CHAPTER - I

THE PROBLEM

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CHAPTER I

THE PROBLEM

1.10 Introduction

Children are said to be the richest resources of the nation and the richness, as such, lies with the mental development and reasoning abilities. Perhaps, Piaget's Concept of 'thinking child' constitutes the core of acquisition of learning and potentiality development.

The present system of education is denounced on the grounds of too much emphasis on note memorization by pupils. To a large extent, the passing or failing of a pupil on an examination depends on the ability of memorization and reproduction of certain bits of information from the instructional materials as well as on the method of presentation. Thus, the entire educational processes have been dominated by memorization. Consequently, the aim of attaining optimum faculty development is arrested to a large extent. The higher mental processes fail to sharpen and operate to the extent it ought to be. Those aims of education, which function on the operation of higher mental processes as promoting abilities for independent thinking, critical reasoning and evaluation are hardly attained.
Consequently, the learner after schooling attains a dependent-prone personality, poor ego-strength and lacks in intellectual tolerance and independent decision making abilities. The existing educational processes, thus, design the 'learning child'. Piagetian school of thought gave a new direction by introducing the concept of 'thinking child' in educational horizon.

One of the basic principles of democratic living is the optimum development of all persons as fully functioning individuals in society. Piaget's views on educational objectives in modern society are probably shared by most educators today. The principal goal of education is to create men, who are capable of doing new things; who are creative, inventive and discoverers. Another goal of education is to develop minds which can be critical, and accept things after due verification (Piaget, 1964, p. 5).

The school as the most significant and comprehensive formal agency of education is expected to provide the child with all kinds of experiences he needs in order to develop and sharpen capacities, master his developmental tasks adequately and derive satisfaction of his needs of personality. Though there is considerable possibility of fostering development of dimensions other than the cognitive through various other agencies of education, the main responsibility for fostering 'cognitive development in children rests with the school, the most important formal agency of education
and that is why cognitive learning is predominant in the
school system.

There has been explosion of knowledge in the field
of science and technology all over the world and in the wake
of this exploration, the objectives of instructions in the
school are also changing. Education for understanding and
problem solving is becoming the need of the day and the
chief goal of instruction at school. Now the time has come
when the child has to be taught the technique of 'learning
to learn' as well as 'learning to think' rather than measur-
ing various concepts by employing the devices and techniques
advanced in learning theories. Brunner (1966) and Diggary
(1972) have specified that the teacher in the class-room
should recognize the potentiality of the 'thinking child'
and therefore, they have advocated for the inculcation and
development of higher mental faculties in the school.

Some Indian educationists who have critically examined
the present school system in India have pointed out that the
primary school programme, especially that of the first two
years, with its over-emphasis on the mechanical skills of
the three R's - the way they are taught, if not the way they
can and should be taught, tends to arrest, even curb the
natural process of cognitive development in children. At
any rate this could slow down the pace of such growth whereas
the purpose, the possibility, and the promise are that it
can and should be promoted through a carefully designed
programme in the special environment of the school.
The Education Commission (1964-65) stressed the gravity of the problem of wastage being the highest in Class I followed by the rest of the primary stage and identified 'unsuitable curricula' in the existing educational system as one of the five; perhaps the most important causes hindering progress. The inability of the teacher to use play-way techniques which can help in initiating the children pleasantly into school life was identified as another cause.

It has been commented that our present way of teaching largely verbally from first standard upward, does not allow a child, who is still pre-operational, to learn through action on objects. The overwhelming use of symbols and deductive processes in teaching does not allow the young child, still thinking pre-logically to explore mentally the situation taught. According to his abilities and motivation, he will therefore either learn by role or lose interest and misbehave" (Mireille De Meurer, 1974, p. 240).

Children and adults have different ways of thinking. This is not generally understood. The child not only knows less than older children and adults but also thinks differently from them which the adult often mistake for poor or wrong way of thinking. According to Piaget, cognitive stages follow an invariant sequence. A child whose reasoning is at the concrete-operational level, for instance, cannot be expected to succeed with formal operational tasks,
in the logical domain. Today Piaget's contributions are well known, although they are not entirely free from controversy. Research has been conducted in various cultural contexts to adduce support or to identify lacunae in Piaget's theories. Piaget's assertion of invariance of stages in concept development was corroborated by studies like Elkind's (1964). On the other hand, the suggestion that the sequential stages as described by Piaget need not necessarily appear in all situations was also made (Dodwell, 1960, 61, 62). Investigations sought to examine the extent to which the results obtained by Piaget with middle class western European children are generalizable to children of other races and cultures. Some of the cross-cultural studies conducted by Peluffo (1967), Greenfield (1966), Goodnow and Bethon (1966), Almy, Chittenden and Miller (1966), Poole (1968), Heron and Simensson (1969), Jahoda (1973), Goodnow (1969), Cole, Gay and Sharp (1971), Furby (1971), Zarour (1971), Llyod (1971), Dasen (1973), Heron and Dowel (1973), Philip and Kelley (1974), Rao (1979), etc. have suggested a lag in cognitive development for instance, in the acquisition of conservation in non-western and non-industrialized cultures.

The current concepts lead us to ponder over some new techniques for the class-room teaching situations. Obviously, the child "as a person" and "as a thinking being" should be known to the teacher before he is introduced to some units of instructions. Piaget (1929) says "children are always
intellectually active. They are striving to assimilate information and make it adjusted with the concept of the world, changing their concepts in order to accommodate information that disagrees with them and trying out various activities in order to test their concepts further". All human beings work all the time to assimilate information gained from their interaction and integration with the environment into a concept or scheme of how things work.

Learning cannot occur unless one's cognitive structures are prepared to deal with it. An infant cannot learn what a child can. Mental operations differ according to one's stage of psychological growth or development. According to Piaget and Inhelder (1956), the stages of development are essentially radical changes in cognitive structure.

The stages of cognitive development as envisaged by Piagetian school of thought have their own unique significance in Indian educational system so far as designing, and developing, planning and programming the school curricular and other learning experiences suited to the different socio-cultural environmental conditions are concerned. The studies on cross-cultural variations as presented in Chapter III indicate that not only 'horizontal decalage' but 'vertical decalage' are significant aspects of cognitive development and since every culture is unique in the process of social inheritance and cultural attributes, the impact
and interaction bring about significant variation in the "Cognitive world" of the children of different cultures. All these cognitive variations have great educational significance; and have great relevance with the present study.

**Stages of Cognitive Development**

Piagetian theory provides the theoretical framework for assessment and interpretation of cognitive performance in the studies of Witkins' Psychological differentiation theory with field independence and field dependence. They are used in assessing and interpreting cognitive style.

Cognitive development is a continuous and sequential process from birth through adulthood according to Piaget who maintained that this sequence is invariant through the age of acquisition and rate of development varies from culture to culture.

The concept of "invariant sequence" has generated much controversy which could be explained in three different ways. First major developmental periods or "global stages" (sensorimotor, pre-operational, concrete and formal operational) have an invariant sequence; that is stage A will be followed by stage B, and stage B will be followed by stage C without skipping any stage and without reversing the progression. Second, there is a fairly reasonable within-stage developmental sequence of various operations.
For example, the conservation of mass/matter is acquired before the conservation of weight, and conservation of weight before the conservation of volume. Piaget identified this kind of within-stage developmental sequence or heterogeneity in performance as horizontal decaloge (Grube and Voneche, 1977). Third, there is a within-operational developmental sequence; that is, before any particular operation is acquired, there is a three-level auto-regulatory process of equilibration. During the initial period, the cognitive structure relative to a particular operation is still undeveloped. During the transitional period, there is uncertainty oscillation and unstable equilibrium. But during the final period when the operation is fully acquired, the cognitive structure becomes stable, and equilibrium is achieved.

The three major periods of development sequence according to Piaget and Inhelder (1956) are: (i) the period of sensory motor development (birth to 2 years); (ii) the period of preparation for and organization of concrete operations (2 to 11 years); and (iii) the period of formal operations (11 to 15 years). The middle period was subdivided into sub-periods of pre-operational representations (2 to 7 years) and concrete operations (7 to 11 years). The first stage, i.e. sensory motor stage, carries the child from inborn reflexes to acquired behaviour pattern. The second stage concerns with the stage of language development. This permits the child to deal
symbolically with the world instead of directly through motor activity. At this stage, the child is the centre of his own world. This is more or less 'ego-centric' in nature. During the third stage of concrete operations, child is less dependent on his own perception and motor activities and shows a capacity for reasoning though still at a concrete level. At the last stage of formal operations, the child deals with abstract, and logical relationships. Piaget (1956) reported that conservation of mass initially appeared at the age of 7-8 years, conservation of weight at age 9-10 years and even greater lag before the conservation of volume at ages 11-12. However, under the Indian conditions of development of physical, mental and emotional growth, the period characterised by concrete operations in foreign countries may seem to be extended further. The experiments on conservation in India can not be said to be exactly a replication in the light of these extensions as cultural differences and other psychological differentiations may affect the occurrences of various types of conservation.

Conservation can be defined as the ability of an individual to be aware of the invariant aspects or properties of objects in the face of transformation. For Piaget, conservation is a central pre-requisite for the acquisition and subsequent development of logical thought. Piaget (1940) found that discoveries of conservation followed a regular order that was related to age.
Piaget was concerned with describing typical intellectual development. He was interested in the way as to how the child builds his conceptual world but not in the measurement of abilities at a specific time. This has a relevance with the cognitive development of the child.

Piaget (1952) describes conservation as developing in three stages on initial stage in which perceptual factors exclusively determine the judgement of quantity; an intermediate stage of transition when perceptual as well as conservation considerations influence the judgement, and finally the stage of complete conservation. Braine and Shanks (1965 & 1956) however using non-verbal assessment techniques have found several kinds of conservations in children of 4.5 - 5.5 years old. Their findings suggest that a child may have the ability to perform a given operation, such as conservation, without having the verbal skill necessary to adequately comprehend and respond to verbal techniques of conservation. Braine and Shanks (1965a, 1965b) demonstrated that children of 4 and 5 years of age are able to conserve, while Smedslund (1961) did not find conservation present in the thinking of children younger than 7 to 8 years of age. These findings conform with the findings of Piaget (1960) and Inhelder (1948) that conservation and other concrete operational thought processes do not appear in children until they reach the age of 7 or 8 years.

We are deeply concerned with intellectual development of the young elementary school children with special
reference to acquisition and utilization of conservation concept. A major concept in Piagetion theory is that knowledge is not a reflection of reality but the result of active interaction between the subject and its environment. Perhaps, social environment and cultural interactions play vital role in the development of thinking potentiality of the children.

Schooling is one of the aspect of culture; another being the social class which has also been found to influence the rate of developmental process. Almy Chittenden and Miller (1966) reported that fewer lower class children show conservation of quantity and number a year later than middle class children. Schooling and social class are two culturally relevant variables which contribute to differential pattern of growth. If the child lives in an advanced society, he becomes "operational".

The application of Piaget's ideas to education suggests that the ideal curriculum presents the students with learning experiences that are developmental in nature. The best curriculum provides the appropriate experience at the right time. For this, the teacher has to understand the child with whom he has to interact in the class-room situations.

Conservation researches conducted by Piaget have been found extremely useful for class-room teachers and
guidance workers as well as for the educationists involved in preparing curriculum for different levels. Attainment of learning potentialities characterized by conservation constitutes the base for teaching-learning processes.

The infant comes into the world equipped with a variety of reflexes. Piaget's assimilation, accommodation model provides a valuable general conception of how man's cognitive system might interact with man's external environment. It is a useful vehicle for thinking about cognitive development that is how the child's cognitive system might gradually evolve with maturation and experience. Piaget assumes that the development of the object concept is intimately linked to sensory-motor development as a whole and he, therefore, uses the same six stage framework in describing it.

The problem before us is whether there could be any relationship between the basal material attained by a child through conservation process and the final learning outcomes to be measured as the end product of the human potential.

The social learning processes accompanied with socialization and rearing practices prevalent at homes with the interactions of family members largely determine the nature and kind of lo knowledge and skill, that the child assimilates during childhood. This is further promoted by schooling and other social interaction. It is, thus, evident that the cognitive mapping and development is the consequences of the interactions with social models available at
homes and schools models as well as with the cultural values and ethical norms prevalent in the society. Perhaps, schooling and cultural patterns in which the child is matured and developed, play a significant role in the development of cognitive abilities and other psycho-social potentialities.

Numerous studies as cited above present briefly the amount of work that has been undertaken in the replication of Piaget's concept of conservation. Narayan Rao (1977) and Shukla, J.P. (1980) conducted significance researches on conservation principle of Piaget. However, they concentrated on school children with a view to know the effect of schooling on conservation. No study in India has yet been undertaken in which the non-school going children's abilities to conserve has been studied.

The present study, therefore, constitutes the important area of research in education, so far as the replication of Piaget's concept of conservation is concerned.

Though the welfare State Government has introduced free and compulsory primary schooling for all children of school going age, but the policy, as such been hardly operative with its full spirit in letters till the age of 14 years. The concept of non-school children is non-operative theoretically, but in it does exist. Large percentage of drop-outs, wastage, and stagnation at primary school speak of the sad affairs of primary schooling. Therefore, it was decided to study the non-school going children who are
characterized as irregular students who have attended the school to the extent of 30% or less as evident from their school attendance. Even from the points of view learning-environment, they could hardly be said to be 'students' in the real sense of the word.

1.20 **Scope and Significance:**

The present study on conservation of school going children and their comparison with their counterpart non-school going children available in urban and rural cultural setting has its unique significance. It has great social relevance from the points of view of socio-educational development in the country. Since children are said to be the richest resources of the nation, the study of their cognitive development that covers their conservation, properties, will unfold valuable attributes that may be fruitfully mobilized for the progress and prosperity of the country.

The present study, therefore, visualizes significant extensions and exploration of the work that exists in the literature on conservation and will certainly add to the body of existing knowledge in the current literature presented in Chapter II.

Broadly speaking, cultural differences may lead to a difference in cognitive functioning. A retardation in the development of conservation has been reported among children from less well-developed societies (Hyde, 1968, Greenfield, 1964, Price, 1968, Broonsong, 1968, Ukusare, 1972). In the
later study, Ukusare observed that 6 to 9 year old rural children not only performed poorly but also were found to lag behind their urban counterparts on the conservation of volume task.

Sometimes cultural differences are confounded with the content of tasks. "Various investigators have found that significant differences in performance can be related to the content of experimental materials". (Cole and Bruner in Berry and Dasen, 1974, p. 217). Thus, certain differences which are actually not due to the different rates/modes of cognitive development of children in various cultures, may be explained by the test content or testing method. Price Williams (1961) found that use of local materials resulted in the early acquisition of conservation among the Nigerian children. A similar result in the classification task was obtained by Gay and Cole (1969).

Studies of schooling effect on Piagetian tests performance across cultures, usually refers to the western type of schooling, where one is exposed to pictorial representations, printed materials, symbols and western modes of thought.

Goodnow (1962) suggests that schooling may not be important, at least, for conservation tasks. Goodnow and Bethorn (1966) did not find any difference between the schooled American and unschooled Chinese children on various conservation tasks but observed that only in the
combinatorial reasoning task, the unschooled Chinese children lagged behind the schooled American children.

Mermelstein and Shulman's (1967) study of two groups of 9 year old children, one attending regular schools and the other being out of school for four years, found no effect that can be attributed to regular schooling. In Delemos's study (1969) some of unschooled children showed conservation ability while some other schooled children did not even after 8 years of schooling which suggested that 'there does not, therefore, appear to be a direct relationship between the development of conservation concepts and western-type of schooling' (p. 266).

Several other studies on the other hand have found significant schooling effects, with the schooled children performing comparatively better than the unschooled children. Okonji (1975) observed an improvement in the conservation ability of the schooled Ugandan children which he attributed to an increase in age and grade in the school; however, no such improvement was found in case of unschooled children.

Page (1973) found most of the unschooled Zulu children to be pre-operational while only fifty percent of the schooled children were concrete operational. Most probably, schooling might have helped them to achieve the concrete operational stage. A positive schooling effect has also been reported by Philip and Kelley (1974), Kelley (1977), Owoc (1973), Halligan (1976), Sandgreen-Asberg (1976),
Streeter, Whiting and Landauer (1977), Laurendeauisendavid (1977) also found similar schooling effects on a variety of conservation tasks which involve active manipulation of objects at school (Ashton, 1975; Delemos, 1969).

Stevenson, Parker, Wilkinsor, Bonnevaux and Gonzalez (1978) also observed that the schooled 6-year old Peruvian children performed better on seriation tasks than the unschooled children of the same age.

Greenfield (1966) reported significant effects of schooling in the conservation performance of rural schooled 6-13 year old Wolaf children of Senegal. Fahrmeir's (1978) study of schooled and unschooled Hausa children's conservation ability showed a very small and inconsistent effect of schooling on conservation tasks. Nyiti (1976) also agreed with Fahrmeir's. Nyiti's experiments with Tanzanian 8-14 year old children observed the difference between the schooled and unschooled.

Devi (1980) investigated the development of number concept in 4-7 year old children in India using discrimination, seriation and numerical operation tasks and found that unschooled children performed poorly on numerical operations and seriation tasks, but no such difference was found in discrimination tasks. Cole and Scribner (1974) studied the effects of schooling on classification tasks of an African tribe. Results showed a very complex effect of schooling on this task (p. 118-21).
A few studies have shown schooled children's performances being poorer than unschooled children in conservation and other tasks (Kiminyo, 1977 and Armah and Arnold, 1977). Similarly Strauss, Ankori, Orpaz and Stary (1977) found that younger (5 to 9 years) schooled Arab children made more errors than their unschooled counterparts, whereas for the older (10 to 13 years) children the reverse was true.

The findings of the studies on the impact of schooling are inconsistent in nature; some showing no effect of schooling, some others showing significance effects of schooling and a few even showing negative or inhibitory effects of schooling.

The present study is, rather, relevant from the points of view of understanding the children's ability to conserve weight, mass and volume of solid and liquids. Such a study would help in developing and designing realistic learning experiences and acquaint the practicing teachers with the level of their conceptual attainments and conservational properties.

The following are the scopes of this study:

1. Replication of some of the properties of conservation of substance found in school going and non-school going children and recording their contrastive potentiality would enable all concerned to design their learning materials and teaching-learning processes.
2. The findings obtained on this study could set a developmental norm on various parameters of conservation in mass, weight and volume of solid and liquid substances.

3. The norms obtained by pupils of different cultures on conservation would reflect on one hand the nature of logical thinking and mental development while on the other hand it would facilitate the text-book writers and curriculum designers to present relevant instructional materials as learning experiences.

4. The knowledge and understanding of conservation of mass, weight and volume of solid and liquid would equip the practising teachers in class-room situations to adjust their teaching with the mental development of their pupils. This will introduce effective teaching-learning interaction in class room situations.

5. The identification of ability of pupils in a class room situation in conservation in mass, weight and volume of solid and liquid by practising teachers would help them in grouping and grading the learners for effective and efficient teaching-learning processes.

6. The results of the present study will help the school counsellor to identify the conserving potentialities among pupils and differentiate
them from those who are non-conservers. Such a
diagnosis of the talents of the pupils can later on
be used as criteria for educational guidance and
vocational placement. Thus, the present study will
help the teachers, counsellors and guidance workers
in educational selection, admission and vocational
placement.

In view of the wider scope and great significance
in the improvement of educational processes, refinement of
learning experiences and acceleration of the vocational
placement system, the present study seems to have great
educational implications and vocational relevance in
bridging the gap existing in the current literature on
conservation.

1.30 Purpose of the Study:

Studies have been conducted in different countries
on various conservation abilities and their relationship to
different background factors. Age has been observed to be
a significant variable (Martin, 1951). Elkind (1961) repli-
cated Piaget's study and found the general conservation
explanation to increase with age. Narayan Rao (1976)
observed conservation responses for mass, number, weight
and volume to vary significantly with age. Uzgiris (1964),
Vernon (1972), Gruen and David (1972) and Miller and West
(1976) and others obtained support for Piaget's theory of
sequential intellectual development and sequential attain-
ment of conservation of substance weight and volume on his
sixth grade students. A few investigators, however, have failed to find support for Piaget's age bound attainment of conservation (Feigenbaum, 1963; Anderson and Batzin, 1976). Vaidya (1969) observed correct response to the conservation of quantity to increase sizably up to the age of 7 years after which it increased only at a decelerate rate. Such a trend was not observable for substance and weight conservation.

No clear cut trend in sex difference in conservation has been observed, while Goldschmid (1967) noted significant difference along sex. Few other investigators (Turnure, 1975; Miller, 1976; Narayan Rao, 1976) have failed to obtain significant differences between performances of boys and girls on different conservation tasks. Silverman and Schneider (1968) noted a trend among girls to conserve earlier but the differences were not significant.

The findings of the studies on the impact of schooling are inconsistent in nature some showing no effect of schooling some others showing significant effect of schooling and a few even showing negative or inhibitory effects of schooling (Armah and Arnolds, 1977) pointed out that experience acting on the environment would not provide the appropriate background experience for the attainment of concrete operations. Okonji (1971), Delemos (1969) and Ginsburg (1978) noted that in the presence of adequate cultural stimulations for concept attainment schooling may not have significant effect.
The review of these studies as cited in Chapter II brings out the importance of different factors in conservation ability. Apart from age, certain background and environmental factors seem to be important. The present study was designed to analyse some of the factors other than purely maturational which operated in the acquisition of conservation ability of mass, weight and volume. Factors of age, sex, cultural differences and rural/urban background were considered.

Since the conservation of mass, weight and volume are significant variables in the processes of assimilation and development of scientific knowledge and skill, and since relatively very scanty, insufficient and insignificant literature is available on these topics, as evident from resume of review of relevant literature on conservation of substances, it is worth undertaking a study by which a gap existing in the literature could be adequately bridged.

The objectives of the study can be more explicitly presented as under:

1. To study the differences in conservation in mass, weight and volume of solid and liquid of school going and non-school going children.

2. To study the effect of schooling and non-schooling on conservation in mass, weight and volume of the solid and liquid.
3. To test the relative effect of age, sex, socio-economic status on conservation in mass, weight and volume of solid and liquid.

4. To study the effect of socio-economic status on conservation in mass, weight and volume of solid and liquid.

5. To examine whether pupils differ significantly on their conservation, performance in mass, weight and volume of solid and liquid when they are stratified in terms of their sex, schooling, age and socio-economic status.

These objectives of the study can high-light its educational significance and the developmental processes of the pupils. Impact of schooling on conservation is significant as reported by studies. The primary purpose of the present study is, therefore, to establish relationship between various measurements of conservation in mass, weight and volume of solid and liquid, as well as to study the differential levels and interactional dynamics of the pupils on the conservation performance. It will, further, high light to what extent the amount of conservation acquired and attained could help the educational processes to function adequately and effectively.

1.40 Statement of the Problem:

The review of the relevant studies and the objectives formulated above point out specifically the scope of the
present study and high light the nature and kind of study that could be taken up by the investigator. At the same time, the needs as specified above point out that the present problem could be stated around the study on conservation in mass, weight and volume of solid and liquid. The differential and correlational study of conservation in mass, weight and volume of solid and liquid could be a meaningful problem which may add to the existing literature on the conservation. The differential studies on conservation through schooling and non-schooling and other independent variables would help us in estimating the level of conservation. To what extent the pupils of different age group, sex, culture, socio-economic status and of educational maturity differ from each other, and how are they related to each other so far as these variables are concerned are some of the problems of our concern. Specifically and explicitly, the problems could be posed as under:

1. Whether there exists any relationship between various measurements of conservation in schooling and non-schooling pupils with respect to weight, mass and volume of solid and liquid?

2. Whether age, sex, socio-economic status and schooling have any impact upon conservation of mass, weight and volume of solid and liquid?

Thus, the present study which examines the correlational, differential and interactional characteristics on
conservation of mass, weight and volume of solid and liquid could be pin-pointedly stated as under:

"A Study of Conservation of School Children in Chhattisgarh Region".

1.50 **Formulation of Hypotheses**:

In the present study, conservation of substances (mass, weight and volume) are the primary dependent variables. Conservation responses have been collected for mass, weight and volume of solid, and liquid substances. Further, the study also aims at the interdependence of the properties of conservation on schooling and non-schooling subjects in relation to age, sex and socio-economic status.

The following hypotheses have been formulated to prove into the problem of this study scientifically.

(a) **Correlational studies**:

H₁: There exists a significant positive linear relationship between the scores on the conservation in mass, weight and volume of solids".

H₂: "A significant positive linear relationship would be observed between the scores on conservation in mass, weight and volume of liquid".

(b) **Interactional studies**:

H₃(a): "All three main variances, namely, sex (2), x Age (3), x Schooling (2) would have significant effects on
conservation of mass of solid substances, when separate ANOVA for each of the three dependent variables are computed, however, schooling would display the highest significant main effect whereas sex, the lowest".

\( H_3(b) \): "All the three main variances, namely, SES (2), \( \times \) Grade (3), \( \times \) Locale (2) would have significant effects on conservation of mass of solid substances when separate ANOVA for each of the three dependent variables are computed, however, the main effect of grade would display the highest significant effect whereas locale the lowest".

\( H_4(a) \): "All the three main variances, namely Sex (2), \( \times \) Age (3), \( \times \) Schooling (2) would have significant effects on conservation of weight of solid substances when separate ANOVA for each of the three dependent variables are computed, however, schooling would display the highest significant main effect whereas sex, the lowest".

\( H_4(b) \): "All the three main variances, namely SES (2), \( \times \) Grade (3), \( \times \) Locale (2) would have significant effects on conservation of weight of solid substances, when separate ANOVA for each of the three dependent variables are computed, however, the main effect of grade would display the highest significant effect whereas locale the lowest".
H₅(a): "All the three main variances, namely, Sex (2), x Age (3), x Schooling (2) would have significant effects on conservation of volume of solid substances when separate ANOVA for each of the three dependent variables are computed, however, schooling would display the highest significant main effect whereas sex the lowest".

H₅(b): "All the three main variances, namely, SES (2), x Grade (3), x Locale (2) would have significant effects on conservation of volume of solid substances, when separate ANOVA for each of the three dependent variables are computed, however, the main effect of grade would display the highest significant effect whereas locale the lowest".

H₆(a): "All the three main variances, namely Sex (2), x Age (3), x Schooling (2) would have significant effects on conservation of mass of liquid substances, when separate ANOVA for each of the three dependent variables are computed, however, schooling would display the highest significant main effect whereas sex, the lowest".

H₆(b): "All the three main variances, namely, SES (2), x Grade (3), x Locale (2) would have significant effect on conservation of mass of liquid substances, when separate ANOVA for each of the three dependent variables are computed, however, the main effect
of grade would display the highest significant effect whereas locale the lowest".

\(H_7(a):\) "All the three main variances, namely, Sex (2), x Age (3), x Schooling (2) would have significant effects on conservation of weight of liquid substances, when separate ANOVA for each of the three dependent variables are computed, however, schooling would display the highest significant main effect whereas sex, the lowest".

\(H_7(b):\) "All the three main variances, namely, SES (2), x Grade (3), x Locale (2) would have significant effects on conservation of weight of liquid substances, when separate ANOVA for each of the three dependent variables are computed, however, the main effect of grade would display the highest significant effect whereas locale, the lowest".

\(H_8(a):\) "All the three main variances, namely, Sex (2), x Age (3), x Schooling (3) would have significant effects on conservation of volume of liquid substances, when separate ANOVA for each of the three dependent variables are computed, however, schooling would display the highest significant main effect whereas sex, the lowest.

\(H_8(b):\) "All the three main variances, namely, SES (2), x Grade (3) x Locale (2) would have significant effects on conservation of volume of liquid
substances, when separate ANOVA for each of the three dependent variables are computed, however, the main effect of grade would display the highest significant effect whereas locale, the lowest”.

(c) Differential studies:

$H_{09(a)}$: Schooling Differences:

"The conservation scores in mass, weight and volume of solid substances of school going children would be significantly higher than those who are non-school going".

$H_{09(b)}$: "The conservation scores in mass, weight and volume of liquid substances of school going children would be significantly higher than those who are non-school going".

$H_{10(a)}$: Age Differences:

"Pupils of higher age group would conserve significantly higher in mass, weight and volume of solid substances than those at lower age group, thereby observing sequential decalag in the conservation of various substances".

$H_{10(b)}$: "Pupils of higher age group would conserve significantly higher in mass, weight and volume of liquid substances than those at lower age group thereby observing sequential decalag in the conservation of various substances".
Grade Differences:

H_{11}(a): "The conservation responses in mass, weight and volume of solid substances of pupils of the upper grade would be significantly higher than those at the lower grades, however, a sequential decalag would be observed in their conservation responses".

H_{11}(b): "The conservation responses in mass, weight and volume of liquid substances, of pupils at the upper grade would be significantly higher than those at the lower grades, however, a sequential decalag would be observed in their conservation responses".

Sex Differences:

H_{12}(a): "Girls regardless of age would conserve significantly higher in mass, weight and volume of solid substances".

H_{12}(b): "Girls regardless of age would conserve significantly higher in mass, weight and volume of liquid substance".

Sex-cum-Grade Differences:

H_{13}(a): "Girls regardless of age, grade differences would conserve significantly higher in mass, weight and volume of solid substances!"

H_{13}(b): "Girls of higher grade would conserve significantly higher in mass, weight and volume of liquid substances than those of boys of higher grade".
SES Differences:

H_{14(a)}: "Pupils belonging to upper SES group would conserve significantly higher in mass, weight and volume of solid substances than those belonging to lower SES groups".

H_{14(b)}: "Pupils belonging to upper SES group would conserve significantly higher in mass, weight and volume of liquid substances than those belonging to lower SES groups".

Locale Differences:

H_{15(a)}: "Regardless of sex, age, grade and SES differences, pupils coming from urban locale would conserve significantly higher in mass, weight and volume of solid substances than those in rural locale".

H_{15(b)}: "Regardless of sex, age, grade and SES differences, pupils coming from urban locals would conserve significantly higher in mass, weight and volume of liquid substances than those in rural locale".

1.60: Delimitations:

1. The study would focus only at the concrete operational period covering ages 7, 8 and 9 years which admits children enrolled in 2nd, 3rd and 5th classes of primary schools.

2. The present study deals only with mass, weight and volume of solid and liquid. The study has not been extended beyond these parameters of conservation.

3. The present study would focus only school going and non-school going children of age 7, 8 and 9 years old.
4. The present study would include both the locales i.e. urban and rural pupil population. The study has not been extended beyond these locales.

5. The representative sample of pupils would be drawn out from classes IIInd, IIIrd and IVth of primary schools located in the two locales under study.

6. The study will cover correlational, differential and interactional aspects.

7. The present study would design to test the effect of schooling (2), age (3), grade (3), locale (2), sex (2) and socio-economic status (2) and on conservation performance in mass, weight and volume of solid and liquid substances. No other independent variable has been incorporated in the present study.

8. The study would be conducted on the children of the concrete operational period (age group 7 to 9) enrolled in the primary schools. The urban locale would be represented by children in Baloda Bazar city whereas rural locale by children enrolled in rural schools of Baloda Bazar block.

9. Though the present study is not rigidly a traditional laboratory experiments, but in all probabilities it would adapt the experimental apparatus in the conduct of the study and control of variables as operated by Piaget. More or less, the study could be said to be replication of Piaget tradition.
1.70 Conceptual Framework and Operational Definitions:

Some of the concepts used in this study have been presented in Chapter III while others have been pin-pointedly explained in this Chapter. Before the relevant concepts on conservation are presented, an attempt is made to vividly distinguish between some similar but conceptually different concepts. Logically, it is worth while to differentiate concept of conservation from concept of concept, concept of concept formation, concept of concept attainment. The concepts would be precisely conceptualized as under.

1.71 Conceptual Framework of Conservation:

1.71(1) Concepts Associated with Conservation:
(a) Concept of a Concept:

The sensory gateways of knowledge are receivers of informations. Nerves are transmitters of knowledge to the brain. Perception causes the processing of sensory data for storage in the brain. Effective perception, thus, helps the learner to assimilate, accommodate, adapt and organise bits of discrete informations. Concepts are the consequences of learner's integration of relevant and related percepts. The most commonly used definition of a concept is that it is, "a common response to dissimilar stimuli" (Kendler, 1961).

Therefore, the term 'concept of a concept' refers to a generalised idea of a class of things. Sometimes a concept is the result of the process of conceptualisation but many concepts are formed through a series of operantly reinforced
discriminations, that is associations in which a label or word becomes associated with an increasingly discriminate class of things (Skinner, 1968).

(b) **Concept Formation and Concept Attainment:**

According to Bruner, Goodnow and Austen (1956), concept formation is the inventive act by which classes are constructed. On the other hand, concept attainment refers to the search for the testing of attributes that help distinguish them.

Therefore concept formation could be understood as referring to how concepts are initially acquired, whereas concept attainment would refer to a translation process in which a concept already in the individual's repertoire is associated with a new name of symbol.

(c) **Concept of Conservation:**

According to Piaget's theory of cognitive development involved through his 'unique' 'clinical method' there are clearly demarcated sequential stages in the cognitive development in an individual. They are: sensory motor, pre-operational, concrete operational, and formal operational stages, with clear qualitative changes or differences. Many competent studies have confirmed and validated this theory and indicated that the sequence is invariant and irreversible though the ages of onset and spread vary with circumstances.
Thus, the structure of knowledge in an individual can be described in terms of its organized contents and operational capabilities at each stage of development. The implicit logical in which the child proceeds in dealing with cognitive tasks makes it possible to determine the way new information is processed. Information which comes in but is not represented adequately, in the concepts and logic already in use (in other words the existing structure), forces whoever is receiving it to examine and perhaps modify his internal structures. This is the process of 'assimilation' and accommodation through which 'adaptation to new situations is made and continuous equilibration is attained resulting in further cognitive development.'

Thus, cognitive development is the development of ways and capabilities of understanding one's world representing it and dealing with it. It is, therefore, at the very core of one's function as a person.

As cognitive structures, develop the child gradually builds more permanent, stable, and inclusive picture of the world of the people in it, of himself, and their internal relationship. He realizes that certain properties are invariant inspite of transformation. In other words, conservation is ability to grasp the invariant aspects or properties of objects in the pace of diverse physical transformation.
Numerous technical words have been used by Piagetian school of Thought which help in the conduct, design and interpretations of the studies on conservation experiments. Standard definitions on such terms as 'horizontal or vertical decalage', 'compensatory relations', 'identify', 'reversibility', 'negation', 'reciprocity', 'schema', 'aliment', 'methods clinique' have been given in any standard textbook on Piagetian Psychology (Sigel and Hooper, 1968).

Understanding of intellectual development would have to concern itself with the acquisition of generalised concepts, actions and relationship in the environments. The ability to form concepts is basic to thinking and problem solving. Vinocke (1952) made a distinction between concept formation and concept attainment.

If 'concept' is associated with identification of an object, then conservation concerns with the development of the cognitive components of concepts. Conservation problems are concerned with the assessment of children's understanding that a quantity remains the same inspite of change in shape or form.

1.71(ii) Operational Definitions on Conservation:

Conservation: Conservation has been operationally defined in the present study as the total score obtained by an individual subject on various tests of conservation which have been employed to measure either conservation of mass, weight or volume of solid and liquid.
(a) **Conservation of solid:**

1. Conservation of mass of solid has been defined as the total score obtained by a subject on the measure employed in the present study to estimate the amount of mass conserved by a pupil when a solid substance is used to measure the mass conserved.

2. Conservation of weight of solid has been operationally defined as the total score obtained by the subject on the measure estimated to conserve the weight by making use of metals cube, balls and weight.

3. Conservation of 'volume' of solid has been operationally defined as the total score obtained by the subject on the measure of estimation of volume perceived through wooden cubes.

(b) **Conservation of liquid:**

1. Conservation of mass of liquid has been operationally defined as the total score obtained by the subject on the measure of estimation of mass of liquid presented in the beakers of different size.

2. Conservation of weight of liquid has been operationally defined as the total score obtained by the subject on the measure of conservation of liquid presented through jars of different size.

3. Conservation of volume of liquid has been operationally defined as the total score obtained by the
subject on the measure of liquid presented through vessels of different shape and size.

Theoretical foundation of the study constitutes the content of Chapter II.