

## **CHAPTER II**

### **REVIEW of LITERATURE**

#### **2.0 Introduction**

Any new knowledge is the product of research, which springs from a pondering mind of inquisitor who further lays down foundation for evolving new knowledge. Hence it can be said '**knowledge stems from knowledge**'.

A present study is an Intervention study focused at enhancing critical thinking in students and studying its impact on their academic performance. Such a study would not be successfully rendered but for the preparatory grounds laid down by the past studies on the same line.

The past studies, based on the early theories of thinking, measurement of thinking and other developmental studies have been the building blocks for the current study. It is in the light of this, the investigator has endeavored to search available literature with the present study in focus.

#### **2.1 Early studies on thinking**

From the days of early Greek philosophers and psychologists have theorized about how the mind works and how inductive and deductive thinking functions. During the eighteen century studies of thinking have been carried on using laboratory experiments and observation of individuals i.e. rapid increase in the number of empirical investigation and whole science of information theory has grown up to assist in the study of thinking and problem solving.

A good summary of such work up to year 1909 is contained in Tichener's lectures on experimental psychology of thought. What was done is that a set of questions were asked to various people, their answers were recorded and like

wise their own account based upon introspection of the process which lead them to give those answers.

Buhler.K (1959) conducted various experiments on thinking using Paradoxical Aphorism, Matching or Analogous proverbs and Password experiments. From experiments like these Buhler arrived at several important results (1) *thought process are goal directed.* (2) *Thoughts and their relationship to the task are simultaneously conscious.* (3) *Thinking always takes place to perform a task, to solve a problem and to satisfy some motivation.* (4) *Thinking is a function of perception and learning.* (5) *Thinking is not just the activity in the head, it does not occur just in the brain and nervous system but also in gestures of arms, hand and head.*

Hull. C.L. (1920), Smoke. K.L. (1932), Reed. H.B. (1946), Heidbreder.E. (1948), and many others conducted a number of different kinds of experiments to study concept formation and their studies revealed that a person often thinks with concepts. A concept is a word or mathematical symbol, which labels or describes common property. The process of forming concepts passes through stages of generalization and differentiation which falls in the domain of thinking. Burt.C. (1929), conducted experiments on thinking, indicated that thinking takes place in two parts (i) the generation of ideas and hypothesis (ii) and the logical development and elaboration of ideas by reasoning. The first is called **imagination and creative thinking** and second is **logical reasoning**, which attempts to make thinking self-consistent and to confirm with factual reality. Further, the following steps have been identified: (i) *a problem has to be solved in order to reach a goal* (ii) *ideas or hypothesizer inferences are generated that aim towards the solution of problem* (iii) *certain responses are selected by trial and error and solution is attempted.*

On the other hand experiments of Alpert.A (1928) and Ruger.H.A. (1910), with children indicated that thinking shows some insight. Ruger found that his subjects often saw the solution in flash after locating or analyzing a part of a puzzle that was causing the difficulty.

In 1957 J.P. Guilford made an important distinction between convergent and divergent thinking. Convergent thinking thought makes use of what every one knows in a particular society while divergent thought follows uncommon pathways.

Helmholtz (1896), Wallas.G. (1926), Rossman.J. (1926) and Pointcare.H. (1908), have conducted experiments on creative thinking and found out in creative thinking a new combination or pattern is formed out of past experiences resulting in an original and novel product. These scientists describe four stages of creative thought (i) preparation, in which the person collects information and works intensively on problem (ii) incubation in which the person puts the problem aside temporarily if he cannot solve (iii) inspiration or illumination when the person gets solution in flash and the final stage (iv) verification or revision.

## **2.2 Measurement of thinking**

Towards the mid-eighteen century theories on thinking were built up that describes thinking as more and more as a measurable construct. Efforts were made to construct instruments to measure attributes of thinking.

Burt.C. (1921), made up a test of Deductive Reasoning Ability designed for children at all different age level. The test was in form of problems with necessary information and the children were asked to draw the conclusion.

A classical form of deductive thinking is 'syllogism' which dates back to the ancient Greek. A syllogism consisted of 3 statements - a major premise, a minor premise and a conclusion deduced from the premises and the subject has to say whether conclusion deduced are correct or incorrect (Krippner et al. N.D.).

**Virginia Shipman developed New Jersey Test of Reasoning Skill.**

This is primarily a test of ability to reason in language. It concentrates on dialogical thinking. It contains no inert items such as vocabulary. Its reading level is 4.5 and its reliability compares favorably with established test ranging from .84 to .91.

William.H.B., Roland.B.K.and et.al. (1960), makes mentions of **General Test of Critical Thinking Appraisal** (1952), which has been designed for use with high school and college students. The test items, which are of a multiple-choice type, presents problems, statements, arguments and data similar to that which a citizen might encounter in daily life. Five subscores can be obtained for (i) *Inference* (ii) *Recognition of Assumptions* (iii) *Deduction* (iv) *Interpretation* and (v) *Evaluation of arguments*. *The test is easily administered and readily scored.*

**Test of Critical Thinking**, developed by Macey. M.T. and Wood. H.B. (1951), is designed for use in the junior high school. Part scores are obtainable on (i) *Inquiry* (ii) *Interest* (iii) *Relationship* (iv) *Open-mindedness* (v) *Generalization* and (vi) *Accuracy*. *All the items are objective.*

**A Test of Critical Thinking**, developed by American Council on Education (1952), was developed for use with college freshmen and has been successful with high school students. Part scores are available for (1) *defining problem* (2) *recognition of assumption* (3) *inventing and evaluating hypothesis* (4) *making and judging inferences*. *It is objective type of test.*

**Test of Practical Judgment** developed by A.J. Cardell (1950) is designed to measure capacity for practical judgment in every day situation. It is intended for high school and college use.

**Ohio Thinking Checkup for Intermediate Grades** developed by Ohio State Department of Education (1946). Common aspects of critical thinking such as 'interpretation of data', 'over generalization' and 'over caution' are evaluated. Normative data are not published.

**Logical Reasoning Test** developed by Educational Testing Service, N.J (1950). This test measures ability to handle formal logic of an elementary sort. As the manual suggests this test seems to be appropriate primarily for senior high school students with some training in formal logic.

**A Critical Thinking in the Language Arts - Interpretation of Literature Test** developed by Educational Testing Service, N.J. (1950). The test scores deal with 'understanding, recognition', 'point of view', grasp of motivation, weighting evidence and literary analysis. This test is based on a detailed analysis of a summary of O.Henry story.

**Co-operative Literary Comprehension and Appreciation Test**, constructed by Frederick. B. Davis and others (1941). It attempts to measure (1) knowledge of the word meaning, (2) ability to reason abstractly, (3) ability to understand and explicit statements, (4) ability to determine the writer's purpose, intent and point of view, (5) ability to draw inference from the passage about the content of the passage etc.

**A Test of Critical Thinking in Social Science** constructed by American Council on Education, Education Testing Service, N.J (1951) does not require specialized knowledge of social studies. No part scores are obtainable but the

test manual gives a description of the particular critical thinking in skill tested by each item. The test is intended for early college use but seems to have applicability for high school students.

**A Test of Reasoning and Understanding Natural Sciences** constructed by American Council on Education, Education Testing Service, N.J. (1952). For the most part it consists of excerpts from science articles written for the general public with questions to evaluate a student's ability to analyze the problems in terms of the broad principles of science. Part scores can be obtained for (1) Problem recognition (2) Hypothesis formation (3) Development of conclusion and (4) Attitudes.

**Watson-Glasser Critical Thinking Test** is designed to measure such thing as (1) ability to recognize assumption, (2) evaluate arguments and (3) to appraise inference. The students who do best on the test are enrolled in MBA and medical programs with median scores of 66 and 68 respectively.

Williamson J.L (1991), mentions a few existing assessment tools measuring critical thinking, they are **Cornell Class Reasoning Test, Form X** (1964); **Cornell Critical Thinking Test, level X**, (1985); **The Ennis-Weir Critical Thinking Essay Test** (1985); **Judgement Deductive and Assumption Recognition** (1971); **New Jersey Test of Reasoning skills** (1983); **Ross Test of Higher Cognitive Processes** (1976); **Test on Appraising Observation** (1983) and many other. In almost all of these tests the scores are obtained for (1) identification of writer's purpose, (2) recognition of assumptions, inferences, author's objectives etc., (3) implication of writer's point of view, (4) identification of main concepts in a passage, (5) drawing reasonable inferences from positions etc.

In addition there are many tests available for higher studies, which are based on critical thinking skills like the SAT, The Test of Academic Aptitude (British), The Graduate Record Exam and many others. Most of our competitive entrance examination - MBA, Hotel Management, IAS, LIC, Bank P.O and many others are based on mental ability, which include analogy, coding-decoding, decision making, logical deduction like deriving conclusion, assumption, questions, statement etc. from passages.

### **2.3 Developmental studies**

Intervention studies as they are called constitute a new trend in research on thinking. The inquisitor engaged in this type of research are doing research of a less traditional nature which deal with complex statistical method.

Spinthall (1975) describes intervention study as a constant interplay between investigation and analysis of significant questions. The action-reflection sequences (try out, examine and try out again) should replace the classical hypothesis testing basis of research. The feed back cycle will provide the means to analyze and correct any error before the next step.

There have been number of studies which are represented as developmental research, in area of education, which consists of experimentation in channelising human thinking in a desired direction. The object of the present study and most of the research reviewed here are common, i.e. to develop thinking in students.

Teaching of thinking skills are potentially one of the most valuable areas of educational research today. The movement to teach thinking skills stems from the belief that thinking can be learnt and taught.

A host of researches point out that thinking can be developed. Dewy (1933), Guilford (1967), Taba Hilda (1957), Bartlett (1985) and many others regard thinking abilities as intellectual skills that are trainable by analogy to psychomotor skills. These skills have been developed largely by informal

practice and they should be improvable by virtue of formal practice, which should apply to critical thinking abilities as well as creative thinking abilities.

Deylon (1991), conducted a study on 58 students of accounting, who trained in the Inclusion process program for developing thinking skills based on the finding of the study it was concluded that students trained in Inclusion process performed significantly better on End-of-quarter problem solving test than students not trained.

Raymond (1993) conducted an experimental-study to determine effectiveness of Thinking Aloud Pair Problem Solving (TAPPS), instructional methodology as a means for enhancing learners' higher order thinking abilities. Results showed that TAPPS appeared to aid students in problem solving and also facilitated students' transfer of knowledge from an instructional unit to the problem situation. In short TAPPS significantly contributed to students' use of metacognitive thinking operations.

Johson's study (1992) sought to determine the effect of critical thinking skill instructions (CTSI) on the academic achievement of students. In the experimental group, students were taught CTSI for one semester. The group that was taught CTSI showed better academic achievement.

Administrators and teachers in the Walla Walla, Washington schools, a district with approximately 5,000 students in 9 school began exploring and experimenting with methods of teaching thinking skills during 1983-84 school year. Following the end-of-year evaluation of the data collected by district officials and school board members have affirmed that the district should provide all Walla Walla students with these skills due to the experience of an excellent education that have been taught.

Jackson. R.M. (1985) taught critical thinking using variety of techniques, including teaching formal logic using prepared sets of questions to model critical thinking to middle school language and arts students. The study showed that her students had learned the skill for understanding the author: recognize and understand figurative language. Students were comfortable with taking the risk of speaking out and defending their opinions, students learnt to analyze whole stories and articles for figures of speech and to use their finding to support an opinion about the author's writing etc.

Joyce, Showers, Beaton and Dalton (1984) used models for teaching thinking for basic school subjects at both elementary and secondary levels. The research indicates models for teaching thinking helps teach thinking, increases the learning of subject matter, academic skills and enhances intellectual growth.

Corole Jean's study (1991) evaluated the effects of Case Study Analysis in formal training program of nursing students. The study showed the experimental students' score on Waston-Glaser Critical thinking appraisal increased. The result of the study supported the efficacy of Case Study Analysis for improving critical thinking abilities.

**Lipman and Bierman carried out the first evaluation of the Philosophy for Children Program in 1970** in the Rand school in Montclair. The skills that philosophy for children aims at sharpening are (1) formulating concepts (2) making appropriate generalization (3) formulating cause-effect relationships (4) drawing syllogistic inferences from two premises (5) formulating questions (6) identifying underlying assumptions etc. The aim of the study was to determine the feasibility of teaching reasoning to fifth grade children. Forty students participated in the study and were divided into two randomly assigned groups. The experimental group received 40 minutes sessions of Philosophy For Children Program over a period of 9 weeks. Both groups were initially tested on

the California Test of Mental Maturity. At the end of 9 weeks, both groups were retested on the same instrument. On the second testing the experimental group achieved mental age scores that were 27 months higher than those of control group.

A still more extensive evaluation of Philosophy For Children Program was conducted by Shipman.V (1978), Haas.H (1975), Karras (1980), Reed and Henderson (1981), Weinstein and Martin (1982). These studies show the effectiveness of the Philosophy For Children. The evidence suggests that students who have been exposed to the program are more reasonable and thoughtful. These studies have reported significant gains on various measures of reading comprehension, logical thinking, reading critical, curiosity etc. - Lipman (1992).

Bryce. B.H and Sybil Eddman (1988) studied effect upon individual children's critical thinking of training them in self-directed critical thinking. The purpose of the investigation was to examine a series of expectation about the effects of training intermediate grade children in use of self-directed critical thinking. Experimental children were taught the self-directed critical thinking skills as member of small discussion groups. After eight discussion sessions each child was confronted individually with new reasoning task. The authors reported children's critical thinking in which teacher led small group discussion was a vehicle for stimulating children's thinking i.e. student not only gave reasonable assessment of the statements but gave evidence in support of conclusion and gave justification.

#### **2.4 Studies conducted in India**

More and more research projects point to the fact that education can play an important role in the development of critical thinking. But it is unfortunate that the

investigator has not been successful in tracing a developmental study, which aims directly at enhancement of critical thinking in students.

Notwithstanding, there have been a number of studies conducted in India which are directed at developing creative thinking in students, using school subjects. Only a few of these are presented here.

Nirpharke (1977), constructed a hypotheses that (1) All experimental group receiving training in least one area would make significant improvement (2) The performance of the experimental groups on creativity test after training would be better (3) The experimental group receiving training in all the area would make highest improvement for testing hypothesis. He took the sample of thirty-six boys in grade V11, coming from middle class families with urban background. For training he used lectures followed by discussion, demonstration, problem solving, role-playing etc. The entire hypotheses were accepted.

Pillay (1978), studied the effect of the patterns of teaching upon creative thinking amongst 71 eight graders. He observed that the treatment of creative teaching method when compared with traditional method did not produce differential effect upon general creative thinking and on the creative thinking in Geography but recorded gain in achievement in Geography. The techniques used for teaching creative thinking were Brain storming and Morphological synthesis.

Bhaskara (1981), prepared verbal creative instructional material for enhancing creative thinking ability of VI std. students. The creative instructional material included divergent problems, construction of riddles, puzzles, solving of consequences situation etc. Results showed verbal creativity instructional materials were able to significantly improve creative thinking in students.

Deshmukh (1979) studied the relative effectiveness of brainstorming and role-play techniques to develop creativity in the secondary school children of Nagpur.

Brain storming technique was found to be relatively superior to role-play in terms of significant difference on creative test also the techniques created conditions that helped to increase scholastic achievement.

In addition, to the developmental studies in the area of creativity there is a plethora of studies that have been conducted using teaching models of thinking envisaged by Joyce and weil (1980) that were proved successful in teaching thinking as well as increased in learning of subject matter. Buch's survey (1983-1988), makes mention of such studies conducted on this line. Out of these surplus studies the investigator mentions only a few.

Buddhisagar (1979), Patania (1980), conducted studies using Advance Organizer Model; B.K Passi, L.C Singh & D.N Sansanwal (1986), conducted series of studies using Joyce & Weil's Models of teaching thinking. B.K. Passi, D.R Goel (1986) conducted work shop on Piagetian Model of teaching; Katyul (1985), Pani (1985), Das (1986) used the Concept Attainment Model in their studies and many more .

The review of related literature indicates there is a huge gap between the theories of thinking and intervention programme to teach thinking and this is much more pronounced in the Indian education scenario. In the present educational process there is no explicit teaching of thinking using school subjects.

The investigator strongly feels that education based on thinking is crucial for respecting human intellectual and individual autonomy and noticing a dearth of studies on critical thinking in India, the researcher has endeavored to develop an intervention study to enhance critical thinking in students.