CHAPTER 5

FINDINGS

AND

DISCUSSION
One of the basic purposes of a scientific research activity is to relate the observed facts (i.e. immediate discovery) to some organisations of a system. It amounts to what Arieti (1976) names, individualizing some underlying commonality or connection between things hitherto deemed dissimilar or unrealated. If, however, some of the observed facts do not seem to fit in a system, such apparent contradictions should be explainable with valid reasons. When the observed facts are related to a system, "the immediate discovery may lead to additional properties hidden in the class or system" (Arieti, 1976). It then, becomes an innovation.

This humble piece of research does not attain that lofty ideal of innovation. It merely tends to relate some of the cognitive and creative potentials with the socio-cultural milieu of the individual.

In this chapter an effort has been made to explain various observations in the light of theoretical orientation of intelligence, creativity, school-climate and hypothetical reasoning. Secondly, the results are discussed to show how these findings are concurrent with the empirical studies already conducted in the field, if any. At places, where the observations did not concur the findings of other investigators, attempts have been made to fathom plausible reasons for these disagreements.
HYPOTHESES OF THE STUDY

1. *Divergent thinking vs. Hypothetical Reasoning*
   (a) There is a positive relationship between fluency and hypothetical reasoning.
   (b) There is a positive relationship between flexibility and hypothetical reasoning.
   (c) There is a positive relationship between originality and hypothetical reasoning.

2. *Intelligence vs. Hypothetical Reasoning*
   There is a positive relationship between intelligence and hypothetical reasoning.

3. *School-Climate vs. Hypothetical Reasoning*
   (a) Creative-stimulation positively affects the development of hypothetical reasoning.
   (b) Cognitive encouragement has a positive relationship with the development of hypothetical reasoning.
   (c) Permissive climate in school is directly related with the development of hypothetical reasoning.
   (d) Acceptance level in school climate is directly related with the development of hypothetical reasoning.
   (e) There is no significant relationship between rejection dimension of the school-climate and the development of hypothetical reasoning.
(f) There is no significant relationship between control and hypothetical reasoning.

4. There is no significant multiple correlation between hypothetical reasoning and intelligence, divergent thinking and school-climate.

5. There are no significant main and interaction effects of intelligence, divergent thinking and school-climate on hypothetical reasoning.

6. There is no significant difference in the hypothetical reasoning of boys and girls.

7. There is no significant difference in the hypothetical reasoning of students from rural and urban locale

FINDINGS

The following findings are given in the order of the hypotheses mentioned above.

1. **Divergent Thinking Vs. Hypothetical Reasoning:**

   (a) There is found to be a positive and highly significant correlation between fluency and hypothetical-reasoning.

   (b) There is found to be a positive and highly significant correlation between flexibility and hypothetical reasoning.

   (c) There is found to be a positive and highly significant correlation between originality and hypothetical reasoning.
2. **Intelligence Vs. Hypothetical Reasoning.**

There is found to be a positive and highly significant correlation between intelligence and hypothetical reasoning.

3. **School Climate Vs. Hypothetical Reasoning**

(a) There is found to be no significant correlation between creative-stimulation and hypothetical-reasoning.

(b) There is found to be positively significant correlation between cognitive encouragement and hypothetical reasoning.

(c) There is found to be a positive and significant relationship between permissiveness and hypothetical-reasoning.

(d) There is found to be no significant correlation between acceptance and hypothetical reasoning.

(e) There is found to be no significant correlation between rejection and hypothetical reasoning.

(f) There is found to be no significant correlation between control and hypothetical reasoning.

4. **Value of Multiple R**

The value of multiple 'R' for every combination of intelligence with one dimension of divergent thinking and school-climate each is found to be significant on hypothetical reasoning.
5. *Analysis of Variance: Multi-factorial Design (2x2x2)*

A. **Main Effects**

1. **Divergent thinking Vs. Hypothetical Reasoning**
   
   (a) Fluency is found to be having significant main effect on hypothetical-reasoning.

   (b) Flexibility is found to be having significant main effect on hypothetical reasoning.

   (c) Originality is found to be having significant main effect on hypothetical reasoning.

2. **Intelligence Vs. Hypothetical Reasoning.**
   
   Intelligence is found to be having significant main effect on hypothetical-reasoning.

3. **School-Climate Vs. Hypothetical Reasoning.**
   
   (a) Creative stimulation in school-climate does not constitute any significant main effect on hypothetical reasoning.

   (b) Cognitive encouragement in school-climate is found to be having significant main effect on hypothetical reasoning.

   (c) Permissive climate in school does not constitute any significant main effect on hypothetical reasoning.

   (d) Acceptance level in school-climate does not constitute any significant main effect on hypothetical reasoning.

   (e) Rejection dimension of school-climate is found to be having significant main effect on hypothetical reasoning.
(f) Control in school-climate does not constitute any significant main effect on hypothetical reasoning.

(B) Significant 2-Way Interactions

1.(a) Intelligence and Rejection Vs. Hypothetical Reasoning

A unique combination of higher level of intelligence and lower level of rejection in school-climate leads to the highest mean score on hypothetical reasoning.

(b) Intelligence and Acceptance Vs. Hypothetical Reasoning.

A unique combination of higher level of intelligence and lower level of acceptance leads to the highest mean score on hypothetical reasoning.

(c) Significant 3-Way Interactions

Intelligence, Creative stimulation, and Fluency Vs. Hypothetical reasoning.

A unique Combination of higher level of Intelligence, lower level of creative stimulation and higher level of fluency leads to the highest mean score on hypothetical reasoning.

6. There is found to be no significant difference in the hypothetical reasoning of boys and girls.

7. Students belonging to urban locale score higher on hypothetical reasoning than the students belonging to rural locale.
DISCUSSION OF THE RESULTS

In developmental tradition of research, the concern is to examine the growth and development of cognitive process from biological (maturational) and socio-cultural perspectives. In this approach, the extent to which different environments provide different opportunities for learning and place certain cognitive demands on individuals or groups in their day to day activity determines not only the extent but also the direction of the individual's cognitive development. Differences in the level of processing and the use of strategies have been found to be associated with variations in both physical and cultural features of environments (Berry, J.W., 1976; Berry, J.W. et al., 1986; Mishra, R.C.; Sinha, D. and Berry, J.W in Press).

In the present investigation; the investigator has obtained a significant relationship between the three dimensions of divergent thinking i.e. fluency, flexibility and originality and hypothetical reasoning. On the basis of the theoretical backdrop, we can deduce that divergent thinkers possess the capacity to scan the problem from divergent view-points. Obviously, therefore, a divergent thinker is often a person who can form different hypotheses regarding the probable solutions of the problems. Hence, the results obtained by the present investigator are theoretically tenable and supported by empirical evidence reported by Jain (1982) who obtained three factors namely General Schematic Learning, Creativity and Academic achievement in science using factor analysis technique. Ashok
Kumar Pandey (1992) in his study “Divergent thinking in Relation to Scholastic Achievement, Cognitive Style, Self Concept and Interest Pattern” reported significant correlation between cognitive style and different dimensions of creativity. It shows that learners with more complex and analytic cognitive structure show greater ability of divergent thinking. Kusum Dubey (1997) has also reported that there is a significant relationship between the problem-solving ability and the creative performance. High creatives were found to be better problem-solvers in her study.

Regarding the relationship between intelligence and hypothetical reasoning, the findings of the present investigation reveal that intelligence constitutes a basic factor for the attainment of this ability. Such findings are comprehensible logically because the development of such abilities, in fact, depends upon the ability of the child to frame cognitive structures and it is quite reasonable to state that development of cognitive structures depends upon child's intelligence of perceiving relations and patterns among objects, concepts and ideas. This is clear from the very definition of the term intelligence as given by Wechsler, according to whom, intelligence is defined as “the ability to think rationally, to act purposefully and to deal effectively with the environment.” The main functions of intelligence - that of inventing solutions and that of verifying them - do not necessarily involve one another, the first part talks of imaginations and the second alone is properly logical. “Search for truth is therefore, the true
function of logic" (Gruber and Voneche, 1977). Piaget in his books, "The Origin of Intelligence in Children" (1936) and "The Construction of Reality in the Child" (1937), defines intelligence as the use of certain means to reach certain goals. The findings of the present investigation, showing a high relationship between intelligence and attainment of hypothetical reasoning are supported by the theoretical formulations and the nature of intelligence and logical thinking as given by Piaget and other thinkers in the field. In addition, the present finding is also consistent with those of Stephens, W.B. (1969); Valentine, E.R. (1975); Clayton, V. and Overton, W.F. (1976); Cloutier, R and Goldschmid, M.L. (1976); Khun, D. (1976); Raizada (1979); Sandhu (1980); Jain (1982); Mathur (1983); Jain (1984); Sadhna (1984); Misra, R.M. (1986); and Dutt Sunil (1989); though Vaidya (1964) and Vaidya (1979) had reported that a given problem is solved over a wide IQ range.

Regarding the relationship between the school climate and hypothetical reasoning, the findings of the present investigation reveal that only two out of the six dimensions of school-climate studied namely cognitive encouragement and rejection are found to constitute significant main effects. Moreover, lower levels of rejection as well as acceptance when coupled with higher levels of intelligence constitute significant interaction effects on hypothetical reasoning. Also, a 3-way interaction of lower level of creative-stimulation with higher level of intelligence and higher level of fluency is found to be contributing to the development of hypothetical reasoning.
From the above mentioned findings, it is obvious that cognitive encouragement provided to a child in the school positively affects the development of hypothetical reasoning in him. Secondly, rejection met in the school has a significantly negative effect on the development of the hypothetical reasoning of the students.

Although, there are certain factors that have been found to constitute significant interaction effects on the hypothetical reasoning of adolescent when coupled with higher levels of intelligence but these relate not only to the positive traits of school-climate but to the negative ones as well. Whereas, minimal level of creative stimulation and acceptance is necessary; higher levels of the same provided in the school do not enhance hypothetical reasoning in a child, on the contrary, rejection met in the school does reduce it.

Somerville, S.C. (1974) reported no relation between the type of school and logical thought. Agarwal (1987) has reported that Government, Private and Mission schools do differ in their impact. However, the investigator could not trace any empirical evidence which could concur with the present findings as such, but these findings are justifiable on psychological and commonsense grounds. The experience tells that rejecting a child in any situation mars his/her curiosity, thinking and creative self-expression - in that order, whereas cognitive encouragement boosts them.
Also, most of us would agree with Havinghurst (1961), who believes “that production of mentally superior people is more a matter of social engineering than of discovery and exploitation of a rare natural resource”. He holds that “teachers must teach in a fashion that stimulates highly creative, intellectual accomplishments. Children become mentally superior through a combination of being born with superior potential and being raised in an intellectually stimulating environment.”

Piaget has also mentioned that attainment of logical thinking depends upon how well one interacts with the physical and social environment. Hilgard and Bower (1977) hold that nature of interaction and the basic intelligence of the child play a significant role in the development of logical thought. Hence, the investigator finds this finding tenable.

The finding of the present investigation shows clearly that sex-difference has no relationship with the attainment of hypothetical reasoning by an adolescent. This finding can also be supported on the basis of a common sense logic and the nature of logical thinking as a cognitive activity. As suggested by Freud, logical thinking is a secondary process cognition (Arieti, 1976) and hence depends upon information or awareness as well as on innate cognitive structures. Even the studies in the field of intelligence and such like cognitive
activities show that it is a normally distributed trait in the total population of mankind irrespective of colour, caste, creed, sex and social status.

The finding of this investigation is in consonance with the findings of Lovell (1961); Jackson (1965); Somerville (1974); Jain (1982); Mathur (1983); Jain (1984); Misra (1986) who did not confirm the sex-difference on levels of formal thought of adolescents.

However, the findings of Elkind (1962); Dale (1970); Graybill (1974,1975); Sandhu T.S. (1980); Padmini (1982); Sahu (1985); Kumar (1987); Agarwal (1987); Bhatt (1992); Kusum Dubey (1997) go against the findings of the present investigation as they reported significant differences in the level of formal thought sex wise.

It is a recognised fact that culture and locale constitute significant factors in influencing development of reasoning abilities. In India, girls are considered inferior to their male counterparts in the imparting of socio-cultural treatment. As regional and socio-cultural differences were thought to be probable reasons for cognitive differences sex-wise by some investigators (Sandhu T.S., 1980; Agarwal, 1987); the present investigator deemed it proper to study the influence of the factor of difference of locale to which the subjects belong in the
development of hypothetical reasoning, in order to clarify the picture.

She finds not significant difference between the hypothetical reasoning ability of boys and girls on one hand and significant difference between the hypothetical reasoning ability of students from rural and urban locale favouring the latter group. Waite, J.B. (1975) and Misra, R.M. (1986) have reported no significant relation whereas Wozny, C.D. (1974) reported significant relation of the locale of the student to hypothetical reasoning. Probable reason for the result of the present investigation perhaps lies in the nurturance of the child. In urban locale, a child is exposed to reasoning and discussions whether with elders or through media; while this freedom of thought is curtailed to certain extent in the rural locale where authoritative attitude of parents often prevails as per investigator's own personal experience.

However, it is generally more difficult to prove the effects on intelligence of environmental factors than of genetic factors because of the complexity and diversity of environments and the variability of people's responses to the same environmental pressure. Frequently, therefore, plausible suggestions regarding environmental influences fail to be confirmed by validatory studies (for instance, the alleged effects of broken homes on the development of black children). Jensen (1981) has pointed out that environmentalists are apt to put forward adhoc hypotheses for which there is little or no evidence, and he calls these “X-
hypotheses, because it is obvious that a person can explain anything by factors that he or she knows nothing about.

Jensen (1981) believes that the question of hereditary and environmental determination could be ignored if mental-test were used for their proper purpose, namely as a guide to psychologists, teachers and parents in planning the most suitable type of education for the individual child. The recognition of genetic differences also implies that educational programmes should be diversified to suit different students instead of, as at present, submitting all disadvantaged children to the same monolithic education which inevitably dooms large numbers to failure.

CONCLUSIONS

In nutshell, the investigator resumes that intelligence and diverent thinking are significantly related to the development of hypothetical reasoning. Furthermore, of the 6 dimensions of school-climate, cognitive encouragement and rejection met in the school constitute significant main effects on the development of hypothetical reasoning. Moreover, significant interactions of lower levels of rejection and acceptance with higher levels of intelligence lead to higher mean scores on hypothetical reasoning. Lower level of creative stimulation with higher levles of intelligence as well as fluency is found to have significant interaction effect on hypothetical reasoning. No significant difference is found between the hypothetical reasoning ability of boys and girls on one hand and significant
difference is found between the hypothetical reasoning ability of students from rural and urban locale favouring the latter group.

EDUCATIONAL IMPLICATIONS

Keeping in view the results obtained during the study, the investigator likes to offer some recommendations, so that the results could be utilised for the benefit of our education system.

1. There should be no segregation of the students on the basis of sex difference in the class-room. Both sexes should be treated as equals while considered for providing facilities and reinforcements. The girls should be given the freedom to choose any of the careers as are open to the boys, for in this study, no difference is found in boys and girls in regard to formal thought operations.

2. Students belonging to the rural locale should be provided greater exposure to the world of information and freedom of thought should be provided due place in their nurturance. Piaget also believes that source of knowledge is interaction. So children should be given maximum opportunities to interact with their physical and social environments. The sooner the child is placed in situations demanding interactions; the better will be the outcome in the form of learning. Teachers and parents should not behave as dictators rather they should bring them up in a democratic way. Opportunities to express his views should
be given. Child should be made to realise that his ideas also have worth and importance.

3. The teachers in the schools should be made aware of the fact that rejection faced in the school-environment dampens the positive upswing of the hypothetical reasoning. Children wish to be accepted as they are. Spontaneous overflow of originality should not be checked unnecessarily in the name of disciplining them.

4. As all the three dimensions of divergent thinking i.e. fluency, flexibility and originality cause significant main effects on hypothetical reasoning, it is proposed that the curriculum material should be revised in order to foster creative thinking in all the subjects taught in the school. Though some efforts have been made by NCERT and some good books are coming up but there is still enough scope for the things to be done.

5. Special courses intended to teach creative thinking as a general attitude should be instituted. Students at a young age should be encouraged to opt for such courses so that the creative thinking can be inculcated as it will lead to the development of hypothetical reasoning.

6. The present set-up of examination system which is based more or less on convergent thinking should be so changed as to pave way for divergent thinking as the base. Reason for the above statement being the need to tap the creative potential in the new generation and as such the excessive
dependence on rote-memory has to be brought down. For, the ability to create problem-situation is an index of the capacity to extract knowledge out of the information given.

7. The institutions imparting the training to the teachers need instructional material based on creative thought, of which there is a great dearth at present.

8. As Dagar, B.S. (1980) maintains that it is our task as psychologists and educators, to discover talent when it is still potential and to provide the kind of socio-cultural climate and intellectual environment which facilitates its nurturance and expression. It is only then that education, perhaps, can perform one of its basic functions by augmenting generation of ideas, process and products; and thus, gearing up the talents of pupils to the fullest possible extent.

SUGGESTIONS FOR FURTHER STUDIES

1. The study needs to be replicated on a large sample from different parts of the country and at different age-levels to confirm the findings of the present study.

2. A study may be conducted to see whether it is possible to enhance reasoning abilities of students through intensive training programmes aimed to cultivate creative potential of the students. Experimental studies may be taken up to evaluate the effectiveness of such training programmes.
3. A study of socio-cultural and personality effects on the adolescent thought may be undertaken for further investigation.

4. A study may be undertaken to explore the influence of actual and preferred school-climate on the growth of mental abilities of children.

5. A study may be conducted to see the effect of intensive training programmes centered on developing divergent thinking on the acquisition level of students for different formal operations such as proportionality, correlations, probability etc.

6. A longitudinal study may be undertaken to chart the growth of cognitive development during adolescence.

7. A study may be undertaken to find out the factors responsible for the poor acquisition of hypothetical reasoning among the adolescents and adults.

8. A study could be undertaken to probe further the exact difference in the sequence of attainment of reasoning with several groups.

9. A cross-cultural study of the difficulty level in the acquisition of different schemes of thought among adolescent pupils of different developed and developing countries.
10. A study could be undertaken to identify the effects of urbanization on logical reasoning by taking socially disadvantaged children belonging to places with differing degrees of urbanization.

11. A study could be undertaken to study the effect of home environment on attainment of reasoning in students.

12. The differences, if any, between the assessment of logical reasoning through P-tasks and that through paper pencil tasks may also be studied further.

13. The findings of the study could be confirmed by using multiple items for every ability studied.
SUMMARY OF THE THESIS

Man in his eternal quest for knowledge, truth and power to conquer physical nature has heavily relied upon one tool namely thinking. Thinking about thinking has been the domain of philosophers traditionally and psychologists have entered the field recently. Now-a-days, a general consensus has reached among the investigators and philosophers that thinking is a much more complicated business than common-sense acquaintance with the term. According to the encyclopedia Britannica:

...The term thinking itself has many definitions, no one of which is satisfactory to everyone. A useful one for those who attempt to study it scientifically defines thinking as that aspect of human activity that primarily involves processing of information... The operations or processes involved in thinking are many and varied in kind and complexity.... These processes are themselves the result of learning and hence vary from one thinker to another.

Thus thinking is a multi-dimensional-activity with respect to both processes and products. This very manner or act of knowing which undergoes changes through out the human life span is implied in the term Cognitive Development.

Cognition is the act of knowing and the analysis of the act and its components has become the core of psychologists' and educators' attempts to understand the mind. Cognition is a troublesome term in psychology, because it has no clear referent. It has been defined so narrowly as to refer only to "awareness" (Guilford ,1967) and so broadly by others as to include all higher mental processes such as perception, thinking,
attention, language, reasoning, problem solving, creativity, memory and intelligence etc.

The theories of Jean Piaget (1896-1980) and his Genevan colleagues are the most mature of the organismic theories of cognitive development, both from the specificity and completeness of the theoretical mechanisms and from the perspective of the richness of the empirical findings the theories have generated.

Piaget proposed that knowledge is a process, a repertoire of actions that a person performs. Piaget was one of the first psychologists to recognize explicitly that humans are born as active, exploratory, information-processing organisms. These ideas have been basic to his theory. He looks upon people's adaptive activities as more fundamental and important than the external stimuli and reinforcement connected with them. (Piaget, 1970). For him, cognitive development proceeds from physical actions; activity provides feed back, not just reinforcement.

The task of a child's cognitive development needs continuous reorganizations (adaptation) of his cognitive structure so as to maintain harmonious relationship between his self and his environment (equilibration) by bringing changes in the existing cognitive structure either through banking upon his past experiences (assimilation) or learning new way of behaving (accommodation) (Jean Piaget). The techniques of adaptation in Piaget's system are called schemes. A scheme as a technique of adjustment, can be biological or mental or both. Such schemes, both physical and mental are always accompanied by feelings which Piaget called affective schemes. (Piaget and Inhelder 1969).
The appropriate model of equilibration is not the beam balance, but the analytical balance in chemistry. It is a balance of a self-regulated set of simultaneous interactions between the elements of the system in which, so to speak, the swings of balance continually increase in amplitude and power and do not dampen to a prior equilibrium.

There are four main periods or levels of development in Piaget's theory; level 1: the sensory-motor period (birth to age 2 roughly); level 2: the preoperational thought period (about age 2 to 7); Level 3: the concrete operational period (about age 7 to 11); and level 4: the formal-operational period (about age 11 to 15).

Piaget distinguishes four major stages in cognitive development, as well as numerous sub-stages within the major ones. The four stages are considered qualitatively distinct from one another, even though the transitions between them are admittedly slow and uneven. The breaks in the process of growing up suggested to him that the child had at each such time completed one phase of growth and was not engaged in further phase. So the Piagetian model of cognitive development can be called a stage theory.

It is by the end of the period of concrete operations, children have markedly increased their abilities to account for the course of physical events so that they are now ready to solve not only problems that involve real objects but also ones concerning hypotheses and proportions about relationship. The adolescent can now imagine the conditions of a problem-past, present or future and devise hypotheses about what might logically occur under different combinations of factors.
This readiness to think in hypothetico-deductive terms is the hallmark of the stage of formal operations. It is typically manifested in propositional thinking and a combinatorial system that considers the real as one among other hypothetical possibilities. Formal operations are characteristic of the final stage of operational intelligence which reflects on concrete operations through the elaboration of formal "group" structures.

By the end of this final stage of mental development the youth is capable of all the forms of logic that the adult commands. Then further experience over the years of youth and adulthood fill in the outline with additional, more complex schemes so that the adult's thought is more mature and free of egocentrism than is the adolescent's.

In Piaget's system the process of cognitive development—generating a growing complex of schemes—is governed by four factors: heredity (internal maturation); physical experience with the world of objects (spontaneous or psychological development); social transmission (education or instruction) and equilibrium (Piaget 1973).

Heredity, in Piaget's view, furnishes the newborn with the initial equipment the infant needs for coping with problems met in the world. Heredity also establishes a time schedule for new development potentials to arise at successive stages of individual's growing years. However, genetically determined internal maturation does not guarantee the materialization of the potential schemes or abilities. Their fruition depends also on the nature of the person's interaction with the environment.

Unlike many theorists, Piaget separated the child's involvement with the environment into two varieties: direct
and generally unguided experience (physical experience or spontaneous development); the second factor, and the guided transmission of knowledge broadly known as education or instruction; the third factor. He, however, contended that the first of these varieties must precede the second.

The fourth factor determining development called equilibrium is a coordinating force, performing the regulation and compensation among the other three factors that are needed to make the entire system of development a coherent whole.

In the light of the above stated factors we can trace the significance of the environment of home and school contributing immensely to the flowering of the innate capacity of the child to make sense of the world on their own.

In this interaction, one factor can never be evaluated without knowing the others. It is not possible to account for a particular cognitive organization without specifying particular environmental conditions. And it is not possible to assess the impact of any environmental event without knowing something about the child's intellectual organization. Intelligence, metaphorically, acts as a generator which transforms raw input into usable power.

For factor analysts like Guilford (1950), the aspect of intellect represented by the I.Q metric is only one of the numerous factors, and not necessarily even the most important one. He segregated the factors of intellect, distinguishing especially between convergent and divergent thinking. Convergent thinking is the generation of new information maximally dependent on known information as in most intelligence test problems where the only acceptable solution is a single already-known solution. Divergent thinking is the
generation of new information minimally dependent on known information, and the acceptable response to a given problem may be a variety of emergent solutions characterized by fluency, flexibility, originality and elaboration which are said to be principal components of creativity. These components of the "many splendoured thing" (Guilford, 1959) constitute the 'potential', which may unfold in a suitable climate providing which in case of students is the responsibility of the formal agency of education i.e. the school.

The direction to look for the answer to the other important factor is provided by Stein (1974) who divided the creative process in three stages only. These are (i) stage of hypothesis formation, (ii) stage of hypothesis testing, (iii) Stage of communicating the results. However, he points out that preparation or education precedes these stages. Stein's conceptualization also highlights Piaget's concept of attainment of hypothetical reasoning as the main feature of the formal operational stage of cognitive development in adolescents.

Schools can play an important role in inculcating students a creative attitude, which is a kind of belief that human ingenuity can find a solution to all problem and these solutions can be more or less satisfactory.

Getzels and Jacksons et al. (1962) suggested the elaboration of creative thinking as an important aspect of creative problem solving behaviour. Piaget and Bruner have insightfully initiated the research in this area. But the elaboration of school climate has hardly been done so far This aspect of Educational-Psychology needs attention for the qualitative improvement in education.
On the basis of the sociological consideration, the social environment of education falls into 3 inter-related categories, namely (i) the social environment of the individual pupil (ii) the internal social environment of the school and (iii) the external social environment of the school.

What possibly we can examine is the role of the social relationship and the organization of the school, involving examination of the roles and the values of head teachers, teachers and pupils. The recognition of the link between school structure and educational achievement is, of course, long standing-It is implicit in most appraisals, favourable or critical, of the school. What is new is the more precise analysis of the social relationships and the structure of schools and their consequences, now being initiated by sociologists. Such study may be fruitful for example, in explaining why two schools matched in all external factors produce strikingly different responses in pupils.

Questions about the impact of schooling on development are intertwined with the questions Berry and Daren (1974, pp 11-12) have identified as the major themes in research on culture and cognition.

..."Firstly, are there qualitative differences in cognitive processes among different cultural groups or are the processes identical (or almost so) through out the species, with the apparent differences attributable to the different cultural materials entering into the processes?... Secondly, are there quantitative differences in cognitive processes among cultural groups? ... Thirdly, are the characteristics of growth in cognitive operations (both qualitative and quantitative) similar in all cultural groups. ?"
In summary, the role of schools in affecting individual's development is complex. It is extraordinarily difficult to sort out the interrelationships among such factors as economic conditions, ethnicity, degree of urbanization and schooling.

The unexpected observation by Getzels and Jackson (1962) that despite a 23-point difference in I.Q, their high-creativity and high I.Q groups performed equally well on standard measures of achievement gave rise to a number of studies with similar and discrepant results. Explanations for the diversity of results called attention to the possible effects of relative rigidity and permissiveness in learning conditions of the school, and of the systematic interactions between convergent and divergent teachers and convergent and divergent pupils.

J.W. Getzels (1979) in his discussion of educational issues concerning creativity has posed the following questions:

...Although such broad categories as convergent and divergent thinking do not exhaust the possibilities, they do suggest the possible existence of different styles of both learning and teaching, the one style focusing rather more on the acquisition of skills and established knowledge, the other on the cultivation of imagination and creativity. what is the effect of the interaction of those different styles among students and teachers?

The interaction effect of convergent thinking and divergent thinking among students can best be studied while keeping in consideration the type of school-climate available to the child. But the investigator could not trace any study attempting to test the interaction effect of intelligence, divergent thinking and school-climate on hypothetical reasoning; the development of which forms the basis of the formal thought attained during
adolescence. Attainment of hypothetical reasoning is very important for the cognitive functioning of an individual throughout his life, and also it is most crucial from the educational point of view. So the present investigator visualized a need to conduct an empirical study to find out how the ability to hypothesize is developed in Indian situation under the influence of extrinsic variable of school climate and intrinsic variables like one's capacity to think divergently and convergently, both. Therefore, the investigator defines the present problem more clearly as under -

**Statement of the Problem**

*A Study of the Development of Hypothetical Reasoning in Relation to Divergent Thinking, Intelligence and School-Climate.*

**Objectives of the study**

In order to make the study more specific and scientific the following objectives were framed:

1. To find out the relationship between divergent thinking abilities and hypothetical reasoning.
   
   (a) To study the relationship between fluency and hypothetical reasoning.
   
   (b) To study the relationship between flexibility and hypothetical reasoning.
   
   (c) To study the relationship between originality and hypothetical reasoning.

2. To find out the relationship between intelligence and hypothetical reasoning.

3. To find out the effect of different dimensions of school-climate in the development of hypothetical reasoning.
a) To study the relationship between creative stimulation and hypothetical reasoning.

(b) To find out the relationship between cognitive encouragement and hypothetical reasoning.

(c) To find out the relationship between permissiveness and hypothetical reasoning.

(d) To find out the relationship between acceptance and hypothetical reasoning.

(e) To find out the relationship between rejection and hypothetical reasoning.

(f) To find out the relationship between control and hypothetical reasoning.

4. To find out the multiple correlation (R) between hypothetical reasoning and one dimension each of intelligence, divergent thinking and school-climate.

5. To find out the main and interaction effects of intelligence, divergent thinking and school-climate on hypothetical reasoning.

6. To find out the difference in the hypothetical reasoning of boys and girls.

7. To find out the difference in the hypothetical reasoning of the students belonging to rural and urban locale.

**Hypotheses of the Study**

1. **Divergent thinking vs. Hypothetical Reasoning**

   (a) There is a positive relationship between fluency and hypothetical reasoning.

   (b) There is a positive relationship between flexibility and hypothetical reasoning.

   (c) There is a positive relationship between originality and hypothetical reasoning.
2. **Intelligence vs. Hypothetical Reasoning**

There is a positive relationship between intelligence and hypothetical reasoning.

3. **School-Climate vs. Hypothetical Reasoning**

(a) Creative-stimulation positively affects the development of hypothetical reasoning.

(b) Cognitive encouragement has a positive relationship with the development of hypothetical reasoning.

(c) Permissive climate in school is directly related with the development of hypothetical reasoning.

(d) Acceptance level in school climate is directly related with the development of hypothetical reasoning.

(e) There is no significant relationship between rejection dimension of the school-climate and the development of hypothetical reasoning.

(f) There is no significant relationship between control and hypothetical reasoning.

4. There is no significant multiple correlation between hypothetical reasoning and intelligence, divergent thinking and school-climate.

5. There are no significant main and interaction effects of intelligence, divergent thinking and school-climate on hypothetical reasoning.

6. There is no significant difference in the hypothetical reasoning of boys and girls.

7. There is no significant difference in the hypothetical reasoning of students from rural and urban locale.
Delimitations of the Study

Due to limitation of time and resources the present study has been delimited to the following aspects:

I. The study was delimited to students of adolescent age group studying in class XI & XII of Senior Secondary Schools.

II. Only three independent variables viz. intelligence, divergent thinking and school climate were taken up to study their relationship with the development of hypothetical reasoning.

III. The sample of 300 students was collected from 8 Senior Secondary Schools in & around Jinn city only.

Procedure

In order to obtain relevant data in accordance with the objectives of the study, initially a sample of 498 students from class IX and XII was taken from 8 different schools of Jind district in Haryana. In selecting the schools care was taken that those truly represented the population. For this purpose different types of schools were taken i.e. Boys school, Girls school, Co-educational school, Govt. school, Privately-managed schools etc. located in rural and urban, both type of areas. Nevertheless, consideration of cooperation of the heads of the institutions and convenience were also taken as criteria for selecting the schools. In addition, for selecting the students from a particular class, the entire section was taken as a cluster in any school the investigator visited for the collection of data. As a result, the following schools were taken for the administration of the tools of research for collecting the data:
5. Maharishi Vidya Mandir, Jind.

However, after administration of the tools of research, the investigator was left with only 300 subjects due to subject mortality during the course of administration of tools.

Tools

Keeping in view the objectives and corresponding hypotheses of the study, four types of research tools were employed. These tools were:

1. Culture fair Intelligence Test by R.B. Catell.
2. Test for Creativity in Words by Dr. Baqer Mehdi.
3. School Environment Inventory by Dr. K.S. Mishra.
4. A paper pencil test comprising ten Piaget-type tasks aiming at assessing hypothetical reasoning of subjects (developed and used by Dr. T.S.Sandhu in his Factorial Study of Adolescent Thought, (1980).

Administration and Scoring

The four research tools mentioned above were administered to the sample of subjects under study in each school on different days. On a particular day only one research tool was administered. The scoring was done by the investigator
herself, following the instructions of scoring as given in the respective manuals of these inventories. Scoring for Piaget-type tasks was done on the pattern as stated by Sandhu (1980) in his factorial study of formal thought.

**Statistical Design and Analysis**

Having obtained scores on all the variables, the investigator adopted appropriate statistical design to analyze the data. These statistical designs were chosen keeping in view the requirements of the objectives and corresponding hypotheses of the study.

The following designs were used for statistical analysis of the data:

1. For comparing hypothetical reasoning score belonging to different groups, t-test technique was applied.

2. For determining the relationship between various independent variables of the study with the dependent variable i.e. hypothetical reasoning, corresponding correlations were computed and their significance tested.

3. To study the correlation of the combination of one component each of the three independent variables with hypothetical reasoning; the dependent variable, multiple R was computed.

4. To study the main effects of different components of the independent variables and also to study the interaction effects of combinations of different independent variables on hypothetical reasoning of the subjects, ANOVA procedures were applied. In applying the ANOVA procedure, a multi-factorial design of the order 2x2x2 was
framed. In a particular ANOVA procedure the different independent variables were:-

i) Intelligence

ii) One component out of the six components of school-climate.

iii) One component out of the three dimensions of divergent-thinking.

The dependent variable in each of the combination of independent variables was hypothetical reasoning score.

Findings

The following findings are given in the order of the hypotheses mentioned above.

1. **Divergent Thinking Vs. Hypothetical Reasoning:**

   (a) There is found to be a positive and highly significant correlation between fluency and hypothetical-reasoning.

   (b) There is found to be a positive and highly significant correlation between flexibility and hypothetical reasoning.

   (c) There is found to be a positive and highly significant correlation between originality and hypothetical reasoning.

2. **Intelligence Vs. Hypothetical Reasoning.**

   There is found to be a positive and highly significant correlation between intelligence and hypothetical reasoning.

3. **School Climate Vs. Hypothetical Reasoning**

   (a) There is found to be no significant correlation between creative-stimulation and hypothetical-reasoning.

   (b) There is found to be positively significant correlation between cognitive encouragement and hypothetical reasoning.
(c) There is found to be a positive and significant relationship between permissiveness and hypothetical reasoning.
(d) There is found to be no significant correlation between acceptance and hypothetical reasoning.
(e) There is found to be no significant correlation between rejection and hypothetical reasoning.
(f) There is found to be no significant correlation between control and hypothetical reasoning.

4. Value of Multiple R

The value of multiple 'R' for every combination of intelligence with one dimension of divergent thinking and school-climate each is found to be significant on hypothetical reasoning.

5. Analysis of Variance: Multi-factorial Design (2x2x2)

A. Main Effects

1. Divergent thinking Vs. Hypothetical Reasoning

(a) Fluency is found to be having significant main effect on hypothetical reasoning.

(b) Flexibility is found to be having significant main effect on hypothetical reasoning.

(c) Originality is found to be having significant main effect on hypothetical reasoning.

2. Intelligence Vs. Hypothetical Reasoning

Intelligence is found to be having significant main effect on hypothetical reasoning.

3. School-Climate Vs. Hypothetical Reasoning

(a) Creative stimulation in school-climate does not constitute any significant main effect on hypothetical reasoning.
(b) Cognitive encouragement in school-climate is found to be having significant main effect on hypothetical reasoning.

(c) Permissive climate in school does not constitute any significant main effect on hypothetical reasoning.

(d) Acceptance level in school-climate does not constitute any significant main effect on hypothetical reasoning.

(e) Rejection dimension of school-climate is found to be having significant main effect on hypothetical reasoning.

(f) Control in school-climate does not constitute any significant main effect on hypothetical reasoning.

(B) Significant 2-Way Interactions

1.(a) Intelligence and Rejection Vs. Hypothetical Reasoning

A unique combination of higher level of intelligence and lower level of rejection in school-climate leads to the highest mean score on hypothetical reasoning.

(b) Intelligence and Acceptance Vs. Hypothetical Reasoning.

A unique combination of higher level of intelligence and lower level of acceptance leads to the highest mean score on hypothetical reasoning.

(c) Significant 3-Way Interactions

Intelligence, Creative stimulation, and Fluency Vs. Hypothetical reasoning.

A unique Combination of higher level of Intelligence, lower level of creative stimulation and higher level of fluency leads to the highest mean score on hypothetical reasoning.

6. There is found to be no significant difference in the hypothetical reasoning of boys and girls.
7. Students belonging to urban locale score higher on hypothetical reasoning than the students belonging to rural locale.

CONCLUSIONS

In nutshell, the study indicates that intelligence and divergent thinking are significantly related to the development of hypothetical reasoning. Furthermore, of the 6 dimensions of school-climate, cognitive encouragement and rejection met in the school constitute significant main effects on the development of hypothetical reasoning. Moreover, significant interactions of lower levels of rejection and acceptance with higher levels of intelligence lead to higher mean scores on hypothetical reasoning. Lower level of creative stimulation with higher levels of intelligence as well as fluency is found to have significant interaction effect on hypothetical reasoning. No significant difference is found between the hypothetical reasoning ability of boys and girls on one hand and significant difference is found between the hypothetical reasoning ability of students from rural and urban locale favouring the latter group.

EDUCATIONAL IMPLICATIONS

Keeping in view the results obtained during the study, the investigator likes to offer some recommendations, so that the results could be utilised for the benefit of our education system.

1. There should be no segregation of the students on the basis of sex difference in the class-room. Both sexes should be treated as equals while considered for providing facilities and reinforcements. The girls should be given the freedom to choose any of the careers as are open to the boys, for in this study, no difference is found in boys and girls in regard to formal thought operations.
2. Students belonging to the rural locale should be provided greater exposure to the world of information and freedom of thought should be provided due place in their nurturance. Piaget also believes that source of knowledge is interaction. So children should be given maximum opportunities to interact with their physical and social environments. The sooner the child is placed in situations demanding interactions; the better will be the outcome in the form of learning. Teachers and parents should not behave as dictators rather they should bring them up in a democratic way. Opportunities to express his views should be given. Child should be made to realise that his ideas also have worth and importance.

3. The teachers in the schools should be made aware of the fact that rejection faced in the school-environment dampens the positive upswing of the hypothetical reasoning. Children wish to be accepted as they are. Spontaneous overflow of originality should not be checked unnecessarily in the name of disciplining them.

4. As all the three dimensions of divergent thinking i.e. fluency, flexibility and originality cause significant main effects on hypothetical reasoning, it is proposed that the curriculum material should be revised in order to foster creative thinking in all the subjects taught in the school. Though some efforts have been made by NCERT and some good books are coming up but there is still enough scope for the things to be done.

5. Special courses intended to teach creative thinking as a general attitude should be instituted. Students at a young age should be encouraged to opt for such courses so that
the creative thinking can be inculcated as it will lead to the development of hypothetical reasoning.

6. The present set-up of examination system which is based more or less on convergent thinking should be so changed as to pave way for divergent thinking as the base. Reason for the above statement being the need to tap the creative potential in the new generation and as such the excessive dependence on rote-memory has to be brought down. For, the ability to create problem-situation is an index of the capacity to extract knowledge out of the information given.

7. The institutions imparting the training to the teachers need instructional material based on creative thought, of which there is a great dearth at present.

8. As Dagar, B.S. (1980) maintains that it is our task as psychologists and educators, to discover talent when it is still potential and to provide the kind of socio-cultural climate and intellectual environment which facilitates its nurturance and expression. It is only then that education, perhaps, can perform one of its basic functions by augmenting generation of ideas, process and products; and thus, gearing up the talents of pupils to the fullest possible extent.