method followed by the verification type of laboratories work was the third and the assignment cum discussion method was the fourth.

REVIEW OF STUDIES CONDUCTED ON MISCONCEPTIONS IN SCIENCE IN ABROAD

Alpern (1946) reported that, there was no significant relation between the Science courses, a student had taken and his ability to select sound procedures to test hypotheses.

Hurd, Paul H. (1954) noted that, the objectives of Science teaching were the teacher’s first consideration in planning curriculum. Objectives strongly influenced the organization of the curriculum and at the same time they provided the guidelines on the selection of teaching techniques.

Curtis et al, found that, direct teaching does modify the attitude of young peoples and the pupils who engage in wide reading in General
Science develop scientific attitude more than those who study only single subject.

Taylor, proposed suggestion for planning of learning experiences to build desirable attitudes such as (1) Increase the degree of consistency of the environment. (2) Increase the opportunities for making satisfying adjustments to attitude formation. (3) Provide opportunity for the analysis of problem situations.

Klausmeier suggested eight steps, that the teachers can take to facilitate the learning of attitudes. These may be interpreted in terms of Science teaching as (1) the attitude to be taught must be identified. (2) The meanings of the vocabulary used to describe attitudes or the behaviors related to them must be clarified for the learner. (3) Informative experience about the attitude object should be provided. (4) Desirable identifying figures for the learners should be provided. (5) Pleasant emotional experiences should accompany the teaching learning process. (6) Appropriate context for practice and confirmation should be arranged. (7) Group techniques should be used to facilitate understanding and acceptance. (8) Deliberate cultivation of the desired attitude should be encouraged.

Abimbola, Isaac O. & Yarroch, William L. worked on The Problem of Terminology in the Study of Student Conceptions in Science: A Second Look And found out It seems misconceptions, alternative conceptions, and knowledge can coexist within each research context. How they might do this, and researchers¹ inferences about them, including underlying thought processes need to be documented. Remediation strategies would then vary with each type of conceptions and with each context.
Bizzo, Nelio M. V. worked on the study MISCONCEPTIONS OR SOCIAL RECONCEPTUALIZATIONS? - the case of evolutionary biology And Found out 1. The tendency of seeing chronologies of the development of scientific knowledge as "myths of rationalism" 2. Students at high-school level have contact with several of these "myths", which could possibly account for some of the traditional misconceptions that have been recurrently reported.

Brody, Michael worked on the study Student Misconceptions of Ecology: Identification, Analysis and Instructional Design and found out that 1. The identification of misconceptions through clinical interviews, concept maps and multiple choice questions is reviewed and discussed in relation to what teachers can do to continually identify and monitor student misconceptions. 2. These concept maps present fundamental topics which must be identified in order to help address student misconceptions several instructional activities which attempt to address these misconceptions including The Water Circle, Molecules in Motion and Classroom Aquaria are described and discussed in relation to specific instructional design.

Carter-Cohn, Karen worked on the study Can a Photograph Have a Misconception? And found out 1. Conceptual meanings are social constructs defined by discourse communities. 2. In order to bring constructivism into a well defined educational paradigm the careful examination and specific use of terminology must be determined by the discourse community. A discussion of these issues using illustrations will be the focus of this presentation.
Chi, Michelene T.H. worked on *Barriers to Conceptual Change in Learning Science Concepts* and found out that identifies and characterizes the existence of a specific class of constructs which may be particularly difficult to learn and understand.

**FARAH-SARKIS, FAIROUZ** worked on *SOURCES OF MISCONCEPTIONS: THE CASE OF POWERS AND RADICALS* and found out that Students' misconceptions were derived from: 1- Interpreting radicals (when the index is greater than 2) either as powers or as square roots. This category had the highest frequency of misconceptions. 2- Applying rules of multiplication of powers. 3- Applying rules which are not related to the concepts of powers and radicals such as operations on negative numbers and simplified writing. Results also showed that with the increased use of the rules across the different grade levels the frequency of their incorrect applications decreased.

**Fischer, Hans E. & Breuer, Elmar** worked on the study *Misconceptions as indispensable steps toward an adequate understanding of physics* and found out that 1. Many units, teaching strategies and so called learning strategies were created which propagated a better way of learning physics. 2. It is obvious that those categories have to have their roots in a theory about learning in general and not about how an expert solves given problems.

**Hammett, John E. III** worked on the study *TO IDENTIFY AND ADDRESS UNDERGRADUATE STUDENTS' MISCONCEPTIONS WRITING TO LEARN STATISTICS: MAINTAINING LEARNING JOURNALS IN ORDER* found out that This workshop focuses on the use of writing to learn statistics. In particular, it concentrates on the role
of the three-column divided page learning journal within the undergraduate introductory statistics course as a means by which instructors can identify and then address students' misconceptions.

Hernández, Virginia & Caraballo, José N. Worked on the study DEVELOPMENT OF A DIAGNOSTIC TEST TO DETECT MISCONCEPTIONS IN MENDELIAN GENETICS AND MEIOSIS. Found out that The diagnosis of previous knowledge and the exposition of misconceptions to estimate conceptual understanding are recognized as a need in science teaching.

Hirsch, Linda S. & O'Donnell, Angela worked on the study An Evaluation of Instructional Interventions to Eradicate the Misconception of Representativeness. and found out that The experiment found the instructional interventions designed to create cognitive conflict and conflict resolution to be effective in long-term elimination of students' misconceptions of representativeness.

Huang, Iris Tai-chu; Huang, Kun-Huei & Liu, Chung-wen are worked on Misconceptions of High School Students when Learning Genetics in the Republic of China and found out that The results indicate that there are many difficulties and misunderstandings experienced by students on the concepts related to "the recognition of homologous chromosomes," "the process of meiosis," and "the relationships between genes, chromosomes, and traits."The students who had high achievement test scores did not necessarily understand related concepts.
Ismail, Zaleha worked on the study Misconception in Learning Differentiation and found out that in learning new calculus concepts, students are usually expected to have a considerable knowledge and understanding of certain basic mathematical concepts. These basic concepts are frequently used in explanations and definitions of new ideas and concepts.

Jara-Guerrero, Salvador worked on the study MISCONCEPTIONS ON HEAT AND TEMPERATURE and found out that research has shown that these misconceptions are not usually simple mistakes, but rather are the result of systems of common sense theories that are so stable and coherent internally that conventional instruction has little effect on them.

Kermis, Wm. J. worked on the study that SCIENTIFIC MISCONCEPTIONS AND CARTOONS: ESTABLISHING A CAUSE AND EFFECT RELATIONSHIP Found that cartoons are a reliable assessment measure, which includes data collection and decision making, for determining the state of a learner's prior knowledge. Cartoons are also an effective instructional tool.

Mermelstein, Egon & Young, Kiang Chuen worked on the study Teaching, Learning and the Process of Science: Some Misconceptions found out the parallels between biological evolution and the development of scientific knowledge in the individual as well as in the scientific community.
Mevarech, Zemira R. & Kramarsky, Bracha worked on *How, How Often, and Under What Conditions Misconceptions are Developed: The case of Linear Graphs* and found that significant differences between the experimental and control groups on students' sense of graphs. While the misconceptions were robust in resistance to conventional instruction.

Moody, David E. worked on the study *Insight as the Basis for a Functional Typology of Misconceptions* and found that attends to the function of misconceptions in the student's conceptual ecology; (2) is designed to facilitate pedagogical purposes; and (3) functions to bring greater coherence to the ongoing stream of research.

Pujol, Rafael worked on the study *The Chemistry Textbooks used by Ninth-Grade Venezuelan Students as Possible Sources of Misconceptions About The Structure of Matter* and found out that chemistry textbooks could lead students to construct erroneous ideas about the structure of matter.

Russell, Tom worked on *MISCONCEPTIONS IN LEARNING TO TEACH SCIENCE: STUDENT TEACHERS' STORIES OF UNFULFILLED EXPECTATIONS* and found out that student teachers' assumptions and expectations are seen as barriers to the intended learning processes of the pre service program. Seven barriers are identified and illustrated. These barriers may be particularly high for science, math and engineering graduates, whose undergraduate programs implicitly reject the value of personal voice and experience.
Sadler, Philip M. worked on Teachers' Misconceptions of their Students' Learning and found out that This study concludes that traditional courses appear to have little effect on students' understanding of astronomical concepts, yet most teachers believe that their effect on students is large. Misconceptions are discussed as possible explanations for teachers' own misconceptions about how much students learn in science courses.

Schoon, Kenneth J. worked on the study The Origin of Earth and Space Science Misconceptions: A Survey of Pre-Service Elementary Teachers found out that The survey are compared to an earlier cross-age survey conducted by the author in which the same questions were asked. The study suggests that many misconceptions originate in the classroom and that pre-service elementary education teachers have many of the same misconceptions that their future students will have.

Sefton, Ian M. worked on the study Overcoming Misconceptions by Challenging Text-book Orthodoxy and found out that Language is part of the structure of knowledge; there are some kinds of misconceptions that can be traced simply to the orthodox language of physics, without reference to the overall structure of the subject. Because physics is reductionist in its approach to the world and its knowledge is organized hierarchically, other kinds of misconceptions can arise from the structure of the knowledge and the associated traditional teaching sequences.
Speece, Susan P. worked on the study **MISCONCEPTIONS ABOUT SCIENCE EDUCATION REFORM** and found out that The programs seemed to widen the gap between those interested in science and those who had no interest in science. Application to everyday life was missing. We had succeeded in producing more scientists, but we failed to impart an understanding of the importance of science in every person's life.

Tallant, David P. worked on the study that **A Review of Misconceptions of Electricity and Electrical circuits**. And found out that (a) the concept that current is consumed in a circuit, and (b) the concept of a battery as a source of constant current. Methods of instruction that are purported to be effective in correcting misconceptions have been presented with implications for teaching, teacher education and further research.

Sharon Bailin worked on the study **Critical thinking and science education** and found that It offers a more philosophically sound and justifiable conception of critical thinking, and demonstrates how this conception could be used to ground science education practice.

John, Jawarski, Harry Memohan and David, Hawkridge conducted a two year international co-operative study funded by the Harold Macmillan Trust of computers in African, Asian and Arabic speaking schools. At the end of the research study, it was suggested that all the 23 third world countries should bring computers to the schools. The governments in the third world countries should seek international co-operation of industrial countries to develop educational soft-wares and suitable hard-wares. The number of computers in the schools should be
increased which will lead to national development. Industrial countries need to improve their provision of aid to the third world countries. Developing countries need to formulate policy. All countries need to know more about how to exploit computers in education, to their mutual advantage.

Now-a-days, along with developed countries, the computers are entering the schools as instruction tool in developing countries including India. Subject wise computer soft-wares are being developed by different government and non-government agencies. It is necessary to guide the parents which soft-wares should be used for effective learning, which criteria should be fixed while purchasing computer soft-wares. The most important aspect attributed to the software is that, the educational software should be research based. This is because as it has been proved that, computers improve student’s skills in academic subjects at all levels of education and create a new environment in schools helping students to enhance their knowledge.

Seetha B.C., (1975) inquired into the psychological and social factors affecting academic achievement’. Her study revealed that the high achievers possessed superior intelligence when compared with low and non achievers. Study habits had a positive relationship with academic achievement in that high achievers possessed good study habits while low achievers had poor study habits. But in case of achievers and non achievers, there was no significant relationship between academic achievement and study habits. Greater need achievement was found in case of high achievers than low and non achievers. No significant relationship existed between interest and academic achievement. No significant relationship existed between social adjustment and academic
achievement. 6. Out of sixteen personality factors, three factors, namely A, B, and L had significant relationship with academic achievement.

Mathew T. (1976) for his Ph.D. on ‘Some personality factors related to underachievement in science found that the mean scores of normal achievers exceeded significantly the mean scores of underachievers for variables like Sense of personal worth, sense of personal freedom, with, drawing tendencies, social standards, etc., and the mean scores of normal achievers were significantly, less than the mean scores of underachievers in test, anxiety and maladjustment. The mean scores of overachievers were significantly greater than those of the normal achievers in cases of sense of personal freedom, social standards and family relations. The mean scores of overachievers significantly exceeded the mean scores of underachievers in cases of self reliance, sense of personal freedom, freedom from , withdrawing tendencies, freedom from nervous symptoms, social standards, social skills, freedom from anti-social tendencies, family relations and community relations. A higher number of overachievers were in the high intelligence, low age group', amongst boys, and among the parents with higher education than their respective counterpart. Greater numbers of overachievers were found amongst high income urban subjects. Four factors-total adjustment, anxiety orientation, group adjustment and self-esteem -accounted for total variance of the overachieving group, and five factors -personal adjustment, social adjustment, social facilitation, leadership, and self acceptance -accounted for the total variance of the normal achieving group.

Doctor, Z.N. (1984) had conducted a Ph.D. level study in Education, entitled “A study of classroom climate and the Psyche of
pupils and their Achievement.” Some of the major objectives of this study were; (1) to find out the classroom climate and Psyche scores of classes. (2) to study the profiles of the classrooms of high and low climate, (3) to have an in-depth study of teacher behavior in classrooms of high and low climate. (4) to compare the master profiles of classrooms having high climate and low climate and (5) to study the socio grams of classes having high and low classroom climate.

The study was conducted on 1279 pupils from all types of schools belonging to Valsad and Surat districts of Gujrat State. The researcher used classroom climate scale, Junior Index of Motivation scale, students Expectancy, Adjustment, classroom Trust, and Dependency scale as tools to collect the data. Besides this, a scale to measure the behavior of the teachers and the pupils and the Ohio sociometry scale was used to measure the sociability of the pupils.

The major findings of this study were; (1) Each classroom had its own individuality. A classroom with high classroom climate had high pupils Psyche. (2) Classroom climate had consistency with academic achievement. (3) Academic achievement was highly dependent on independency of pupils. (4) Adjustment was closely linked trust and expectancy. (5) Classroom climate and pupils Psyche were more connected with independency and dependency. (6) Academic achievement was dependent in teachers and pupils’ behavior, pupils’ Psyche and classroom climate. (7) From the cinematography, it was found that in independency, academic motivation, and legitimacy etc, the scores of most of the schools were less than the scores on other variables taken in the study.
Amir, Ruth & Tamir, Pinchas worked on the study  **THE "LIGHT" AND "DARK" REACTIONS OF PHOTOSYNTHESIS - TERMINOLOGY AS A SOURCE OF MISCONCEPTIONS** and found out The division of the process of photosynthesis into a "light phase" and a "dark phase" is a well established presentation of the functioning of the photosynthetic apparatus. This division can be traced to important points in the history of photosynthesis research. Consequently it is also the way the subject is presented in textbooks and taught. From psychological, didactical and scientific points of view this division into "light" and "dark" phases is fully justified: In the light ATP and NADPH2 are produced and oxygen is released. Subsequently the products of the light phase are utilized to fix carbon dioxide. The light reactions occur in the thylakoid membranes whereas the so called dark reactions proceed in the soluble part of the chloroplast - the Stroma. The light phase can experimentally be separated from the dark phase as shown by Hill (1937).

Baturo, Annette R. worked on **A Cognitive Analysis of Misconceptions in Year 12 Students' Understanding of Elementary Probabilistic Notions** and they describes a study conducted to explore Year 12 (16-17 year olds) students' cognitive functioning in the domain of probability in an Endeavour to discover what it means to know/understand the elementary notions of probability. Leinhardt's (1988) theory of understanding as connections between the four knowledge types (intuitive, concrete, computational and principled conceptual) served as the model for examining the students' understanding of elementary probability. The research design incorporated two pilot studies and a main study and, altogether, 31
students participated. Each student was clinically interviewed whilst working on a set of elementary probability tasks which were developed for the study. The protocols revealed that the students had used a variety of cognitive schema for example, fraction (part/whole), ratio (part/part), and comparison (whole/whole) but, in general, those who performed best used the fraction schema predominantly. Several misconceptions were disclosed. For example, \( P = 1 \) was connected with either one trial in an experiment or with one item in a sample space; \( P = 2 \) was acceptable; possible was synonymous with certain; ratios were confused with fractions.

Braghiroli, Clara worked on the study MISCONCEPTIONS: A CONCEPTUAL OR METHODOLOGICAL DEFICIENCY? - A Case Study showing a Theory in Action and found that During my first years of teaching activity in the University my attention was focused, imperceptibly, by the most capable students of my classroom (I only had knowledge then ...). As time went by and, perhaps, half-way in my history, my interest moved towards those students showing the lowest performances (I had already gained experience ...). At present, after a long way gone through, I choose (full consciously) to put all my enthusiasm on those students who, even having a learning potential, seem to have not found the means to develop such potential

Caillot, Michel & Xuan, Anh Nguyen worked on ADULTS MISCONCEPTIONS IN ELECTRICITY and said that We present how unskilled workers and staff employees understand everyday situations where static electricity or electricity at home is involved. The method of data gathering was clinical interviews based on situations relative to static electricity in cars or in an electronic assembly workshop, to the functioning of a circuit-tester and a washing machine. Different
cases were discussed (e.g.: electric shocks, short circuits, and so on). The
analysis was made in the framework of mental models used to describe
these situations. In spite of electricity lessons in their school time and/or
in-service training in their companies, the subjects made no reference to
formalized electricity. The models they used were built up from their own
experience. Often electricity is considered as a substance or a fluid easily
transferable from one place to another. Conceptions about grounding
show that the earth is assimilated to a big reservoir into which electricity
flows and then is lost. Human body is also considered as a reservoir of a
limited amount of electricity.

CALVO, Carlos A. & COHEN, Michael R. worked on their study "Enhancing Teacher's Understanding of Student's Science Concepts: The Results from "Misconception" Research on in Service and Pre-service Teacher Education" and explained that the new Costa Rican science program, with its emphasis on local environmental content may create additional problems for experienced and novice elementary school science student teachers who work hard designing and implementing science lessons that engage their students and teach accurate science concepts. This is especially true for those elementary school student teachers who have a limited knowledge of science. While additional study in the sciences is helpful, it is virtually impossible to prepare a general elementary school student teacher for all the science topics they will encounter in Costa Rica’s new elementary school science program. Three current educational ideas from the foundation of this study: 1.- cognitive research; 2.- research on change and implementing innovations; 3.- and research on student teacher education.

Chang, Bor-nian in this study on "A study on the Analysis of Error Patterns and Misconceptions for BASIC Programming’s of
Novice College Students in Taiwan and found that To use the theories of artificial intelligence and cognitive science in designing the intelligent computer-assisted instruction (ICAI) systems is a challenging job with much research value. This research collected different types of error patterns that novice learners had during computer programming. These error patterns were analyzed and categorized. The misconceptions of semantic errors during the programming were also analyzed. The outcome will serve as the base knowledge for computer programming ICAI system design.

Comins, Neil F. worked on the study Sources of Misconceptions in Astronomy and describe a program I have begun to identify misconceptions about astronomy and to understand their origins and how they are replaced with new concepts. I begin by describing the protocols used for each part of the project. The data for this work comes from undergraduate college students at the University of Maine who take the (non-mathematical) Introductory Astronomy course I teach. In three semesters of this work 396 students have so far participated in the misconception-gathering part of the program. Of these, seventy-five were also involved in focus groups and writing about the origins and replacement of their misconceptions. Of the 5,500 misconceptions stated by the cohort, I have identified 553 separate misconceptions. Many of these misconceptions are described in various contexts below. I end by presenting a set of internal and external origins of these misconceptions I have derived from the lists and from the focus groups.

Doig, Brian & Adams, Ray worked on Methodological misconceptions: naïve or not interested? discusses the limitations of current methodologies for exploring Œmisconceptions and offers an alternative methodology which integrates various levels of sophistication
of conception to describe a continuum of conceptual understanding. This approach recently employed in science education at elementary and junior high school levels used novel instruments (cartoons and short stories) to collect data from some 3000 children. This data was analyzed with item response techniques and continua constructed which allow educators to plan effective instruction for learners whose conceptions cover a range of sophistication, many of which may impede further learning.

Furuness, Linda K.B. in their study on The Application of "Misconception" Research Experiences in Teacher Education: Integrating Misconception Research into the Classroom and said that Much misconception research has been published since the mid 1970's. And, some of the suggested "treatments" have been tested in classrooms. However, there appears to be very little published about how teachers have come to understand the misconception literature and how successful they have been in implementing this knowledge in their classrooms. In truth, getting teachers to understand the research itself and then integrating it into their classroom curricula is the most difficult aspect of bringing about conceptual change in students. This paper outlines a graduate science education course for teachers offered at Indiana University Purdue University Indianapolis (IUPUI) that attempts to address the above problem.

Furuya, Koichi in their study on A Study on the Teaching Strategy of Force and Motion: A method of exchanging the students' misconceptions with scientific knowledge In the past several years there has been a significant increase in research dealing with students' misconceptions of science prior to formal instruction (Gilbert & Watts,
1983; McCloskey, Washburn, & Felch, 1983; Fisher, 1985). These previous works show that even after formal instruction misconception will remain and may play a crucial interfering role in the learning of any field of science. What kind of teaching methods should science teachers employ in the classroom?

Gerhardt, Almut; Piepenbrock, Christiane & Rusche, Gabriele in their study on **Students' Misconceptions in Biological Subject Areas and Consequences in teaching Biology** Students' misconceptions in biology have been rarely investigated in Germany (SCHAEFER 1983 a, b, HEDEWIG 1988, GRAF 1989, GERHARDT/PIEPENBROCK 1990, 1992). In our research group (Gerhardt, Piepenbrock, Rusche) we are studying students' misconceptions in different biological subject areas (Fig.1). Grades 1 and 4 of the primary schools and grades 5, 7 and 10 of the secondary schools I (Sekundarstufe I) in North Rhine - Westfalia are involved in these studies.

Kesidou, Sofia worked on the study **The Role of Research on "Misconceptions and Educational Strategies" in Developing Benchmarks for Science Literacy** This paper addresses the relationship between research on misconceptions (and educational strategies) and the development of Project 2061 benchmarks for science literacy. The benchmarks specify a sequence of steps through which students would be expected to progress to reach desired outcomes specified for high school graduates in Science for All Americans. Benchmarks result from a process Project 2061 calls "back-mapping." "Back-mapping" involves considering what the component ideas are for a particular learning goal, then imagining lower levels of sophistication at which these ideas might
be understood at earlier grade levels. Benchmarks reflect the logical structure of science and an understanding of student learning, gleaned from teachers’ experience as well as from research into how children learn. Because such research is limited in many areas, developing benchmarks is an especially difficult task. Kinds of research proving most useful and further research needed in developing and revising benchmarks and curriculum based on them will be identified.

Koulaidis, Vasilis & Christidou, Ilia worked on the project *Children's Misconceptions and Cognitive Strategies Regarding the Understanding of the Ozone Layer Depletion* The research project to be presented in this paper aims at studying the way different cognitive strategies are employed and information concerning the greenhouse effect and the ozone layer depletion is processed by primary school children. Specifically, concerning the aim of this paper we are mainly focusing on 1. An initial analysis of the metaphors primary school children use in order to render unfamiliar processes understandable, and 2. An initial analysis of explanations as well as causal relationships children use.

Lowenthal, F. worked on the study *SPATIAL AND LOGICAL MISCONCEPTIONS IN LOGO SESSIONS: a comparison of normal and handicapped subjects' strategies* and they created a new technique to observe and favor the cognitive development of young subjects: this technique is based on the use of concrete representations of formal systems (Lowenthal 1972; 1978). These representations consist of sets of objects provided with technical constraints. These constraints make certain actions possible and others impossible. Using simple devices as concrete representations of formal
systems appears very useful for researchers interested in Cognitive Psychology: the technical constraints of the device provide hidden axioms and deduction rules. This creates a simple logical framework within which an objective interpretation of the subjects' productions becomes possible since all the ambiguities due to the use of verbal interactions can be eliminated. Lego bricks constitute a good example of a device that can be used as a concrete representation of a formal system; the bricks must be placed on a baseboard and a subject can only continue a path of bricks by placing more bricks next to the bricks already placed on the board, using flat or right angles: all other attempts yield to technical impossibilities. The axioms hidden in this device are those defining the absolute geometry. It must be noted that such devices can only be used to present a logical problem to the subject and to observe his or her solving strategy at the output level.

Moreira, Marli Merker worked on the study STUDENTS' MISCONCEPTIONS OF TIME/RELATIVITY IN LANGUAGE LEARNING in This paper addresses an issue that relates to the understanding of how EFL students deal with their (mis)conceptions of time/relativity when using verb tenses in English. Why do EFL students have so many problems using the perfective aspect of tenses? Are these problems related to their concepts of time? What kinds of concepts do they hold in their conceptual framework? Is time independent from space for these students? Is time-space relative for them? Do they see any linkages between the use of tenses and time-space/relativity?

Nasser, Ramzi & Carifio, James in their study on Students Misconceptions and Errors in Solving Algebra Word Problems Related to Misconceptions in the Field of Science This study relates
domain specific misconceptions in mathematics to misconceptions in science. A set of propositional relation algebra word problems were constructed. These problems had the key contextual features of familiarity, image ability and variable type which interact with learner characteristics. The errors observed on these algebra word problems were due to the context of the algebra problems as opposed to the structure or content which are the source of scientific misconceptions and errors. Mathematical misconceptions, therefore, appear to be the result of naive cognitive operations which are epistemologically based.

O'Rafferty, Maureen H. in their study on Conceptualizing Chromatography: Student Misconceptions Revealed by Analysis of Responses to Second International Science Study Process Testing at Grade 9 Level in USA This analysis of the responses of 322 students to a practical chromatography task uses data collected during spring 1986 as part of the Second International Science Study [SISS] organized by the International Association for the Evaluation of Educational Achievement [IEA]. The sample, drawn from 39 schools, is a subset of the national sample of U.S. students. The task required students to observe the dispersion of four dots of colored ink on filter paper when it absorbed water, record their observations, and explain the change in a dot of black ink. Students recorded details of their work observations and their explanations of these in test booklets. These written records were analyzed to provide a detailed description of student responses, and of concepts invoked by students to explain their observations. To show the types of concepts used in these explanations, a categorization of student responses was produced, in an attempt to group together responses using similar concepts. Literature on explanation in science education and on
student difficulties with chromatography tasks is reviewed. The results of analysis of the student responses are presented and discussed.

**Philippou, George** worked on the study *Misconceptions, Attitudes and Teacher Preparation*. The problem of students' low achievement in mathematics has been extensively investigated with respect to a variety of possible interacting variables including emotional. Mathematical learning may differ from learning in other subjects and probably requires special student and teacher efforts due to its level of symbolic language, abstraction and the hierarchical development of logical schemata. The still prevailing academic way of presenting new concepts, the frequently behavioristic automation in learning and applying procedures, the failure (on the part of teacher) to connect mathematics with real life situations, in short, the poor and unimaginative teaching has created and preserved social stereotypes, beliefs, fears, negative attitudes and anxiety which constitute major obstacles.

**Squires, David** worked on the study *Misconceptions in Photosynthesis: the Use of Novel Database Software*. The aim of this research is to explore the use of Bioview, an information handling package specifically written for use in biology education, as an aid to students' understanding of science concepts. A database concerned with photosynthesis provides a focus for the research. The software uses a novel pictorial approach to represent data corresponding to three interacting variables, and runs within the graphical user interface provided by Microsoft Windows. Thus this research spans two areas of interest: (i) students' understanding of science concepts (particularly those concerned with photosynthesis), and (ii) users' interactions with graphical
user interfaces. Of particular interest is the interplay (positive and negative) between these two areas.

Peter Facione (1990) conducted a Delphi study Critical Studies in Critical Thinking which will be described in the next section where a group of critical thinking experts drafted the following definition of critical thinking (CT). They concluded: "We understand critical thinking to be purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation, and inference, as well as explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations upon which that judgment is based. CT is essential as a tool of inquiry. As such, CT is a liberating force in education and a powerful resource in one's personal and civic life. While not synonymous with good thinking, CT is habitually inquisitive, well-informed, trustful of reason, open-minded, flexible, fair-minded in evaluation, honest in facing personal biases, prudent in making judgments, willing to reconsider, clear about issues, orderly in complex matters, diligent in seeking relevant information, reasonable in the selection of criteria, focused in inquiry, and persistent in seeking results which are as precise as the subject and circumstances will permit. Thus, educating good critical thinkers means working toward this ideal. It combines developing CT skills with nurturing those dispositions which consistently yield useful insights and which are the basis of a rational and democratic society" (p. 3).

The multiple definitions of critical thinking and confusion concerning its specificity led to the need for further refinement of the composition of the critical thinking construct. Facione (1990) assembled a group of forty individuals (52% from Philosophy, 22% from Education, 20% from Social Sciences, 6% from Physical Sciences) recognized by
their colleagues as having special experience and expertise in CT instruction, assessment, or theory. Facione (1990) employed the powerful qualitative research methodology known as the Delphi Method was used to develop the theoretical framework used for this study. The Delphi study (Facione, 1990), which ran from February of 1988 until November of 1989, consisted of six rounds of questions and response. The findings of the Delphi Report are as follows: 1. Critical thinking includes the dimensions of skill and disposition. 2. There was consensus that critical thinking could be improved in several ways. The experts agreed that a person could critically examine and evaluate one's own reasoning processes, that they could learn how to think more objectively and logically, that they could expand their repertoire of those more specialized procedures and criteria used in different areas of human thought and inquiry, and that they could increase their base of information and life experience (p. 4). 3. "While CT skills themselves transcend specific subjects or disciplines, exercising them successfully in certain contexts demands domain-specific knowledge, some of which may concern specific methods and techniques used to make reasonable judgments in those specific contexts" (p. 5). 4. "There is a critical spirit, a probing inquisitiveness, a keenness of mind, a zealous dedication to reason, and a hunger or eagerness for reliable information which good critical thinkers possess but weak critical thinkers do not seem to have...the affective dispositions are necessary for the CT skills identified to take root and to flourish in students" (p. 11). 5. "It is inappropriate use of the term to deny that someone is engaged in CT on the grounds that one disapproves ethically of what the person is doing. What 'CT' means, why it is of value, and the ethics of its use are best regarded as three distinct concerns" (p. 12). 6. "A good critical thinker...is habitually disposed to engage in, and to encourage others to engage in a wide range
of contexts and for a wide variety of purposes. Although perhaps not always uppermost in mind, the rational justification for cultivating those affective dispositions which characterize the paradigm critical thinker are soundly grounded in CT's personal and civic value. CT is known to contribute to the fair-minded analysis and resolution of questions. CT is a powerful tool in the search for knowledge. CT can help people overcome the blind, sophistic, or irrational defense of intellectually defective or biased opinions. CT promotes rational autonomy, intellectual freedom and the objective, reasoned and evidence-based investigation of a very wide range of personal and social issues and concerns" (p. 13).

Many of the findings of the Delphi study are addressed in one way or another in this investigation. The first finding as stated above indicated that critical thinking includes the dimensions of skill and disposition. This consensual agreement among the experts was a reiterated point of critical thinking scholars preceding them (Dewey 1933; Norris and Ennis 1989), but Facione (1990) and his group of experts went a step further. They identified a set of specific skills and sub-skills for the skill dimension and a specific set of attitudes for the disposition dimension (Facione 1990).

Joyce Yukawa in this study on Critical Thinking in Science Education explained that It is widely held that developing critical thinking is one of the goals of science education. Although there is much valuable work in the area, the field lacks a coherent and defensible conception of critical thinking. As a result, many efforts to foster critical thinking in science rest on misconceptions about the nature of critical thinking. This paper examines some of the misconceptions, in particular the characterization of critical thinking in terms of processes or skills and the separation of critical thinking and knowledge. It offers a more
philosophically sound and justifiable conception of critical thinking, and demonstrates how this conception could be used to ground science education practice

**Dana L Zeidler, Norman G Lederman, S C Taylor** in their study on *Fallacies and student discourse: Conceptualizing the role of critical thinking in science education* they examine the role of critical thinking in science education by defining and conceptualizing critical thinking and exploring common fallacies in student argumentation. Critical thinking, as defined by B. K. Beyer (1988), is a repertoire of specific operations, between major thinking strategies and micro thinking skills in their complexity and function. These operations may be used independently or in combination and in any order. Students often show systematic patterns of flawed reasoning behavior (i.e., they engage in fallacious arguments). A fallacy is defined as any argument that purports to be correct and is psychologically persuasive but proves to have violated some rule of logic that renders it incorrect. A number of fallacies are discussed, including circular reasoning, hasty generalization, normative reasoning, false dilemmas, and appeals to popularity and authority.

**Lauren Starkey** in his research on *CRITICAL THINKING* This article presents a theoretically grounded model of critical thinking and self-regulation in the context of teaching and learning. Critical thinking, deriving from an educational psychology perspective is a complex process of reflection that helps individuals become more analytical in their thinking and professional development. My conceptualisation in this discussion paper argues that both theoretical orientations (critical thinking
and self-regulation) operate in a dynamic interactive system of teaching and learning. My argument, based on existing research evidence, suggests two important points: (i) critical thinking acts as another cognitive strategy of self-regulation that learners use in their learning, and (ii) critical thinking may be a product of various antecedents such as different self-regulatory strategies.

Haobin Yuan, Wipada Kunaviktikul, Areewan Klunklin, Beverly A Williams in their study on learning in the People's Republic of China: a quasi-experimental study and found out that a quasi-experimental, two-group pretest-post-test design was conducted to examine the effect of problem-based learning on the critical thinking skills of 46 Year 2 undergraduate nursing students in the People's Republic of China. The California Critical Thinking Skills Test Form A, Chinese-Taiwanese version was used as both a pretest and as a post-test for a semester-long nursing course. There was no significant difference in critical thinking skills at pretest, whereas, significant differences in critical thinking skills existed between the problem-based learning and lecture groups at post-test. The problem-based learning students had a significantly greater improvement on the overall California Critical Thinking Skills Test, analysis, and induction subscale scores compared with the lecture students. Problem-based learning fostered nursing students' critical thinking skills.

Kyung Rim Shin, Ju Young Ha, Kon Hee Kim worked on the study A longitudinal study of critical thinking dispositions & critical thinking skills in baccalaureate nursing students This longitudinal study was done to investigate critical thinking dispositions and critical
thinking skills of nursing students enrolled in a 4-year baccalaureate program at a university in Korea. **METHOD:** The study used a longitudinal design. A convenience sample of 32 nursing students who were completing their 1st, 2nd, 3rd, and 4th year in a baccalaureate program at a selected university was included. The subjects completed the California Critical Thinking Dispositions Inventory (CCTDI), the California Critical Thinking Skill Test (CCTST), and a demographic questionnaire. Data was analyzed by descriptive statistics, repeated ANOVA, adjusted p-values, and Pearson's correlation coefficient with SAS 8.12. **RESULTS:** There was statistically significant improvement according to academic year in the CCTDI total mean score (F=7.54, p=.0001) and subscales of Open-mindedness, Self-confidence, and Maturity. Contrarily, no statistically significant difference was found in the CCTST total mean score and subscales' score except Analysis. **CONCLUSION:** There is no significant correlation between critical thinking dispositions and skills, so it will be necessary to repeat a study like this, and the translated instruments should be modified by considering Korean culture.

**Bernadette M Gadzella, Kent Hartsoe, James Harper** in their study on **Critical thinking and mental ability groups** and investigated the effects of teaching critical thinking (CTH), using 4 different approaches with 116 undergraduates who were identified as being of high, average, and low mental abilities based on scores on the Otis-Lennon School Ability Test. Ss completed the Watson-Glaser Critical Thinking Appraisal before and after participating in small group (SG), individualized study (IS), or control conditions. When information on CTH was provided and exercises and problems were used in a course, Ss of high and average ability generally reported higher CTH scores than Ss
of low ability. High ability Ss profited most in the SG study approach, while CTH scores did not differ significantly in the IS condition. (PsycINFO Database Record (c) 2007 APA, all rights reserved)

Paul J Schafer in his study on Critical thinking ability of teachers he Administered the Watson-Glaser Critical Thinking Appraisal to 200 teachers. Findings indicate that (a) female teachers demonstrated a higher level of critical thinking than male teachers; (b) suburban teachers showed a higher level of critical thinking than city teachers; (c) teachers who were graduated from a liberal arts college demonstrated a higher level of critical thinking than teachers graduated from a state college; and (d) teachers with various years of experience exhibited no significant difference in their ability to think critically. The 1st 3 differences were significant (p < .05). There was no significant difference among the scores for teachers with various years of experience. (PsycINFO Database Record (c) 2007 APA, all rights reserved)

Robert H Ennis in his study on Problems in Testing Informal Logic, Critical Thinking, Reasoning Ability Assuming that 'informal logic', 'critical thinking', and 'reasoning' mean roughly the same in current discussions and texts, ennis notes and suggests ways of dealing with some problems in testing for some aspects of the topic. problems discussed are the inclusion of items that test for a student's value judgments, the importance of background knowledge and beliefs in answering induction items, and treating assumptions as "necessarily made." items from current leading tests are examined and criticized. ennis also explains and
criticizes current psychometric doctrine regarding reliability and validity, as applied to critical thinking tests.

**John Ricketts, Rick Rudd** in their study on **Critical thinking: Literature review and needed research** discussed An effort is made in this review to cover a wide range of issues relevant to critical thinking as well as the most important and controversial works discuss the movement in critical thinking followed by definitions and theories of critical thinking present an overview of efforts in curriculum and instruction related to the teaching and learning of critical thinking, as well as a discussion of the issues involved in teacher training the testing and evaluation of critical thinking capacities is then discussed the teaching of critical thinking subject matter specificity and instruction, transfer, classroom atmosphere the learning of critical thinking developmental readiness, prior knowledge, student characteristics needed research

**S Bailin, R Case, J R Coombs, L B Daniels** worked on the study **Common misconceptions of critical thinking** and In this paper, the first of two, we analyse three widely-held conceptions of critical thinking: as one or more skills, as mental processes, and as sets of procedures. Each view is, we contend, wrong-headed, misleading or, at best, unhelpful. Some who write about critical thinking seem to muddle all three views in an unenlightening melange. Apart from the errors or inadequacies of the conceptions themselves, they promote or abet misconceived practices for teaching critical thinking. Together, they have led to the view that critical thinking is best taught by practising it. We offer alternative proposals for the teaching of critical thinking.
Buffington, Melanie L. in his study on Contemporary Approaches to Critical Thinking and the World Wide Web said that Teaching critical thinking skills is often endorsed as a means to help students develop their abilities to navigate the complex world in which people live and, in addition, as a way to help students succeed in school. Over the past few years, this author explored the idea of teaching critical thinking using the World Wide Web (WWW). She began in-depth research on the topic to understand what critical thinking entails and the potential for art educators to use the WWW to help their students develop critical thinking skills. This article begins with a review of the history of critical thinking and some current ideas on the topic. Then, the author explains her working description of critical thinking and how critical thinking is currently articulated in discussions of the WWW in schools. She concludes with ideas for teachers related to developing critical thinking in art classrooms using the WWW. (Contains 1 figure and 3 endnotes.)

J. Stephen Scanlan, San Diego (2006) conducted a study on The Effect of Richard Paul’s Universal Elements and Standards of Reasoning on Twelfth Grade Composition A Research Proposal Presented to the Faculty of the School of Education Alliant International University In Partial Fulfillment of the Requirements for the Degree of Master of Arts in Education: Teaching This proposal describes the procedures used by a student teacher in a San Diego area twelfth grade Rhetoric and Composition class that were designed to improve the critical thinking (CT) skills of his students. Emphasis was placed on improving the CT skills of the students by incorporating researcher Richard Paul's "Elements and Standards of Reasoning" into all standards-based curriculum, which included persuasive essays on the topics of child
abuse, language, gender and culture, and the value of life. Students were identified as high-range, mid-range, low-range achievers, or ELL's. The progress of each group was measured through a progressive series of rubric assessments of their writing, examining five key areas important in rhetorical composition: Clarity of Writing, Analysis of author's argument, Use of supporting information, Organization, and Grammar and Syntax. Through the introduction of this focused critical thinking training, student composition improved dramatically in all of the five key areas, among all the groups. The researcher proposes to introduce focused CT practices in a trial set of Language Arts classes within the district at large, modeled on this action research.

Patty Payette, Ph.D., Sharon LaRue, M.A., CPAT, and Karen Newton, in their study on Implementing your institution's critical thinking initiative: Strategies for administrators, faculty, and staff and This session will provide an overview of guiding principles for organizational change developed by staff and faculty at the University of Louisville. In 2007, the University launched a multi-year institutional transformation to infuse the Paul-Elder model across the undergraduate curricula as part of their quality enhancement plan (QEP) required by their regional accrediting agency, SACS-COC. After two years of designing and implementing their campus-wide vision for a shared focus on critical thinking skills with faculty and staff, UofL QEP staff and two colleagues will present their framework for success, explain lessons learned so far, and share examples of successful integration of the model.

James E. Lewis, Ph.D., Jeffrey L. Hieb, Ph.D., and James H. Graham, Ph.D. worked on the study “Engineering” critical thinking:
Faculty exemplars on course redesign and assessment from the University of Louisville’s Speed School of Engineering and found that the J.B. Speed School of Engineering is at the beginning of a multifaceted project to incorporate the Paul-Elder model of critical thinking across the undergraduate engineering curriculum. This is in part to fulfill the University wide quality enhancement program titled “Ideas to Action: Using Critical Thinking to Foster Student Learning and Community Engagement”. The program begins with the Introduction to Engineering course, ENGR 100, where critical thinking and the Paul-Elder model are explicitly taught. Implicit and explicit instruction of critical thinking continues in upper level courses. The purpose of this session is to investigate the intentional and transparent inclusion of critical thinking and the Paul-Elder model into specific engineering courses by examining some of the techniques used. The courses discussed in this session will be the Introduction to Engineering course, Differential Equations (a common engineering sophomore level course), co-operative seminars, co-operative reports, and a senior level Electrical Engineering course.

Cathy Bays, Ph.D., and Edna Ross, Ph.D. worked on the study "Strategies for teaching critical thinking across instructional settings: Pedagogy and best practices" and the purpose of this session is to share the current evidence on how faculty can incorporate critical thinking in their class, lab, practicum/field learning environment. Upon completion of this session participants will be able to 1.) Examine the evidence for critical thinking; 2.) Select at least one strategy to enhance critical thinking in their educational setting; and 3.) Identify methods to assess critical thinking. This highly interactive session will use a combination of
reflective questions, Classroom Assessment Techniques (Angelo and Cross, 1993), and Clickers to accomplish the learning objectives. Additionally, university faculty exemplars for incorporating the Paul-Elder critical thinking model in the learning environments will be shared with the participants. Lastly, the presentation will include literature and experiential based strategies for assessing critical thinking.

Patricia Gagne, Ph.D., Jennifer Mansfield Jones, Ph.D., and Edna Ross, Ph.D. in the study on The Paul-Elder Model in Action: Sociology, biology, and psychology faculty discuss their work with promoting critical thinking in their courses and The Paul-Elder critical thinking model is a useful resource for faculty who wish to explicitly structure critical thinking into their assignments, assessments and course design. Faculty at the University of Louisville are infusing the concepts and language of the Paul-Elder model into their instructional design decisions as part of their quality enhancement plan (QEP) required by their regional accrediting agency, SACS-COC. Because the model provides a common language and structure for the teaching and learning of critical thinking across the undergraduate curricula, faculty from different disciplines and departments can utilize it in their courses. University of Louisville faculty will share their exemplary use of the Paul-Elder model in a panel discussion of a junior-level sociology course, a freshman human anatomy and physiology laboratory course, and a large-lecture introductory psychology course.

Agnieszka Alboszta worked on the study Critical Thinking Instruction: Adapting to Diverse Audiences and the Critical thinking, as defined by Dr. Paul and Dr. Elder, can be effectively fostered in a wide
variety of classes and with learners of diverse educational backgrounds and little formal instruction in critical thinking. In this session, participants will be shown how activities – paraphrasing, analyzing thinking, assessing thinking, Socratic discussion- can be combined creatively to increase awareness of critical thinking and inspire its continued practice and application after the end of a course. Drawing on knowledge of the elements, standards, and traits as well as adult teaching experience, the presenter will suggest specific exercises and approaches that have helped learners to become increasingly aware of their reasoning and increasingly adept at improving it. Examples will be drawn from both face-to-face courses and an online teacher training course.

Beverly G. Hart worked on the study Imbedding Critical and Creative Thinking Into A Practice-Based Curriculum described Critical and creative thinking is a central concept in all practice-based undergraduate college programs, and has been a central concept in all nursing programs accredited by the American Association of Colleges of Nursing. In a practice-based profession, critical thinking is often conceptually difficult to teach and more problematic to empirically measure. This presentation will discuss one perspective on how to incorporate critical thinking curriculum-wide, the creation of a fertile learning environment, and the layering and leveling of critical thinking assignments across a practice-based curriculum. Other content will focus on the use of discipline specific reasoning processes in relationship to the Elements of Reasoning and the Paul and Elder Model of Critical Thinking, the use of the “SEEI” teaching model for a practice discipline, and various assessment measures.
Lynnette Noblitt worked on the study **Maximizing Critical and Creative Thinking in Simulations and Case Studies** and said that Instructors from a variety of disciplines already recognize the value of introducing simulations and case studies into their courses. Research demonstrates that several aspects of student learning, including critical and creative thinking, are enhanced through the introduction of such classroom activities. This session will focus upon how to maximize the critical and creative thinking that students accomplish in simulations and case studies. Specifically, the session will introduce practical tips and advice that will assist instructors in the design and implementation of course simulations and case studies. The session will also focus upon the assessment of these course activities and how instructors can design instruments that both encourage deep student learning and reflect student performance accurately. Participants in the session will be encouraged to share their experiences with course simulations and case studies and to improve existing course activities during the session.

Beverly G. Hart, and Lynnette Noblitt worked on the study **Infusing a Model for Critical Thinking Campus-Wide Through a Quality Enhancement Plan** and discussed that Eastern Kentucky University is finishing its second year of implementation of its Quality Enhancement Plan “to develop informed, critical and creative thinkers who communicate effectively.” This presentation will focus on the administrative aspects of the QEP implementation, including the infrastructure elements. EKU is promoting the Paul/Elder model of critical thinking and infusing it campus wide. This presentation will discuss current methods of garnering faculty support, implementing the communications and marketing plan, providing professional development for faculty and staff, and designing the assessment plan. The session will
highlight the “QEP Coaches” program that promotes faculty and staff peer education, the proposed Critical Thinking Certification Program, and other instructional tools and programs currently under development that will promote critical thinking campus wide.

**Larry J. Frazier** worked on the study *Founding the Chowan Socratic Club: the Roles of Paul, Elder, and Lewis (C.S.) in the Pilot of the Chowan Critical Thinking Program* said that Participants in this session will engage in an analysis and evaluation of the original course outcomes and schedule for Critical Thinking (CT) 102 – a course designed to introduce incoming freshmen to the elements and standards of effective critical thinking. CT 102 is one course within the Chowan Critical Thinking Program (CCTP), which was created as Chowan University’s Quality Enhancement Plan (QEP). Chowan University is a small, church-related university located in northeastern North Carolina.

The CCTP proposes a two-course sequence taken in the student’s freshman year. The courses are based on the Paul and Elder model, with the first semester course (CT 101) focusing on dispositions and the second semester course (CT 102) focusing on elements and standards. CT 102 is to be a topical course. One component of the CCTP involved the implementation of pilot courses during the 2008-2009 academic year. This session will review the overall plan for the CCTP and briefly examine CT 101. The bulk of the session will be devoted to examining CT 102 – a course that was presented around the topic of “C. S. Lewis.” By analyzing and evaluating the original course schedule syllabus, participants in this session will be challenged to identify the purposes, point of view, and assumptions of the course and especially to evaluate the logic of those assumptions – logic which proved at times to
be faulty, as the pilot course revealed. The analysis and evaluation of the participants will be compared to the actual lessons learned from the implementation of this course.

Joel Levine worked on the study Infusing Critical Thinking at a Community College: Year Three They present these ideas from four points of view: Student leadership concerning use of the Elements and Standards for decision-making; ESL faculty concerning developing students’ writing skills through OUR WRITING TOOLBOX; Reading faculty concerning building students’ reading skills through OUR READING TOOLBOX, and School Dean concerning building faculty teaching skills through infusion of critical thinking in classroom instruction.

Mary Filice in her study on Truthiness, Trust, and Technology: Critical Thinking in the Age of Convergence In October 2005, political satirist Stephen Colbert proclaimed “the truthiness is, anyone can read the news to you; I [Colbert] promise to feel the news for you.” A year later, Merriam-Webster bestowed their Word of the Year Award to “truthiness,” a fake word created by a fake cable-news talk-show host. But what is the impact of this convergence of information and entertainment? What does it mean that “truth” is gained from a fake talk-show?

Dr. Marzieh Hasanpour in his study on The process of critical thinking in Iranian nursing education: A Qualitative Research While the history of ‘critical thinking’ goes back to ancient Greek Philosopher’s era, yet it was from 1950s that such concept, was implemented as an
effective means to improve learning in general education. In recent decades nursing education has emphasized on critical thinking as a core and essential competency of students and nurses. Nurses as critical thinkers will be able to provide favored care in healthcare system with rapidly changing knowledge and technology developments in complexity modern world. To date, no research has been conducted to describe critical thinking concept and to examine its process in Iran nursing education. The purpose of this study was to explore the process of critical thinking in nursing education

Bonnie Potts in his research on Strategies for Teaching Critical Thinking, said that Critical thinking skills figure prominently among the goals for education, whether one asks developers of curricula, educational researchers, parents, or employers. Although there are some quite diverse definitions of critical thinking, nearly all emphasize the ability and tendency to gather, evaluate, and use information effectively (Beyer, 1985).

In this article, we discuss skills related to critical thinking and three specific strategies for teaching these skills: 1) Building Categories, 2) Finding Problems, and 3) Enhancing the Environment.

From these reviews it is concluded that the researches and literatures reviews show that the problem on which researcher is working is new one and need to be complete hence researcher is working on problem that is

**Relationship between misconceptions of secondary school students in physics and their critical thinking skills – a study**