CHAPTER II

Review of Related literature

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Chapter 2

Review of Related Literature

2.1 Introduction

The phrase ‘review of literature’ consists of two words: Review and literature in research methodology the term literature refers to the knowledge of a particular area of investigation of any discipline which includes theoretical, practical, and its research studies. The term ‘review’ means to organize the knowledge of specific area of research to evolve and edifices of knowledge to show that this study would be an addition to this field. The task of review of literature is highly creative and tedious because researcher has to synthesize the available knowledge of the field in a unique way to provide the rationale field for his study. The term ‘review of literature’ has been defined in the following ways:

*Good Barr and scales*\(^1\) “The competent physician must keep abreast of the latest discoveries in the field of medicine ................. obviously the careful student of education, the research worker and investigator should become familiar with location and use of sources of educational information.”

*John W. Best*\(^2\) “Practically all human knowledge can be found in books and libraries. Unlike other animals that must start with a new with each generation, man builds upon the accumulated and recorded knowledge of the past. His constant adding to the vast store of knowledge makes possible progress in all areas of human endeavors.”

2.2 Need and importance of review of related literature:

The review of related literature is one of the most important activities of the entire research work. In fact it forms the foundation for the entire research without which the research work may be shallow and native and often duplicate the work already done by someone. Review of related literature helps in developing an understanding of the
research problem properly and acquaints him with the up-to-date knowledge and latest
techniques relevant to his work. With the help of review of literature, researcher develops
a clear cut insight about the theoretical background of his research problem and has an
opportunity to use the best possible methodology in conducting his research work. But
very few studies are available on mathematical creativity of secondary school students in
India. A review of the related literature would bring to light the factors that have
remained unexplored in relation to mathematical creativity. This would also explain the
importance and necessity of the present study. This chapter summarizes the vast literature
on mathematical creativity in to some meaning categories. For the sake of clarity in
understanding and convenience in presentation, this chapter has been divided in to three
sections:
2.3 The studies abroad.
2.4 The studies in India. and
2.5 The general conclusions.

2.3 The Studies Abroad

Wilson (1970) studied on the topic “The Identification and Encouragement of
Mathematical Creativity in First Grade Students.” Reported is research involving the
development and testing of a program designed to encourage individual creative
mathematical activity in first grade students. Initially, some characteristics of the creative
process and creative thinking were examined and six criteria describing certain aspects of
mathematical creativity were identified and validated. An instrument used to measure
observable mathematical creativity was designed in order to test the program on
mathematical creativity. Two hypotheses were formulated: H1: "Participation in the
program will increase a student's observable mathematical creativity"; H2: "Participation
in the program will not affect a student's performance on a test of general creative
ability".

Scott (1977), studied on the topic of Inquiry Strategy, Cognitive Style, And
Mathematics Achievement and he formulated the following objectives:
1. What effect does this specific inquiry strategy have on the analytical style of students?
2. What relationships might exist between analytical styles and mathematics achievement? Following were the hypotheses of the study:

1. The analytical styles of inquiry students will not be significantly different from those of the comparison students. 2. The high school geometry and algebra grades of the inquiry group will not be significantly different from those of the comparison students. 3. There will be no significant correlation between the analytical styles and mathematics grades of inquiry and comparison students.

Method and Tools used: Chi-square, using a 2 X 2 contingency table, was employed to test Hypothesis 1. t tests for Hypothesis 2. and Pearson correlations for Hypothesis 3.

1. For this investigation the Sigel Cognitive Style Test (SCST) was used to assess a student's analytical "conceptual" style. 2. To assess mathematics achievement, the first-year geometry and second-year algebra grades for all students were obtained from the high school transcripts. The mathematics grades were converted to numbers. A = 4 to E = 0. 3. Questionnaires were filled in by all students in response to the question, "What do you recall from your sixth-grade science classes?" 4. Questionnaires were sent to 26 inquiry students. The questionnaires used an open-ended format and asked for their reaction to these items: (a) effect of inquiry on geometry (b) effect of inquiry on algebra (c) effect of elementary mathematics on geometry/algebra (d) effect of junior high mathematics on geometry/algebra.

Findings of the Study: There is a significant finding ($x^2 = 9.21, p < .01$) for analytical responses and that the inquiry group had a higher median score for this category than the comparison group, indicating that Hypothesis I can be rejected. With the inquiry group significantly more analytically inclined than the comparisons, one might expect it to have the better showing in high school mathematics achievement. In order to focus in on the source for the mathematics grades of the inquiry group, the results from a second questionnaire were analyzed in order to obtain answers to these
questions: "Would the elementary or junior high mathematics programs (or teachers) be mainly responsible for this superior mathematics ability in inquiry students? If not, what clues could the students give us as to the effect of inquiry strategy on their geometry or algebra activities?

The student responses where the effects of elementary and junior high school mathematics are recorded, indicated that the greatest single thing recalled from elementary school mathematics was the fact that the basic computational skills were recognized for what they were—necessity for any mathematics competency. No effects, or a negative trend, were indicated by 6 of the students, while 2 students recalled that the teacher was a great help. Neither of these 2 students went beyond the statement to recall any specifics. At this point, there was not much to go on to show why there would be a significant trend toward senior high mathematics competency. The results in Table 3 for the effect of junior high mathematics do not lend much support either, for 10 of the students stated that the case for the effect of inquiry on algebra was not as strong as that for geometry. Eight students either reported no effect or did not bother to record anything.

Adisai, G. (1978) A Comparative study of Creative Thinking in relation to Socio-economic status, School Climate and Classroom Behaviour of High School students in Baroda city (India) and Bangkok city (Thailand). The researcher started his work with the following objectives: 1. To Compare the Creative thinking of Indian students and Thai students 2. To study relationship of the creative thinking of high school students of India and Thailand in accordance with their socio-economic status, school climate and classroom behaviour. 3. To study the interaction effect of country, socio-economic status, school climate and classroom behaviour upon creative thinking, and 4. To compare the factor structure of the space due to variables relating to the creative thinking of Indian and Thai students. The study employed a sample of 300 Indian students and 300 Thai students of grade IX in the age range 13+ -16+ years and a sample of 18 Indian teachers and an equal number of Thai teachers for observation. The tools used were Passi test of creativity (Verbal Form), Torrance test of creative thinking (Figural Version Form A and
Verbal version form B), Kuppuswamy’s Socio-economic status Scale (Form B), Organizational Climate Description Questionnaire and Flanders’s interaction analysis category system. The statistical techniques used were t-test, Factor analysis and Analysis of variance. The findings of the study were 1. There existed a significant difference in the mean creativity Between Indian and Thai students. The Thai students had higher mean scores in all dimensions of creative thinking than their Indian counterparts. 2. The students- Thai and Indian- from higher socio-economic status had more creative thinking than lower socio-economic status. 3. The open school climate and closed school climate groups of Indian and Thai samples were found to have significant differences in the mean scores on Passi Test of Creativity but the results were reverse as regards the dimensions of Torrance Tests of Creative Thinking. 4. Different classroom behaviour groups, both Indian and Thai, did not differ with regard to creative thinking. 5. There was no interaction effect among country, socio-economic status, and school climate or classroom behaviour of students upon their creative thinking, in Indian or Thai sample. 6. Factor analysis gave four and six rotated varimax factors of Indian and Thai students, respectively. Some of them were general creative process, consequences creativity, figures elaboration unusual uses, fluency, verbal creativity, non-verbal creativity and sensitivity to problems.

Leone Burton⁶ (1984) studied the mathematical Thinking: The Struggle for meaning. This paper argues that mathematical thinking is not thinking about the subject matter of mathematics but a style of thinking that is a function of particular operations, processes, and dynamics recognizably mathematical. It further suggests that because mathematical thinking becomes confused with thinking about mathematics, there has been little success in separating process from content in the classroom presentation of the subject. A descriptive model of mathematical thinking is presented and then used to provide a practical response to the questions, Can mathematical thinking be taught? In what ways? The teacher is encouraged to recognize both what constitutes mathematical thinking, whether in the mathematics class or some other, and what conditions are necessary to foster it.
George, P. Huber (1991) studied on the topic of Organizational Learning: The Contributing Processes and the Literatures; this paper differs from previous examinations of organizational learning in that it is broader in scope and more evaluative of the literatures. Four constructs related to organizational learning (knowledge acquisition, information distribution, information interpretation, and organizational memory) are articulated, and the literatures related to each are described and critiqued. The literature on knowledge acquisition is voluminous and multi-faceted, and so the knowledge acquisition construct is portrayed here as consisting of five sub-constructs or sub-processes: (1) drawing on knowledge available at the organization's birth, (2) learning from experience, (3) learning by observing other organizations, (4) grafting on to itself components that possess knowledge needed but not possessed by the organization, and (5) noticing or searching for information about the organization's environment and performance. Examination of the related literatures indicates that much has been learned about learning from experience, but also that there is a lack of cumulative work and a lack of integration of work from different research groups. Similarly, much has been learned about organizational search, but there is a lack of conceptual work, and there is a lack of both cumulative, work and syntheses with which to create a more mature literature. Congenital learning, vicarious learning, and grafting are information acquisition sub-processes about which relatively little has been learned. The literature concerning information distribution is rich and mature, but an aspect of information distribution that is central to an organization's benefiting from its learning, namely how units that possess information and units that need this information can find each other quickly and with a high likelihood, is unexplored. Information interpretation, as an organizational process, rather than an individual process, requires empirical work for further advancement. Organizational memory is much in need of systematic investigation, particularly by those whose special concerns are improving organizational learning and decision making.

T. L. Mccarty & Adley Ynch (1991). studied on the topic of Classroom Inquiry and Navajo Learning Styles: A Call for Reassessment; The educational literature continues to characterize Native American children as non analytical, nonverbal learners.
Applied to educational practice, these generalizations downplay the use of questioning, "speaking up," and analytical or inquiry based pedagogies. Here we report on the introduction of an experimental Navajo bilingual bicultural curriculum emphasizing open-ended questioning, inductive/analytical reasoning, and student verbalization in both small and large group settings. The critical elements influencing students' and teachers' positive response to this curriculum are examined as they relate to natural learning-teaching interactions outside the classroom, and to an articulated Navajo philosophy of knowledge. These findings challenge conventional characterizations of holistic/analytical and verbal/nonverbal teaching and learning "styles," which, when applied to educational practice, can perpetuate patterns of learned dependence that extend well beyond the classroom to the reproduction of structural relations within the wider society.

Elizabeth clayden & Charles Deforges (1994), Authentic Activity and Learning: This article describes the tension that exists between the views of learning as a means of knowledge transfer and the alternative idea that it is socially situated and not separable from the activities in which it is developed. It concludes that the 'authentic practices' of particular academic domains should be employed in schools to encourage learning rather the culture of schooling itself.

Whitburn (1996), studied contrasting Approaches to the Acquisition of Mathematical Skills: Japan and England. In the present Study International differences in mathematical attainment among secondary school age pupils were well documented, indicating that the performance of pupils in England lags behind that of many other countries: in particular, the average attainment of 13- and 18-year-old pupils in Japan is significantly higher than that of the corresponding cohort of pupils in England. The causes of the poor performance at secondary schools in England, it is argued, may be found partly in the inferior foundations of mathematical understanding at primary schools, aggravated by the 'linearity' of mathematical development and the cumulative effect of failure. Although cultural influences at the societal level and curriculum influences at the governmental level are largely beyond the control of the school, yet the other main influence on mathematical development, namely classroom practice, is determined to a great extent by
the class teacher, and can be adapted to improve conceptual learning. By considering the current practice in the teaching of mathematics to six-year-olds in Japan within the context of available research evidence relating to effective teaching, and comparing this with the practice in England, areas of possible change can be identified which are largely within the control of the individual class teacher and through which standards of attainment might be improved. This article is based on observations of mathematics teaching to six-year-old children in Japan and England in 1995, in the state or public sector of education.

Vermunt\textsuperscript{11} (1996), studied Meta-cognitive, cognitive and affective aspects of learning styles and strategies: A phenomenographic analysis. This paper addresses the following questions: how do students perform meta-cognitive, cognitive and affective learning functions; how is the execution of learning functions regulated by internal and external sources; what learning styles can be discerned from the viewpoint of learning functions and regulation? Subjects were students from an open distance university and a regular university. The interviews were analyzed in a phenomenographic way. The results indicate that there are large differences among student in the manner in which they carry out learning functions, that these differences are associated with internal and external sources, and that four qualitatively different learning styles can be discerned: an undirected, an directed, a meaning directed and an application directed learning style. Mental models of learning and learning orientations turn out to be related to the way in which students interpret, appraise and use instructional measures to regulate their learning activities. It is concluded that in many instances instructional measures do not have the intended effects. Suggestions are given regarding the implications of these results for the improvement of teaching practices in higher education.

Raelin\textsuperscript{12} (1997), studied on the topic of A Model of Work-Based Learning; A comprehensive model of work-based learning is illustrated combining explicit and tacit forms of knowing and theory and practice modes of learning at both individual and collective levels. The model is designed to bring together epistemic contributions which are typically studied in isolation. The learning types produced from the model represent
processes the inter-section of which can contribute to the development of a comprehensive theory for integrating learning and work. At the individual level, work-based learning might start with conceptualization which provides practitioners with a means to challenge the assumptions underlying their practice. In experimentation, they engage their conceptual knowledge in such a way that it becomes contextualized or grounded. However, within the world of practice, in applying theoretical criteria or advanced analytical techniques, one confronts technical, cultural, moral, and personal idiosyncrasies which defy categorization. Hence, experience is required to reinforce the tacit knowledge acquired in experimentation. In fact, learning acquired through experience, often referred to as implicit learning, is the foundation for tacit knowledge and can be used to solve problems as well as make reasonable decisions about novel situations. Nevertheless, reflection is required to bring the inherent tacit knowledge of experience to the surface. It thus contributes to the reconstruction of meaning. At the collective level, conceptualization again makes a contribution in informing spontaneous inquiry but is now embedded within the more formal methods of applied science. Scientists seek to describe and explain social reality through the manipulation of theoretical propositions using the rules of hypothetic-deductive logic. The theories of applied science are often not helpful to practitioners, however, unless they are incorporated into practice. This is the purview of action learning wherein real-time experience, especially problems occurring within one’s own work setting, constitutes the primary subject matter. As practitioners come together by being involved with one another in action, they may become a community of practice wherein they learn to construct shared understanding amidst confusing and conflicting data. Hence, community of practice returns knowledge back into its context such that groups learn to observe and experiment with their own collective tacit processes in action. Action science is called upon to bring the individuals' and group's mental models, often untested and unexamined, into consciousness. It is a form of "reflection-in-action" which attempts to discover how what one did contributed to an unexpected or expected outcome, taking into account the inter-play between theory and practice. Applications of the model can spur conceptual and practical developments that might lead to a comprehensive theory of work-based learning. The discussion takes up such issues as transition links between learning types,
their segmentation by function or process, and implications for epistemology. A sample program, incorporating many of the learning types in the model, is demonstrated. The paper argues that all eight types of learning need to be brought into consideration if learners are to achieve proficiency and become critical while learning at work. (Theory and Practice; Epistemology; Organizational Learning; Action Learning; Action Science; Community of Practice; Organizational Cognition)

Scott\(^{13}\) (2002) studied the Stimulating awareness of actual learning processes; what do we know about how our students actually learn? This paper explores this simple question by considering some relevant concepts, and methods that can be used for working with them. A variety of topics or areas of study, where actual learning processes might be explored are summarized. Areas have been selected which have learning as a clearly identifiable component and which should be relevant to a broad view of OR. Ideas are included on how OR students might then be encouraged to better understand their own learning processes. This is supplemented by a short description of a study, undertaken in our first year management systems class, to increase learning process awareness through the use of the approaches to study inventory. This work is based on the personal observation that there is limited attention to how our students actually learn in the literature on OR/MS education and sets out to encourage greater interest. Good, practical reasons exist for this encouragement, such as the stimulus of practitioner skills, potentially better grades; better teaching, and helping establish a positive learning environment as Zuber-Skerritt discovered. At the centre of the paper is a summary of areas used for studying actual learning, in subject matter that is relevant to OR/MS today. These range from topics that might be part of a natural curriculum, to the more education related which could complement a curriculum. All offer different ways of stimulating greater awareness, both in students and in academics as facilitators of learning. Suggestions are made as to how the methods might be used. The education related can run in parallel with the course. The OR related are based on the fact that all students have study and learning experiences which can be used as an immediate area of application for related technical concepts. Experience from a first year Management Systems course adds further illustration. Work in this course is being extended to a study of the detailed
constructs and factors that underpin successful learning. The intention is to increase performance and enjoyment through greater awareness of successful practices, with increased efficiency on the part of the student. The approach is a variant of the Robertson approach. A working paper describing our first attempts at this has surfaced. If learning process is fundamental to education, and then one expects there are other interesting and useful studies out there, perhaps not written up or written for a limited audience. If you are aware of interesting studies, within the scope of this work, please share it!

Kramarski and R. Mevarech (2003), The purpose of this study was to investigate the effects of four instructional methods on students' mathematical reasoning - and meta-cognitive knowledge. The participants were 384 eighth-grade students. The instructional methods were cooperative learning combined with meta-cognitive training (COOP+META), individualized learning combined with meta-cognitive training (IND+META), cooperative learning without meta-cognitive training (COOP), and individualized learning without meta-cognitive training (IND). Results showed that the COOP+META group significantly outperformed the IND+META group, which in turn significantly outperformed the COOP and IND groups on graph interpretation and various aspects of mathematical explanations. Furthermore, the meta-cognitive groups (COOP+META and IND+META) outperformed their counterparts (COOP and IND) on graph construction (transfer tasks) and meta-cognitive knowledge.

Kramarski and R. Mevarech (2003), the purpose of the present research was to design an innovative instructional method for teaching mathematics in heterogeneous classrooms (with no tracking) and to investigate its effects on students' mathematics achievement. The method is based on current theories in social cognition and Meta cognition. It consists of three interdependent components: Meta cognitive activities, peer interaction, and systematic provision of feedback-corrective-enrichment. The method is called IMPROVE, the acronym of which represents all the teaching steps that constitute the method: Introducing the new concepts, Meta cognitive questioning, Practicing, Reviewing and reducing difficulties, Obtaining mastery, Verification, and Enrichment. The research includes two studies, both implemented in seventh grades: One focused on
in-depth analyses of students' information processing under the different learning conditions (N = 247), and one investigated the development of students' mathematical reasoning over a full academic year (N = 265). Results of both studies showed that IMPROVE students significantly outperformed the non-treatment control groups on various measures of mathematics achievement. The theoretical and practical implications of the research are discussed.

Nava L. Livne and Milgram\(^\text{16}\) (2006) studied on the topic of Academic versus Creative Abilities in Mathematics: Two Components of the Same Construct? Structural equation modeling, hitherto used to examine one-dimensional theoretical models only, was used to investigate 2 dimensions, abilities and levels, simultaneously. Good evidence for the validity of conceptualizing 2 types of mathematical ability, 1 academic and 1 creative, each at 4 hierarchical levels, was established in 10th- and 11th-grade students (N = 1,090). IQ scores, representing general academic ability, predicted academic, but not creative, ability in mathematics. Creative thinking predicted creative, but not academic, ability in mathematics. These findings led to an innovative approach to identifying mathematical abilities and provided reliable and valid psychometric tools to make it possible. Based on two new instruments, teachers can differentiate curricula and individualize instructional strategies to match each student's needs.

Vengopal and Mridula\(^\text{17}\) (2007) studied the Styles of Learning and Thinking: The present study is aimed at examining the hemispheric preferences for information processing and styles of learning and thinking in children. A sample of 250 students of class VIII which included both boys and girls from five English medium schools were selected. The tool Styles of Learning and Thinking was administered. Results revealed that there was significant difference in the right and left (brain) hemisphere preference for information processing among children and that boys were more right hemispheric oriented and girls were more left hemispheric oriented in information processing. Significant difference in the styles of learning and thinking and concept preference among right hemisphere and left hemisphere dominant children was also observed with respect to both genders.
Wu-Yuin Hwang, Nian-Shing et al. (2007) "Multiple Representation Skills and Creativity Effects on Mathematical Problem Solving using a Multimedia Whiteboard System" The aim of this study is to explore student multiple representation skills and creativity in solving mathematical problems when supported by a multimedia whiteboard system. The subjects were 6th grade primary school students that were tested and selected as excellent students in mathematics. Twenty-one numerical and geometry problems were given to the students in the experiment. The learning activities including problem solving, peer criticizing and response improvement facilitated by the designed multimedia whiteboard system. The findings of this study are that student multiple representation skills are the keys to successful mathematical problem solving. Students with high elaboration ability can take better advantage from peer interactions and teacher guidance to generate more diversified ideas and solutions in mathematical problem solving. In contrast, students with low elaboration ability would have great difficulty in representation skills. We conclude that elaboration ability in creativity is a critical factor that affects student’s multiple representation skills. The study suggests that teachers could design mathematical problem solving activities supported by a multimedia whiteboard system to improve student multiple representation skills.

2.4 The Studies in India

2.4.1 The studies related to mathematical creativity and mathematics education:

Kapur (1976) examined the relationship between school mathematics and creativity and pointed out that creativity in mathematics requires intuition, imagination, experimentation, judicious guessing, blundering, fumbling, hard-work, tabulation and real thinking.

Acharyulu (1978) studied on the topic "A Study of Relationship among Creative Thinking, Intelligence and School Achievement." The researcher started his work with the following objectives: To clarify the nature of relationship among Creativity, intelligence and School Achievement, and especially to test for interactive effects of
intelligence and creativity upon achievement in different school subjects. It also examined the getzels-Jackson effect besides testing Anderson’s Ability gradient theory in terms of existence or otherwise of the maximum and minimum intelligence thresholds.

Kalra21 (1979) studied on the mathematical creativity of gifted and non gifted students. In his study Kalra found that the mathematical gifted were quite high on creativity. And non gifted students were low on the level of mathematical creativity.

Tuli22 (1979) studied on the topic of mathematical creativity as related to aptitude for achievement in and attitude toward mathematics. Hypotheses of the study were: mathematical creativity was significantly related to aptitude for mathematics, significant relationship existed between mathematical creativity and attitude towards mathematics, mathematical creativity contributed significantly towards achievement in mathematics and aptitude for mathematics and attitude towards mathematics conjointly contributed to mathematical creativity. the major findings of the study were- mathematical creativity was significantly positively related to aptitude for mathematics, the attitude towards mathematics was not found to be a predictor of creative ability in mathematics, achievement in mathematics was significantly with creative ability in mathematics and the attitude and aptitude towards mathematics conjointly did not contributed to mathematical creativity in the present study.

Bala, V.23 (1980), studied on the topic “A Comparative Study of the Effects of Modern and Traditional Mathematics curricula on Piagetic Concrete and Formal logical Thinking.” Hypothesis of the Study were:

1. Modern curricula facilitated piagetian concrete logical thinking in a greater degree than a traditional curriculum at primary school level.
2. Pupils of lower secondary school exposed to modern mathematics curriculum performed significantly better on Piagetian formal operational tasks than pupils studying traditional mathematics.
3. Boys and girls of modern mathematics group of grade VI performed significantly better than those of the traditional group on Piagetian concrete operational tasks.
4. Boys and girls of modern mathematics group of grade VII performed significantly better than those of the traditional group on Piagetian formal operational tasks.

The study was designed as a single factor experiment. A mixed sample (boys and girls) of 58 students of grade VI and 60 of grade VII, selected from a school in Ambala (Haryana) was taken. The sample was randomly divided into two treatment groups which were separately exposed to the two curricula by same teacher, for a period of 16 weeks. The two groups of both the grades were found to be like on mean and standard deviations on Cattle's culture fair intelligence test. Both the groups of both the grades were post tested on Piagetian concrete and formal operational tasks and scoring was done according to the stages given by Piaget himself. Following were the findings of the study: 1. Modern Mathematics facilitated piagetian cognitive thinking ability to a greater degree than the traditional mathematics, at the primary school level. 2. On Piagetian formal operational tasks both the groups (Modern and Traditional) of grade VII were found to be nearly equal. 3. Boys and girls of the modern group of grade VI performed significantly better than those of the traditional group on several of Piagetian concrete logical measures. 4. Boys and girls of both the groups (modern and traditional) fared almost equally well on Piagetian formal operational tasks. 5. Acceleration of concrete logical thinking through modern mathematics was indicated. 6. Acceleration of cognitive abilities could be declared only with some reservation, as scholars and studies have pointed out temporary gain in these.

Mohammad Miyan\textsuperscript{24} (1982) constructed a test for mathematical creativity for students of class IX which included abilities to analyze, determine patterns, and see likeness and differences and application for pre secondary school students.

Mainka\textsuperscript{25} (1983) has been studied on the Acquisition of Concept in Mathematics of Pupils at Primary School Level, and its relation to Some Personal and Environmental Variables of the Pupils. The objectives of the study were (i) to determine if the ability to acquire mathematical concepts was normally distributed, (ii) to evaluate understanding and the acquisition of mathematical concepts of pupils, (iii) to determine the development level of mathematical concepts in each pupil which might facilitate the adaptation of
material and instructional procedures according to the individual needs and the abilities of the pupils. (iv) to determine the development of mathematical concepts according to grades. (v) to determine the sex wise level of acquisition of mathematical concepts at each grade level, and (vi) to suggest better methods for later learning by securing more efficient learning methods for children in the acquisition of mathematical concepts. The study revealed that: 1. Grade wise sequential placement of concepts in the syllabus was not justified. 2. Scores of pupils in each concept showed consistent rise with increasing education level, revealing the existence of grade wise differences in the acquisition of set, number and space concept at primary school level. 3. The majority of pupils who were promoted to the next grade did not show acquisition of concepts of the lower grade. 4. A pupil did not acquire any concept to its fullest from in one grade but the growth of mathematical concepts took place at all levels with different degrees of individual differences among the acquisition of mathematical concepts at primary school level. 5. With increasing age, a pupil made up in one or other concepts in mathematics, but his success in one concept was limited by the success in other concepts. 6. The highest variability in the acquisition of mathematical concepts was observed with pupils of grade III at primary school level. 7. Mathematical concepts developed better with pupils good in language and did not develop to their fullest form with pupils poor in language. 8. Concepts in higher mathematical hierarchy could not be developed unless the lower concepts were acquired. 9. There did not exist sex differences in the acquisition of mathematical concepts at primary school level. 10. For the better development and acquisition of mathematical concepts, individualized instruction was found useful. 11. Evaluation of concepts acquired in the unit test was difficult. True evaluation could be undertaken at the end of the year in the final examination.

Raina\textsuperscript{26} (1984), studied on the topic of “Research and development in talent search: The objectives of the study were: 1. to Study the relationship between creative thinking ability, creative perception and measures of talent. 2. To find out whether the candidate selected for National talent search award differed from those called for interview but rejected in their performance on Wallach-kogan tests of creativity. 3. To study the relationship between scores on test of creativity and measures of talent. 4. To determine
whether the two batteries of verbal and visual test of creativity defined separate dimensions of intellect as compared to what was measured by measures of talents. The researcher concluded that. 1. there was significant difference between two groups of students-selected and rejected on the verbal dimension of creativity but no significant difference in scores on visual creativity test. 2. The selected and rejected groups of students did not differ significantly on measures of creative perception. 3. There was no significant relationship between general mental ability test scores and scores on verbal and visual test of creativity. 4. there was a low negative correlation between scholastic aptitude test scores and various dimension of verbal and visual creativity. In some cases in the 1978 batch, the correlation was zero. 5. A modest correlation was found between measures of creative perception and general mental ability test. 6. There was a negative correlation between measures of creative perception and scholastic aptitude test scores. 7. No association was noticed between measures of creative perception of the total group and that of selected or rejected group of candidates. 8. Scores on various tasks of creativity were fairly cohesive. 9. Six verbal indices of creativity were not found to be highly correlated with four visual indices. 10. Factor analysis indicated task specificity as well as verbal specificity in test of creativity. Some of the factors that emerged were number factor, factor meanings, uniqueness-line meanings, and scholastic ability and uniqueness similarities.

Bhalwankar's\textsuperscript{27} (1985) study revealed that in the case of a high intelligence group, the expository method was more effective than the guided discovery method on application objective. But, for low intelligence children, the guided discovery method was more helpful on retention of application objective.

Chitkara\textsuperscript{28} (1985) found lecture-discussion strategy better suited for below average ability extraverts and intraverts while inductive- discussion-drill and auto-instruction-group-discussion suited the high ability extraverts and high ability intraverts, respectively. Expository and discovery methods were tried out in respect of mathematics achievement and mathematical creativity.
Chitkara, M.²⁹ (1985) has been studied on the Effectiveness of Different Strategies of Teaching on Achievement in Mathematics in Relation to Intelligence, Sex and Personality. The objectives of the study were to find out (i) whether achievement in mathematics was affected by different strategies of teaching, (ii) whether different strategies had differential effects on achievement of male and female students, (iii) whether levels of intelligence interacted with teaching strategies in terms of achievement, and (iv) whether personality acted as a potential factor in selection of teaching strategy. The findings of the study were: Boys and girls of superior ability did not show any significant difference between their mean scores on achievement in mathematics. Girls of average ability scored significantly higher in mathematics than boys of average ability. Under the strategy of auto-instruction group discussion, high ability and low ability extraverts did not differ from the high ability and low ability introverts. But extraverts of average ability differed significantly in their achievement from average ability introverts. Out of the three strategies, strategy I was more suited for below-average ability extraverts and introverts, strategy II for high ability extraverts and strategy III was most suited for high ability introverts for achievement in mathematics.

Parasnis³⁰ (1985) standardized a test (In Marathi) for measuring creativity of class X students. According to author, creativity in mathematics is measurable in terms of five factors, namely, visualization, re-organization, judgment, number fluency and divergent production.

Singh³¹ (1985) develop a specially designed teaching strategy (SDTS) for the development of mathematical creativity. The effect of SDTS was found significant to promote mathematical creativity among middle school children.

Girdhari Lal³² (1986) studied the effects of individualized and conventional instruction and found that individualized instruction was more effective in terms of mathematics achievement than that of conventional instruction.

Golwalkar³³ (1986) studied on the topic of "A Study of Scientific attitude Creativity and achievement of tribal students of Rajasthan." The main objectives of the study were: 1. To
Study scientific attitude of tribal students studying science in secondary schools located in tribal area. 2. To compare this with the scientific attitude of non-tribal students of the same schools studying science in secondary classes. 3. To compare the creativity of tribal and non-tribal students of the same schools studying science in secondary classes. 4. To compare the achievement of tribal and non-tribal students in science subjects. The study consisted of 270 tribal and 270 non-tribal students of class IX and X offering science as an optional subject and living in tribal area. The tools and techniques used were scientific attitude scale. Thinking creativity with words and thinking creativity with figures the findings of the study were:

1. On ten components of scientific creativity Non-tribal students were found to be superior to tribal students.

2. There was no significant difference between the mean scores of tribal and non-tribal in seven components. On no factor did the tribal fare better than non-tribal. The overall mean score on scientific attitude scale for non-tribal was higher than for tribal

3. There was a significant difference between the mean creativity scores of tribal and non-tribal. The non-tribal had a high level of creativity than tribal. Factor wise comparison of two groups on basis of verbal test of creativity showed that for the fluency component, the mean fluency score of non-tribal was higher than that of tribal. The two groups did not differ significantly on the flexibility component. The mean originality score of non-tribal was higher than that of tribal.

4. The non-tribal students had a higher scholastic achievement in science subject than tribal students.

Haylock (1987) In spite of the neglect of the study of creativity specifically within the subject of school mathematics, the notion of creativity is apparently considered by many mathematical educators to be relevant and important in terms of children doing mathematics. Some of the research and literature associated with creativity in school mathematics, mainly from English speaking countries, is reviewed. Particular attention is given to attempts to assess creative ability in school mathematics. Two key aspects emerge: the ability to overcome fixations in mathematical problem-solving, and the
ability for divergent production within mathematical situations. It is proposed that these might form the basis for a framework for fostering and rewarding mathematical creativity in schoolchildren.

Biswa, J. 35 (1988) studied on the topic of creativity in mathematics as a function of study habits and pupils perception of teachers’ impression about their performance in mathematics. Objectives of this study were, to estimate the functional relationship between mathematical creativity and study habit in mathematics and mathematical creativity and pupil perceptions of teachers’ impression about their performance in mathematics, to determine inter correlations among pupils’ fluency, flexibility and originality measures derived from mathematical creativity search battery. Major findings of this study were, pupils creativity in mathematics was found to be a linear function of each of the variables. study habits in mathematics and pupils perception of teachers impression about their performance in mathematics the product moment correlation in both the cases were positive. A functional relationship was also found to exist between pupil’s creativity in mathematics.

Tuli 36 (1988) studied on the topic of Mathematical creativity and personality. Objective of the study was, to study the personality profile of high and low creative persons in mathematics. The major findings of the study were, the high creative person in mathematics were happy-go-lucky, impulsive, lively enthusiastic, tender-minded, dependent, over-protected, sensitive, self-sufficient preferring their own decision, resourceful, controlled, socially precise, following self-image tense, frustrated driven, overwrought, expedient, evading rules, felling few obligations, venturesome, socially bold, uninhibited, spontaneous, suspicious, self-opinionated and hard to fool. Significant differences existed personality profiles of high and low creative persons in mathematics. The creative person in mathematics had a unique stand of mental abilities, interest, attitude, temperament and other variables characterizing thoughts, feelings and behaviour.
Singh (1989) identified that the SDTS was not uniformly good to all types of children. The effect of SDTS was found more in case of high mathematical creative children as compared to average and low creative children.

Pal, A. (1989) conducted a study on the topic of 'The Dependence of Achievement in Mathematics on Four Variables of the Affective Dimension, viz., Self-Concept, Anxiety, Attitude and Academic Motivation'. He formulated 56 hypotheses related to these variables and classification of students into urban, semi-urban and rural students and male and female students. He found that the regression equation to predict the performance in mathematics as a linear combination of the four affective variables.

Bhawalkar (1992) found that self-confidence, tolerance of ambiguity, risk taking, low dependence, intelligence, scientific attitude and academic motivation, achievement in mathematics and science predicted creativity.

Rosaly, A. (1992) conducted a study on the topic of 'The Relationship between Attitude of Students towards Mathematics and Achievement'. The study tried to find out whether high school students have a favorable attitude towards learning mathematics, and whether the favorable and unfavorable attitudes of the students affect their achievement in mathematics. The main objectives of the study were to construct an attitude scale to measure the attitude of high school students towards learning of mathematics and to construct an achievement test in mathematics and to find out the relationship between attitude and achievement in mathematics. The sample comprised 200 students of class X from Dindigul town. Findings of the study were noted that the attitude of high school students towards learning mathematics and their achievement in mathematics were related, urban girls had a more positive attitude towards mathematics than rural girls similarly urban boys had a more positive attitude towards mathematics than rural boys, girls were higher than boys in their achievement in mathematics and urban girls were higher than rural girls in mathematics.

Singh, V.P. (1993) found that the mathematical creativity does not contribute significantly in the development of problem solving performance in mathematics of high
school students. He further reported that the interaction of intelligence, achievement in mathematics and mathematical creativity contribute significantly to development of problem solving performance in mathematics.

**Sharma, Bhargawa and Sinha** (1993) found that science/mathematics students had greater planning and problem solving ability than commerce students.

**Goel** (1996) found that in the first grade children show better performance in arithmetic with actual manipulation of concrete objects than representation and abstract levels.

**Singhal and liegise** (1994) observed that, in Nagaland, 10th grade rural-urban students differed in verbal flexibility and verbal fluency. The differences were also observed in government and private schools.

**Kumar** (1997) noted that learning style had significant effect on achievement in biology of secondary students with significantly greater achievement in favour of deep than surface approach.

**Thampurati and devi** (1994) has found that creativity has whole had a substantial significant correlation with high achievement in mathematics, while, fluency was found to be significantly correlated with mathematical achievement of residential schools and significant differences were found between the residential and non-residential school students.

**Kichi** (1994) studied the problem solving method in reference to mathematical creativity and reported that the problem solving is most important method of instruction to develop Mathematical Creativity.

**Gupta** (1995) brought out social class differences in creativity. He reported that urban and upper caste boys were more creative.

**Sumangala** (1995) has studied in 750 students of class 9th in kerala and found all the components of mathematics attitude, i.e. numerical ability, numerical reasoning, ability to use symbols, spatial ability and abstract reasoning abilities to be significantly correlated
to achievement in mathematics this implies that those who possess these aptitudes are quite likely to do well in mathematics. Perhaps this can be used as a good indicator for nurturing the mathematically talented students.

Thomas (1995) have attempted to study “achievement in mathematics” among 300 high school students of tribal town Aizwal. They have compared the performance of government schools, deficit schools and mission schools. It was found that, achievement of students from government schools did not vary from that of students from deficit schools but mission schools students achieved better than both the schools.

Raju (1996) reported a low positive relationship between creativity in science and social adjustment among 9th grade students. The students with high self-confidence were high on scientific creativity.

Goel (1996) found out that in the first grade children show better performance in arithmetic with actual manipulation of concrete objects than representation and abstract level.

Pal and Natarajan (1997) in their study on gender and mathematical mystique have considered ‘home support’ as one of the variables and found that home support along with teacher support and liking of teaching influenced the perceptions and attitudes related to mathematics and all these factors interactively influenced the mathematics achievement for both boys and girls.

Patel (1997) studied and compare students who different on different problems they have covering areas, viz. health, monetary, personal, social, religious cum sex and educational the researcher concluded that the under achievers and more problems as compared to high achievers in all the six areas thus the psychological tranquility is to be maintained by the learners with the active support and guidance of teacher and family members in order to facilitate higher achievement in mathematics.

Swarnelekha (1997) has attempted to use joyful active learning in promotion of problem solving ability among primary level students. It is found that remarkable improvements in
the area of problem-solving area of mathematics learning were attained by paying attention of the language comprehensive skills and other non-scholastic areas. It was found important to frame different activities to develop different skills like comprehension, judgment, analysis, synthesis, critical thinking, problem-understanding, finding analogy, checking equivalence in similar situations. Which were finally linked with operationalisation of the basic problem solving skills essential in mathematics? It was also found that the teachers who were given more opportunities to interact and share the experience showed positive approach towards joyful learning as compared to their counterparts who showed total negative approach and believed that joyful learning practices were more said than done. Mathematics needs to be taught with full involvement and conviction. The beauty that is inherent in mathematics needs to be enjoyed by teachers and they need to enthuse learners to develop love towards mathematics, thereby teaching-learning mathematics becomes interesting.

Rajagopalan\textsuperscript{56} (1998) observed that creative talent was related to both convergent and divergent thinking. However, divergent thinking has greater contribution towards aesthetic and scientific creativity. in students with high (above 120 IQ), achievement was related to convergent and divergent thinking.

Sood, S.\textsuperscript{57} (1999) studied on the topic of creativity, problem solving ability and personality characteristics as correlates of mathematical achievement of students of residential and non-residential schools, and find out that personality characteristics were positively correlated with achievement. Researcher also concluded creativity and problem solving were positively correlated with achievement in mathematics.

Singh, A.\textsuperscript{58} (2000) found that “willing to take risk in Mathematics contributes significantly in the development of mathematical creativity among elementary school children” whereas the contribution of nonconformity was found not significant. She further reported that the contribution of personality characteristics was found significantly more than attitudinal characteristics in the development of mathematical creativity. Anxiety towards mathematics and test anxiety were found suppression; variables which inhibit pupil’s mathematical creativity. Interaction effect of personality
and attitudinal characteristics were also found significant. Effect of anxiety on mathematical creativity was found not significant whereas the rural girls were found to exhibit more anxiety towards mathematics.

Singh, B.\(^5\) (2000) studied on the topic of quantity and quality of mathematical creative thinking in the adolescents and found that quality and quantity of mathematical creative thinking were significantly related to each other.

Worthington and Carruthers\(^6\) (2003) Research exploring the development of children's early drawing and early writing has opened our eyes to what had been hidden. Understanding this development has helped teachers to recognise and value these early marks, to start from children's personal, informal understanding. When this happens, children respond in often highly creative and challenging ways and frequently exceed expectations. For children's understanding of the written language of mathematics, there is significant value in supporting and building on what they already understand.

Sriraman\(^6\) (2004). studied the mathematical creativity ensures the growth of mathematics as a whole. However, the source of this growth, the creativity of the mathematician, is a relatively unexplored area in mathematics and mathematics education. In order to investigate how mathematicians create mathematics, a qualitative study involving five creative mathematicians was conducted. The mathematicians in this study verbally reflected on the thought processes involved in creating mathematics. Analytic induction was used to analyze the qualitative data in the interview transcripts and to verify the theory driven hypotheses. The results indicate that, in general, the mathematicians' creative processes followed the four-stage Gestalt model of preparation-incubation-illumination-verification. It was found that social interaction, imagery, heuristics, intuition, and proof were the common characteristics of mathematical creativity. Additionally, contemporary models of creativity from psychology were reviewed and used to interpret the characteristics of mathematical creativity.

Geetha\(^6\) (2006) studied the learning disabilities and achievement in mathematics and found across all ages in all socio economic classes and is not a type of mental retardation.
as is mistaken by many, feels that good teachers should not only teach their pupils but also analyze and find out the disabilities felt by the pupils in the process of learning.

Marlow\(^6\) (2006) studied the relation between oral communication and mathematics and stated that good attitude toward mathematics should always be emphasized as good attitudes enable the learner to do better in achieving in higher levels of cognition and skill ends of instruction. The researcher asserted that teacher need to use material of instruction that emphasize interaction among individuals in the classroom.

Sharma\(^6\) (2006) studied on the topic integrated approach to mathematics teaching and proposed that learning of mathematics should be viewed as construction of coherent and well-organized knowledge base without being split into separate strands, the researcher proposed that there is a need for an integrated approach where content is well planned, assignments are ready and varied, and teachers are enthusiastic and willing to make mathematics livelier, more practical and more meaningful.

2.4.2 Studies related to academic climate, style of learning and thinking:

Rastogi\(^6\) (1967) studied the class room climate in his research to know how does the classroom climate affects the students internally. The sample of the study comprised convent school, government school, government aided school and municipality schools. In the study the researcher concluded that which type of school climate motivate the students.

Sharma\(^6\) (1971) studied the organizational climate and achievement of students and find out the significant relation between institutional work and organizational climate. In his second study Sharma concluded that teachers working in Rajasthan government feel more free than private schools. And in his one more study he find out that effectiveness of principals, and satisfaction of teachers are directly related with school climate.
Kumar\textsuperscript{67} (1972) studied the social climate of schools and behavior and characteristics of students. In his study researcher studied the effect of social climate of schools on students behavior, individual social adjustment, values, attitude towards teaching objectives and achievement of schools. And concluded that social climate of schools affects the students behavior differently.

Gandhi\textsuperscript{68} (1977) studied the effect of school climate on the employees personality and students control. And find out that there is no significant relation between organizational climate and different categories of schools. Age of teachers significantly relates with climate perception while there is no difference in the perception of male and female teachers. Students control and personality were significantly correlated. There was significant difference in the thinking of open and closed climate of schools.

Shah\textsuperscript{69} (1981) studied the effect of schools climate with reference to students and teachers and concluded that every school has its unique climate which affects the teachers personality. Adjustment and achievement were significantly correlated. Different type of climate affects the achievement of students.

Vichao, P.\textsuperscript{70} (1983), studied on the topic of “A Study of organizational climate and teacher morale in primary schools in the central zone of Thailand”. The researcher started his work with the following objectives. 1. To construct tool on climate, morale and leadership behavior suited to the educational scene in Thailand. 2. To develop procedures to identify school climate appropriate tool on the organizational climate. 3. To study organizational climate of each of the sampled schools on a continuum with regard to openness, intermediate position and closeness. 4. To measure the morale of the teachers of the sampled schools. 5. To study the leadership behavior pattern of the principals in relation to some selected variables. The sample of the study included 100 primary schools of Bangkok. On the basis of halpin’s theories the researcher constructed three tools in Thai language for organizational climate, teacher morale and leadership behaviour respectively. And found that: 1. in the central zone of Thailand, the majority of schools belonged to the intermediate type and only 16 percent of schools had open climate. 2.
The closed climate schools constituted 35 percent of total schools. 3. All the three categories of schools were distributed overall the four regions. 4. In the open-climate category, around one third of the principals had 10 to 29 years of service experience and around 13 percent of them had 30 to 39 years experience. 5. Of the total sampled schools, 18 percent had high teacher morale. 62 percent had average teacher morale and 20 percent had low teacher morale. 6. In the high morale category of schools, 72 percent of the schools were municipal-managed, among the average morale category, 60 percent were municipal ones and 85 percent of the low morale categories were municipal.

Dholakia71 (1985) studied the student attitude and academic climate of students. Anxiety and motivation change according to time. Students were punctual and students learn subjects mechanically without understanding of subjects. Students attitude was positive towards school climate and students showed interest in school going.

Sarkar, S.C.72 (1985) studied on the topic of A Comparative study of role perception and job satisfaction of Headmasters and teachers in relation to organizational climate of secondary school in Dacca city. The researcher formulated the following hypothesis: 1. To enquire if the secondary schools in Dacca city possessed different of organizational climate. 2. To compare the role perception of Headmasters and teachers working under organizational climate. 3. To compare the job satisfaction of headmasters as well as teachers working under different organizational climate. 4. To find out the relationship between organizational climate and role perception of headmasters as well as teachers working under open, autonomous, controlled, familiar paternal or closed climate. 5. To find out the relationship between organizational climate and job satisfaction of headmasters as well as teachers working under open, autonomous, controlled, familiar paternal or closed climate. 6. To find out the relationship between role perception and job satisfaction of headmasters as well as teachers working under open, autonomous, controlled, familiar paternal or closed climate. and findings of the study were: 1. There were significant differences in role perception in all areas collectively among headmasters working under different organizational climate. 2. Differences in job satisfaction experienced by headmasters working under different organizational climates
were found to be significant. 3. There was no significant relationship between sub tests of organizational climate and job satisfaction of headmasters. 4. There was no significant relationship between overall role perception and job satisfaction of headmasters in open, autonomous, controlled, familiar paternal or closed climate. 5. There existed significant differences in role perception in all areas collectively among teachers working in different climates of schools. 6. There existed no significant differences in role perception of teachers working under different organizational climates, in the areas of professional ethics and classroom teaching. 7. There existed significant differences in job satisfaction of teachers working in different organizational climate. 8. In a parental climate disengagement, spirit, intimacy, thrust and consideration had a significant relationship with overall role perception of teachers.

**Saxena, S.B.** (1985). studied on the topic “A Study of the influence of environmental handicaps upon the logical thinking ability of children”. The main objective of the study was to find whether advantaged environmental conditions facilitated and disadvantaged environmental conditions interfered with the development of logical thinking ability of children. The study was conducted on 400 students by including equal numbers of boys=200 and 200 girls studying in class III to VI and in the age range of 8 to 11 years. The test used were (I)Logical Thinking Ability test developed by researcher (II) Piaget’s test of additive classification ability (III) Mehdi test of creative thinking ability and Raven’s progressive Matrices. Findings of the research were: 1. Logical thinking ability (LTA) was correlated to additive classification ability (ACA), logical reasoning ability (LRA) and creative thinking ability (CTA). 2. The LTA, CTA, and LRA were predicted by the home environmental variables. 3. Environmental handicaps significantly differentiated advantaged and disadvantaged children in respect of their LTA. ACA was found to be in favour of advantaged group. 4. No significant sex differences were found between the advantaged and disadvantaged group with respect to their LTA, ACA and CTA. 5. The variables of home and school, when condensed in to three factors by Varimax rotation were found to be differentiating the advantaged group for the variables of maturity, creativity, motivation, male dominance from the disadvantaged group.
Patel (1987) studied the classes of schools on the basis of dimension of classroom climate. Classroom climate was classified on the basis of open, intermediate and closed classroom climate.

Yadav, R.S. (1990) conducted a study on the topic of 'A Study of Relationship of School Environment and Socio-Economic Status in the Formation of Geometrical Concepts among School Children'. The study aims to explore whether the home culture of children in the form of their socio-economic status has a significant impact not only in their schooling but also in their learning process in the classroom. Major findings of the study were noted that all the three factors namely Age, SES and School Environment, had a significant effect upon concept formation in geometry, where as age had the greatest effect and the school environment had the lowest effect. The SES occupied the second position. The position was reversed in the case of middle schools. Interaction effects (age x schools and age x SES) significantly affected the concept formation in geometry at both levels, i.e. both primary and middle schools. However the interaction (school x SES) had no significant effect over concept formation in geometry at primary level but had a significant effect at the middle school level. The combined interactions of all the three sources of variations had significant effect at both the levels, the children of NGUSS school were significantly better than the children of UGS school and RGS school on the development of geometrical concepts from classes I to VIII. Pupils of the high SES group were found better in the concept formation ability in geometry than the low SES groups, their existed no significant difference between the pupils (Low SES) of the three categories of schools on concept formation in geometry. A positive significant correlation was found between the scores on the tests geometry and fathers education in UGS at middle school level only and no significant correlation has been found between the geometry scores and fathers income.

Pradhan (1991) studied the effect of organizational climate of schools on the students creativity, adjustment and students achievement. Pradhan concluded that there is no effect of organizational climate on the creativity, adjustment and academic achievement.
Samantroe et al.\textsuperscript{27} (1995) studied the gender discrimination between the school and family climate. The study was done on rangilunda block district Gunjan in Orissa. Two high schools were randomly selected one of them was from urban and rural area. The students were selected from IX grade for 14-16 age group from co-ed institutions. The researcher concluded that 61% boys and only 39% girls were sent to schools. Maximum of students did not show difference in the climate of family and schools. Rural institutions students showed more difference in their opinions.

Kumar\textsuperscript{28} (1996) studied the classroom climate of basic parishadiya schools with facilities and non-facility. And find significant difference between the basic parishadiya schools with facility and non-facility. Facility and non facility of schools affects the school climate directly.

Chaudhary\textsuperscript{79} (1997) studied the effect of Educational motivation on the classroom climate secondary schools. The researcher concluded that classroom climate significantly affects the educational achievement motivation. Some dimension of classroom climate such as unity, traditional rules, goal direction, difficulty, democracy, competition, creativity, encouragement and adaptation were significantly affects the achievement motivation.

Zarin\textsuperscript{80} (2001) studied the correlation between classroom climate and achievement in mathematics of parishadiya and private schools. Parishadiya and private schools differ significantly on the 11 dimension out of 12 with respect to perceptual learning. Parishadiya and private schools students perceive equally on prize.

Kumar\textsuperscript{81} (2002) studied the classroom climate of private and parishadiya primary schools. The researcher concluded that parishadiya and private primary schools differ significantly on their academic climate.

Singh\textsuperscript{82} (2007) studied the learning styles of highschool students in the context of their locality and find out that the pupils of urban as well as rural locality exhibited their more
degree of preferences to motivation centered, flexible, non individualistic learning styles and low preferences to non flexible aural and non motivation centered learning style. The urban as well as rural pupils demonstrated the equal degree of preferences to visual Vs Aural learning style. There appeared a positive degree of difference between the learning style preferences of urban and rural pupils on every learning style but not up to the level of significance.

2.5 Conclusions:

average ability extraverts and introverts. Chitkara, M (1985) studied the Effectiveness of Different Strategies of Teaching on Achievement in Mathematics in Relation to Intelligence, Sex and Personality. H.N. Parasnis (1985) studied to construct and standardize a test (In Marathi) for measuring creativity of class X students. Singh (1986) Studied the effect of the specially designed teaching strategy and some sociopsychological factors on Creativity among Middle school Children. Girdhari Lal (1986) studied the effects of individualized and conventional instruction. S. Golwalkar, S (1986) Studied the Scientific attitude Creativity and achievement of tribal students of Rajasthan.


There are a lot of studies related to mathematical creativity or creative ability in mathematics related to different personality, biographical and cognitive perspectives in Indian and abroad also but there is no study which reveals the mathematical creativity of CBSE and UP Board students with reference to academic climate, style of learning and thinking. There are a lot of unanswered questions related to mathematical creativity, academic climate style of learning and thinking so the researcher has selected this problem in his study.
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