CHAPTER 1

INTRODUCTION
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HISTORICAL BACKGROUND

1 Title and Meaning of the Terms:

The title of the thesis is suggestive of the scope of enquiry in the present investigation although it is true that the terms embedded in the title are not organised in a simplified manner. To be very frank, the title has been borrowed from Vernon (1957) who, under this general heading, reported three important studies in connection with intellectual stimulation. Naturally, then, the title appears rather general or wide in its structure but as one of the main aims of the present investigation is to study the method of classifying the intellectual stimulation in terms of different grades of schooling, it was decided to pick up this general title so that the present investigation might throw light on the relevant studies that may be discussed under this general heading. The meaning of the title would have been very clear, had we readjusted the terms in the following way: intellectual stimulation and intelligence during adolescence. That means, if intellectual stimulation occurs, there will be some change, whatever, in intelligence of the adolescents. To be more clear, the title suggests the effect (or influence) of intellectual stimulation on intelligence during adolescence.

It is therefore necessary to define the terms: (A) intelligence during adolescence and (B) intellectual stimulation during adolescence. Let us then define the terms one by one.
(A) Intelligence:

Breuer (1952) in his *Dictionary of Psychology* has defined the above terms. According to him, "intelligence is the relating activity of mind; insight as understood by the Gestalt psychologists, in its lowest terms intelligence is present where the individual, animal or human being, is aware, however dimly, of the relevance of his behaviour to an objective; many definitions of what is really indefinable have been attempted by psychologists, of which the least unsatisfactory are:

(I) the capacity to meet novel situations, or to learn to do so, by new adaptive responses, and

(II) the ability to perform tests or tasks, involving the grasping of relationships, the degree of intelligence being proportional to the complexity, or the abstractness, or both, of the relationships." Then, again, "adolescence" is defined by Breuer (1952) as "the period in human development between the beginning of puberty and the attainment of adulthood."

So, we shall have to survey the relevant literature on the picture of the development of intelligence during the beginning of puberty and the attainment of adulthood and coming to the most period of adolescence it would be if we survey the picture of human "intelligence" various thinkers and workers in the past. A precise and scientific, it would be more unconventional plan with the following picture, and then (iii) it
(1) Binet's view of biological-operational-psychological picture.

Brover's definition is quite broad to cover up the definitions given by psychologists holding different views. Psychologists have been testing intelligence with some success for over forty years but have failed to reach any definition agreed upon by all. Binet (cf. Vernon, 1950 P.3) regarded intelligence as a collection of faculties: "judgment, practical sense, initiative...... adapting oneself to circumstances."

Several psychologists have considered intelligence as the ability to profit from experience. In a famous symposium published in 1921, thirteen psychologists gave thirteen different definitions of intelligence. Vernon defined intelligence as the capacity for abstract thinking, Dearborn capacity to learn and Calvin adjustment to environment.

Fleishing (1932, P.193) summarizes the definitions given by various psychologists in the following manner:

"Stearn defined intelligence as the ability to adjust oneself to new situations. Terman took more account of the quantity of bonds or connections - the intellect capable of the highest reasoning and adaptability differs from the intellect of an imbecile only in the capacity for having more connections. Spearman suggested the significance of the ability to observe one's own mental processes, to discover essential relations, and to make further inferences thereafter. In addition, in view of the tendency to positive correlations between success in different types of intellectual activity, he postulated a hypothetical general factor underlying all cognitive performances of any kind. Knight added that "the man of high intelligence is one who, faced with a problem,
can seize upon the significant aspects of the objects or ideas before
him, and can bring to mind other ideas that are relevant. In Piaget's
view, intelligence is the most highly developed form of mental adaptation—
the word intelligence being a generic term to indicate the superior
forms of organization of equilibrium of cognitive structurings to which
all others tend. To Piaget it is important to note that intelligent behaviour
may admit of differences in kind as well as in degree — intelligent
activity consisting in grasping the essentials in a given situation and
responding appropriately to them; while Vernon (1955) would agree that
intelligence is a very fluid collection of overlapping abilities comprising
the whole of mental life.

Some of these definitions referred to by Fleming (1958) lay emphasis
on biological aspects of mental functioning, others on competence in a
variety of fields, and still others on the influence of environment and
on adaptation to cultural or social and emotional pressures. It is, therefore,
very relevant that we should elaborate the views which are very important
here in this investigation. Of these views, Piaget's and Vernon's are
the most important. Let us discuss them in the following to conclude this
section.

Piaget's work on the development of intelligence in children is
based on experimental findings. He formulated a theory of intelligence
consisting of two aspects. Braine (1959, Pp.1) summarizes Piaget's
theory of intelligence as follows:

"Piaget's theory has two aspects. First, it is a theory of
intelligence: Piaget believes that the development of intelligence consists
in the development of an ability to perform logical operations.
Second, Piaget makes specific statements about the ages at which certain type of reasoning develop. He claims that as children grow older certain specified groups of logical operations develop in the average child at given ages. In his studies the principal ages of transition are reported to be at 7 and 11 years, approximately. At around age 7, the operations of the spatial and class interpretations of the Boolean calculus make their appearance in children's thinking; at around age 11, the operations of the propositional interpretation appear. The appearance of the spatial interpretation are revealed in Piaget's studies by changes at around age 7 year in the child's manner of using measuring instruments and in his performance on a number of tasks supposedly demanding conception of, or reasoning about, spatial relations (Piaget and Inhelder, 1956; Piaget, Inhelder, and Szeminska, 1948). The operations of the class interpretation are revealed by the development of number concepts and by the disappearance of certain anomalies in the child's class concepts (Piaget and Szeminska, 1952). The appearance of propositional operations at age 11 is attested according to Piaget, by the child's performance on a variety of reasoning tasks (Piaget, 1935; Piaget and Inhelder, 1953).

Piaget's theory affirms that in the course of development there are ages of transition during which intelligences changes from relatively "primitive" to more "natural" forms. Such important changes in the nature of intellect should be manifest in longitudinal studies of the development of intelligence as measured by intelligence tests. In the past twenty years there have been several studies of this kind, of which probably the best known is the Berkeley growth study (Jones & Rayley, 1941).
In the past there have been two principal viewpoints about the development of intelligence. The classical view is that there is no change in the nature of intelligence during development, that there are no qualitative differences in thought and reasoning between early childhood and later years, and that intellect develops through steady and continuous quantitative increments from birth to, at least, adolescence. The viewpoint found its clearest expression in the doctrine of the "consistency of I.Q." At the time of the heyday of the classical view about 25 – 50 years ago, the exponents of the opposite viewpoint were largely limited to Piaget's group at Geneva, although the psychosocial view has this in common with Piaget's: the theoretical dichotomy between the "primary processes" characteristic of infancy and the "secondary processes" which are thought to develop approximately at the time of resolution of the Oedipus complex necessarily implies a transition in the development of intellect.

Many of the early criticisms of Piaget's work were advanced before the classical viewpoint had been generally discredited. These criticisms, therefore, tended to assume that there were no changes in the nature of intelligence during development and consequently where Piaget saw a research problem, his critics saw either no problem or a pseudo-problem. Thus, not only were Piaget's early theories (Piaget: 1926, 1928, 1930a, 1930b) severely criticized, but also, unfortunately, the problems on which he was working were largely disregarded. Consequently, most of these critical studies (Bruce, 1941; Daviau, 1957; Edberg, 1943; Huang & Lee, 1945; Isaac, 1930; Nisbett, 1933; Oaks, 1946) have tended to be unfruitful; they have led neither to alternative solutions nor to reformulations of Piaget's
research questions. They have largely confined themselves to demonstrating, often convincingly, that Piaget's theories, as he stated then, had serious flaws and that the evidence adduced by him was often a good deal less than cogent. Piaget himself admitted the validity of some of the criticisms of his early work (cf. Piaget, 1953 b, Pp.12).

The most revolutionary and widely accepted view today is that of Professor P.E. Vernon (1955 b), who in his presidential address on "The Psychology of Intelligence and G" classifies into three main groups the thinkers who have offered the definitions of intelligence. He designates them as (1) the operational, (2) the biological and (3) the psychological. "Operational writers consider that theorising about the nature of intelligence has proved fruitless; it is best regarded as " what the tests measure ", and should be investigated by factor analysis of the relations between different tests, and through empirical research into what tests enable us to predict about people. The biological approach contrasts the relatively mechanical responses of lower animals, based on fixed tropisms, reflexes, or instincts, with the more versatile and adaptable behaviour of higher species, including man. Thus many definitions stress capacity for profiting by experience, adaptation to environment, plasticity or ability to learn by trial and error, or, still more, by insight. The third category of psychological definitions includes various faculties, such as grasping relations, abstract thinking, reasoning, problem solving, originality, foresight, judgment all-round mental efficiency, etc.

Summarising his viewpoints Vernon (1955 a, Pp.194) suggests three types of intelligence. According to him the term intelligence can be ,
and often is, used in the very different senses, A, B, and C. He says 
"Intelligence 'B' is the all-round ability or mental efficiency that 
children or adults actually display in everyday life, at school or at 
work. Intelligence 'B' is very largely acquired. Intelligence 'A' connotes 
the underlying, inborn potentiality, that is some quality of the central 
nerve system determined ultimately by the genes. But this quality 
is purely hypothetical. It is a legitimate hypothesis, but we have not, 
at present any means of observing or measuring it, and have little prospect 
of ever being able to do so. Intelligence 'A', then, is the innate 
capacity to acquire intelligence 'B'. Intelligence 'C' is the I.Q. or 
Mental Age or other score obtained from a standard test, which may or may 
not correspond very closely with Intelligence 'B'. It too is largely a 
product of environment; and though it is ultimately limited by innate 
potentiality 'A', it certainly does not measure pure inborn ability ".

Again he sorts out the definition of intelligence in this way:

"Intelligence 'B' is not any one thing; it is a loose mixture of all 
sorts of overlapping abilities, which can fairly readily be broken down 
or classified under a number of relatively distinct headings by factor - 
analytic investigation. Moreover the mixture is very different at different 
age levels " . In this connection Vernon (1955 a) quotes Ebb (1949) who 
defines Intelligence 'B' as the intelligence which is recognised in daily 
life. This type covers the intelligent thinking capacities which are 
acquired during adolescence. These various intelligent thinking capacities 
do not develop fully without the aid of intellectual stimulation. Again 
he quotes Piaget (1950) who emphasizes in his recent book 'The Psychology 
of Intelligence' that intelligence is no one distinctive faculty, and can
not be reduced to grasping relations or abstract thinking, but is present in all adaptations of the organism.

(11) Factorial picture:

Actually there is much overlapping between psychologists giving different views on definition and concepts of intelligence. But it is very difficult to prove the truth of the statement unless we have a scientific approach to the definition of intelligence. In other words, the real and concrete definition of intelligence, better known as abilities, can be given in terms of factors. Vernon (1950) says, "the real need for factors arose as soon as we begin to discuss and name abilities or traits, and to compare the relative standing of different people on such faculties". He defines factor as a construct which accounts for the objectively determined correlations between tests in contrast to a faculty which is a hypothetical mental power. Factor should be regarded primarily as categories for classifying mental or behavioral performances, rather than as entities in the mind or nervous system.

But until the advent of factorial approach to intelligence, workers were busy with correlational techniques to study the problem of intelligence. Galton and Pearson devised the method of correlation to measure the agreement between two sets of scores. First, this method was applied by Wissler (1901) to measure mental functions. His results obtained from the analyses of tests of reaction time and sensory acuity showed scarcely any correlation with the grades of college students. Thorndike and others on transfer of training reinforced the view that abilities are highly specific. Manso (1922) and Perrin (1921) obtained extremely small correlations between different tests of manual skills.
Thomson has shown that the statistical fact that test intercorrelations can be largely accounted for by a single factor does not prove that such a factor represents any unitary power, or organ of the mind. It might also arise if the mind is thought to consist of an immense number of 'bonds', including inherited reflexes, acquired habits and associations, etc. Accordingly, Thomson's (1939, P.31) view is that factors over and above 'g' arise, partly perhaps from hereditary influences, but mainly because an individual's upbringing and education imposes a certain grouping on his bonds. Illustrating the view of Thomson, Vernon (1950, P.32) writes: 'The multidimensional factor is a rather strongly unified group because our society gives a fairly uniform education to all its members. It does not readily break down into separate verbal, number, speed, reasoning, attention, memory or other factors because the abilities covered by these names tend to be developed differently in different schools and homes, though partially distinct minor group factors can often be established, especially in fairly homogeneous groups such as university arts students. On the practical or kin side there is, as Anastasi points out, less cultural standardization, hence the kin pole is more heterogeneous and amorphous than v.s. ed. It would appear to be not so much a positive practical ability as an aggregate of all non-symbolic capacities, or of bonds that are not usually affected by primary schooling. Nevertheless, evidence is available to the extent that not only mechanical and spatial, but physical and manual, and some non-verbal 'g', perceptual and performance tests all have something in common over and above 'g'.
The kind of test which is most strongly saturated with this factor is the mechanical assembly test, presumably because this epitomizes, as it were, non-scholastic activities.

Spearman's Two Factor Theory: However, there are many of such evidences relating to the works with correlational techniques. But, in the fall of the present century, it was Spearman who in 1904 published his results obtained from correlations between sensory tests and estimates of intelligence which showed that: 'all branches of intellectual activity have in common one fundamental function (or group of functions), whereas the remaining specific elements of the activity seem in every case to be wholly different from that in all others'. He devised a technique, known as tetrad differences, to prove that no significant factors other than 'g' and specifics are present.

Spearman's book on 'The Abilities of Men' was published in 1927. In this book he has given his theories and of the numerous experimental findings obtained by himself and his students supporting the view. Vernon (1951, P. 13) summarizes Spearman's theories which show that neither the anarchic, nor the monarchic or oligarchic theories of the mind accord with the facts. The anarchic view reduces all abilities to a single capacity of general intelligence or 'common sense'. This would imply that they are all perfectly correlated, and would make no allowance for the unevenness of people's abilities along different lines. The anarchic theory is the view that the mind is ruled by a number of separate powers or faculties.

Although Spearman wisely refused to identify 'g' with intelligence or any other quality whose definition was controversial, he suggested
that it depends on the general mental energy with which each individual is endowed. He compared e-factors to a large number of mechanisms or engines, which could be stimulated by general mental energy or 'g'.

Although Spearman, in Britain, established for the first time the truth of the general factor 'g', actually the importance of additional sub-types of ability or group factors came into existence from the works of Kelley (1923), Stephenson (1932), El Kessy (1935), Alexander (1935), Burt (1940), and others.

Burt's concept of Group-factors: Burt (1909) suggested a sensory discrimination group factor beyond 'g'. He noticed verbal, numerical and practical group factors in school subjects, in addition to a general factor. He used a fundamental formula for the Simple Summation technique of analysis, later rediscovered by Thurstone and named centroid method, and developed techniques of assessing group factors. The verbal factor appeared to be two-fold, one part included the literary subjects, namely Composition, History, Geography and Science, the other included the simpler word-reading and spelling attainments. The practical group included Handwork, Drawing, Writing Quality and Speed. Substantially similar results were obtained with 613 ten-year children in 1929, except that the two types of verbal ability appeared to have amalgamated. For the average school subject the variance attributable to the general factor was 27.9 per cent., and to group factors 29.7 per cent. Another interesting point was that the general factor correlated highly, but not perfectly, with an intelligence test. This suggested that general scholastic ability is largely made up of 'g', but it also involves other qualities as interest.
**Keller's Work:** In 1925, Keller studied the inter-correlations of batteries of tests given to three groups of over a hundred pupils, aged around 13, 9 and 5½ - 6 years. He studied inter-correlations of batteries of tests. He established verbal, memory, routine memory, spatial, and speed factors. The general factor was prominently found in all groups. He explained this general factor in the light of heterogeneity due to differences in age or maturity, race, nurture, sex, etc.

**Stephenson and El Kessy:** Stephenson and El Kessy established group factors. In 1931 Stephenson tested a large group of 1037 girls, aged around ten to twelve. He gave seven verbal and eight non-verbal intelligence tests. A single factor 'g' was established by correlations between the non-verbal tests. The correlation between verbal tests and with non-verbal tests could establish 'g' and a verbal group factor.

**Illustrating their findings Vernon (1950) writes:** Stephenson's results do not disprove the alternative of another group factor of a spatial - perceptual nature in the non-verbal tests - that is the structure similar to that of Table I. In terms of variances (roughly calculated by Vernon) Stephenson's solution was:

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A solution which would be more favoured now-a-days, and which maintains the same communalities, would be

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El Keeney (1935) was the first man who applied the symbol 'h' for the spatial factor.

Alexander's Mark: In 1935, Alexander applied Thurstone's centroid method in his investigation for measuring abilities. He tested one hundred Scottish primary school boys and girls, aged around 11 to 12 years, American Secondary and Technical school pupils (16-17 years), and adult women in a delinquent institution. He gave large batteries of verbal and non-verbal intelligence tests. He obtained multiple factors which were closely related to a group factor pattern. In addition to 'g', he obtained 'v' factor in the verbal tests, and a practical group factor, which he called 'P' in constructive performance tests. On the basis of these results obtained from this investigation, he developed his performance test scale, consisting of cube construction, hose hooks and passalong, for measuring 'concrete' or practical ability. In the third group he found out another factor, which he called 'X' and identified it with the influence of personality and interests.

Multiple Factor Analysis established by Thurstone: Bart's simple summation technique of analysis was rediscovered by Thurstone (1931) and named as centroid method. He applied this technique of analysis to measures of attitudes and to ratings of personality traits.

Thurstone (1935) obtained eight main or primary factors from his long series of investigations of human abilities. He could not notice 'g' at all. The eight factors are as follows:

V  Verbal
F  Perceptual Speed
I  Inductive Reasoning
N  Number
Vernon's concept of Group Factors and Hierarchical theory:

Vernon (1950, Pp.14) strongly criticises Spearman's theory in the following manner: "The chief criticism would be raised nowadays against Spearman's view is that he failed to allow sufficiently for types of ability which, while less general than 'g', are certainly not specific. He admitted indeed that different number of tests, also different mechanical, and certain other types of tests show residual correlations over and above 'g'. But he ascribed this to the presence of common specific factors and insisted that such 'specific overlap' is very rare. Actually the notion of specific overlap is a contradiction in terms, and towards the end of his life Spearman did begin to recognise the existence of broad group factors such as the verbal and spatial, which arise from the overlapping of quite diverse s-factors. One reason why his own work, up to 1927, failed to yield evidence of group factors was that he and his followers were seldom able to test large populations. Hence any residual overlap that did appear was usually not statistically significant; it might have arisen from chance errors in the correlations. But Spearman was unduly cautious and did not admit that lack of statistical significance does not disprove the existence of additional factors; it only fails to prove it. A large-scale experiment was carried out by Brown and Stephenson (1933) with the avowed object to demonstrating the truth or falsity of the two-factor theory. Three hundred 10-year boys
were given twenty varied tests. Some of the pairs of the tests did in fact show correlation beyond that accounted for by 'g'. Some years later Eysenck (1940) re-analysed the correlations by Thurstone's method, without omitting any of the overlapping, and concluded that verbal, perceptual and spatial group factors were present, though their variance amounted only to 12.9 per cent., as compared with 41.2 per cent. attributable to 'g'.

It is noteworthy that if Spearman's strict view was correct, educational or vocational guidance with the aid of tests would be impossible. We could not measure aptitude for linguistic or mechanical work by linguistic or mechanical tests, since both types of tests would predict nothing but 'g'. In fact the only tests worth using would be the purest 'g' ones. By means of these we could determine the general level of occupation or education for which an individual was suited, but could not differentiate between different types of ability at this level. The only possibility would be to apply tests covering the specific factors in each prospective job. Thus an assembly test might measure the o-component of mechanical assembly work; but would throw no light on aptitude for lathe operating or other mechanical jobs.

In point of fact Spearman has proved much more nearly right than vocational and educational psychologists would wish him to be. We shall see later that group factors are generally more limited in scope than general, and highly specific, ones, so that it is indeed very difficult to differentiate types of aptitude ".

The hierarchical theory was first put forward by Burt, under the influence of M. B.tru. Burt (1949 a) describes its origin and application to abilities. Vernon (1950) says, "it is certainly an improvement both
on the original two factor theory and on the 'see-faculty' limitations and implications.

Vernon (1950 a), however, from the tests of recruits entering Navy and Army confirmed the importance of 'g'. In his eight analyses, 'g' was found to cover more than twice as much variance as all group factors combined (cf. Fig.1). After the removal of 'g', tests tend to fall into two main groups: The verbal-numerical-educational on one hand (referred to as visl factor), and the practical-mechanical-spatial-physical on the other hand (referred to as hinf factor). If the analysis is sufficiently detailed, i.e. if sufficient tests are included, these types themselves sub-divide. The visl factor gives minor v and n (numer) group factors. In further analyses (cf. Vernon 1950, Fp.23) hinf splits similarly into mechanical information, spatial, and manual subfactors.

\[ \text{Fig. 1} \]

\[ \text{Fig. 1: Illustrating Hierarchical Structure of Human Abilities.} \]
(iii) Intelligence during Adolescence:

We have covered up a fairly selective, yet wide, range of the psychological literature on 'intelligence'. Now let us survey the position of 'intelligence during adolescence'. We have already defined 'adolescence' (cf. Desyer, 1952). The term "adolescence" (cf. Jersild, 1937) is used in the present problem to denote a period during which the growing person undergoes transition from childhood to adulthood with reference to his cognitive aspect.

During adolescence the normal young person advances on many intellectual fronts. He continues during the teens to gain in intellectual capacity and power. He grows in ability to learn. He becomes better able to deal with abstract ideas. While growing in the ability commonly measured by intelligence tests, the adolescent also continues, if all goes well, to gain in breadth of knowledge, in depth of understanding, in practical wisdom, in judgement, and in common sense.

Jersild (1937, Pp. 2) explains the importance of adolescence period in this way "Adolescence is a time of great promise but much of the promised land is a wilderness that is untried, uncharted, and unknown. It is unnecessary for the young person to find a path, to build a road, to establish, as it were, a settlement of his own, before he can be at ease in the promised land. No matter how much help his elders may try to give him they cannot fully open the way or prepare a place for him. The adolescent's task is not simply one of dealing with the external environment and other individuals but one of seeking to discover himself, his reach and his limits, and his role in the world in which he lives."
Again regarding the importance of relationship between intellectual abilities and adolescence Jensen (1957, pp. 74) continues, "there are many young people, who, during adolescent years, attach increasing importance to their intellectual abilities when they directly appraise themselves. Moreover, as we have implied, the young person's intellectual abilities have an important indirect bearing on his appraisal of himself. From an early age his experience of success and failure has been influenced to a prominent degree at school and also at home and in the community, by his ability to acquire the many intellectual skills children in our culture are taught. His ability to learn things calling for mental ability influences the way others regard him and this, in turn, influences his regard for his own worth. Sometimes even the young person's conception of his "goodness" or "badness" is influenced by the fact that he has high or low intelligence. Often the youngster who is regarded as "good" is one whose mental ability enables him to learn quickly the lessons parents and teachers want him to learn. Failure to learn or slowness in learning is often treated with impatience by adults, as something that should be punished as a sign of disobedience or lack of moral character.

In subtle ways the growing person's ideas concerning his intellectual ability will influence not only his conception of who and what he is but also his anticipations and hopes concerning what he may become. If an adolescent is convinced, rightly or wrongly, that he is rather stupid, this conviction may close many avenues of life to him that might otherwise be open. Even in the late elementary grades he may look upon himself as one who probably cannot take a full academic program in high school and should not even think about going to college. The more his thinking is dominated by this idea, the more he will tend to shut off lines of vocational choice about which he
might otherwise speculate and daydream."

This has been recognized that some of the changes in thinking and concept formation take place when a young person matures intellectually; for example, (i) ability to deal with the generalizations, (ii) ability to deal with the abstractions, (iii) ability to deal with the concept of time, (iv) ability to deal with the ideas without immediate personal involvement and (v) ability to make decision, etc.

Under this heading we will consider some of the intellectual developments during early and later adolescence. Jersild (1937, Pp. 76) summarizes several characteristics of the adolescents' mental operations, 'generalizations', 'abstraction', 'concept formations', etc.

Regarding the increased ability to generalize, one very noticeable characteristic of the mental operations of an older person, compared with a younger child, is the ability to deal with the generalizations and more inclusive classes or categories of thought. This is shown, for example, when children express their wishes. The younger the child, the more he tends to think in terms of the concrete things, such as bicycle or a baseball glove. As he grows older he tends to think in more inclusive terms (cf. Jersild and Harms, 1949).

A corresponding trend towards a more generalized type of thinking appears in the fact that the younger child tends to see things on personal level, while the older child sees more on a conceptual level. In studies of children's reactions to a war situation (cf. Bender et al., 1942; Preston, 1942; Jersild and Haiga, 1943) it was observed, for example, that younger children tended to describe war in terms of concrete happenings, such as the damage that had been done by bombing or the fact
that butter was rationed. A large portion of children of about teen age, on the other hand, saw the war in terms of larger concepts: the damage from a particular bombing represented not an episode but an example of a larger wartime policy. The scarcity and the lack of butter was incorporated into a more inclusive idea concerning scarcity of material or destruction of materials in wartime.

However, before closing this discussion it would be wise on our part to take into consideration Vernon’s (1950, 1955 A) picture of adolescent abilities in terms of factorial concepts, as depicted by Levitt (1953), in the following manner:

Verbal educational abilities (the vised group), and spatial mechanical abilities (the kmi group), increase during adolescence, provided the individual is receiving adequate stimulation in these fields. As for later adolescence, the vised abilities (other than reading abilities) remain stationary or decline somewhat, in the years immediately following school-leaving, unless there is further training or relevant experience; while it is possible that the kmi abilities increase until the late teens with or without much training or experience. Teachers, Levitt advises, should note that the more homogeneous the children in a secondary-school class are in respect of general intelligence, the more important special abilities become in determining the relative progress that pupils can make in a school subject.

(B) Intellectual stimulation during adolescence

 Brewer (1952), in his dictionary of psychology, defines intellect as "mind in its cognitive aspect, and particularly with reference to the higher thought processes". Here by ‘higher thought processes’ Brewer means intelligence and when intellect covers mind in its cognitive aspect,
etc., intellectual stimulation would naturally mean mental stimulation with reference to cognitive aspect or higher thought processes (i.e., intelligence). Thus mental or intellectual stimulation may be aroused by any suitable environmental factor. That it is to say, it could be either length of schooling or quality of schooling or home upbringing or institutionalizations or sex, age or any kind of socio-economic stimulus.

As the present investigation is concerned with the quality of schooling it would be more coherent if we quote some of those important workers who took the term to mean practice (i.e., roughly meaning an aspect of education or schooling). Vernon (1957) reported three investigations and while discussing 'intellectual stimulation' he meant by the term "not quantity but quality of schooling during adolescence". Lange in America and Hessen in Sweden showed that length of schooling in adolescence and early adulthood has an important influence on intelligence. Levall (1955) studied the intellectual deterioration, etc. By intellectual deterioration he meant lack or forgetting of schooling or education either in one particular intellectual aspect or in several such aspects. After Levall if anybody is to be referred to here, it seems that Harris (1949) merits a place in this context. His study suggested that educational attainment tends to lapse rapidly after leaving school except in so far as they are used in daily life. There are still number of workers who may be referred to in this context. However, as the purpose of the present section is to survey as far as possible, within the limitations of space and time, the intellectual stimulation aroused by any environmental factor or stimulus, such as sex, age and other socio-economic conditions, let us discuss them...
one by one to have a clear idea about the tremendous influence which these factors or the conditions exert in connection with intellectual (or mental) development. It seems quite sufficient to quote mainly Vernon (1949) who has wonderfully summarized with his masterly comments various studies of intellectual differences with age, sex and other socio-economic factors which are briefly discussed below:

(1) **Age**

(1) 'g' factor increases on the average at a steady rate up to about 12 years and the rate of decline is observed after the age of 15 when a maximum is reached, though on some tests there is little if any increase after 13 and on others rises have been reported even beyond 18-20 (cf. Bearborn and Rotinay, 1941).

(2) Between twenties and sixties there is a progressive decline on tests of 'g' involving abstract reasoning and speed of mental manipulation, though on other tests of what has been called 'crystallized' intelligence, such as vocabulary and information, the level is better maintained (cf. Cattell, 1943; Brody, 1944).

(3) Vernon et al. (1949 b) have discussed (cf. Fleming, 1949) that 'longitudinal' studies of particular children often show great irregularities of mental growth, with spurts and plateaux attributable partly to emotional adjustment or maladjustment, partly to the stimulating or inhibiting effects of the child's home and school environment. The same may be true of adults, but longitudinal studies are much more difficult since an adult cannot be re-tested many times without his scores being affected by 'sophistication', and by his attitudes towards the investigation e.g. growing hostility.
(4) Educational attainments tend to be forgotten rapidly after leaving school, except in so far as they are used in daily life. Thus, Morris (1940) finds that scores on linguistic tests may rise till about 40 years, but arithmetic achievement declines in most persons other than clerks who practise arithmetic in their job. The performance of adults on intelligence tests, according to Jarige (1943), is also affected by education beyond 14 years, though, as Garrett (1946) points out, results on a verbal test do not necessarily mean that intelligence itself alters. Adults with a university education, tested at 14 years, were about two years superior in mental age to others at the same intelligence level when aged 14 years who had received no secondary or university schooling. An investigation by Miles (1932) also appeared to show an earlier decline in intelligence among adults who had only had elementary schooling, and Gellard (1949) claims that superior occupational groups retain their intelligence better than lower ones.

(5) While discussing changes with age from 14 to 18 Vernon et al. (1949) write that he, during 1946-47, administered several S.P. tests on a sample of 1200 14-year olds leaving school at Glasgow. He observed that percentage increases or decreases in this group were very different from those found among boys of superior intelligence whose education was continued. There is only a negligible increase in the all-round ability measured by Binnett Mechanical test or in the 'g' measured by Abstraction Test. On educational test there is a serious loss.

Further summarizing the facts Vernon et al. (1949) write that average performance of a group of adolescents or adults on psychological tests varied greatly with the type of ability tested, with age and with any schooling or other training the group has received, or forgotten.
Anastasi (1938, p. 460) has clearly discussed the influence of sex on the global scores on intelligence tests (cf. Bigg, 1940). In her opinion, "whether boys or girls obtain higher I.Q.'s depends upon the items included in the test. When no deliberate effort has been made to exclude sex differences from the test, there has generally been a tendency to favour girls. This follows from the fact that intelligence tests consist so largely of verbal items (cf. McCarthy, 1930, 1953, 1954), on which girls are superior. In so far as the tests depend upon memory, girls have an additional advantage. Moreover, many intelligence tests are validated against school achievement (cf. Truaxer, 1954), in which girls also excel, especially at the elementary school level. It is apparent from the above discussion that question of which is the more "intelligent" sex is somewhat ambiguous. Anastasi herself is well illustrated by the 1937 Stanford-Binet which is the revision in current use (cf. McLearen, 1942). Items that showed a large sex difference in percentage passing were excluded entirely, on the assumption that sex differences on such items may be specific to the task in question and may simply reflect differences in experience and training. Among the remaining items, those slightly favouring girls were balanced against others which favoured boys to an equal degree. The fact that no significant sex difference in I.Q. was found in the standardization sample of the 1937 Stanford-Binet is, therefore, an index of the care with which this procedure was followed, and has little or no bearing upon sex differences in intelligence.
Occupational and geographical differences:

Few large-scale studies of civilian occupational differences were carried out (cf. Vernon, 1949, p. 193). In this study the age distribution was held constant in all groups.

It was observed that the range of scores from clerks at the top to labourers at the bottom is rather small, corresponding in terms of I.Q. to a range of about 110 to 90. Verbal Tests, such as Army Alpha and Cattell's scale III give a much wider range than does Matrices. This bears out the contention that occupational suitability and, therefore, occupational level, depends on vited factor and as well as on 'g'.

Regarding the geographical distribution of intelligence, Vernon et al. (1949) observed the findings of the studies conducted over nine very heterogeneous areas into which Naval recruiting centres were grouped. They observed small yet significant differences indicated by the mean scores, also they observed differences between Glasgow and Manchester, between Scottish Highlanders and Glasgow Irish and also observed differences between boys of Roman Catholic.

Regarding socio-economic status and intelligence, studies of Neff (1938) Jordan (1933), Leesanger (1940), Freda (1939), Becknell (1939) and many other investigators have indicated interesting results which may be valuable references to our present study. Regarding locality, community or race discrimination, the works of Elsberg (1931), Lealy (1936), Rizzman (1937), Thorndike et al. (1942) and Thorndike (1931) would be of great interest to the present study but due to various limitations these works could not be discussed here in details.
II Previous Researches: Methods and Tests Used:

A) Methods:

The fact that changes in environment can bring about changes in capacity to do intelligence tests has been, as far as possible within the limitations of space and time, clearly discussed in the previous section of this chapter. But as previously no mention about the design of experiment or investigation was made, the present section deals with the same. Before starting with the present investigation it is desirable that we should make few points clear beforehand.

In the previous section we have discussed that now-a-days intelligence does not mean a single faculty or power and instead of using the word in place of 'intelligence' we may conveniently use 'abilities' as classified under several factors. Later in this section we will notice that while measuring intelligence, the workers have expressed their estimates either in terms of global scores on tests (i.e. I.Q.) or in terms of ability factors present in the tests. This remark was thought desirable at this stage so that no reader might lose his sense of continuity in the discussion. From the survey of the researches we may broadly classify the methods of the previous workers under the following heads: (i) Longitudinal method (i.e. by testing-re-testing technique); (ii) Cross-Sectional (i.e. cross-cultural, cross institutional, etc. technique). Although the statistical technique of agreement (i.e. by correlational methods) and of the difference (i.e. by differential method of variance etc.) have been frequently referred to by the workers, it seems necessary not to regard this statistical approach as a separate technique as it is liberally used by the
followers of both the techniques.

Hence, let us survey in brief the relevant researches classified under the above two main headings so that from the discussion of the techniques we will find their defects or merits and can design our own investigation that will benefit from the mistakes, if any, of the previous researches.

(1) Longitudinal (i.e. testing - re-testing technique)

Dearborn and Rotnsey's (1941) work: They summarise most of the American work and show, from their Harvard Growth study, that practice effects are generally not very large, but that they do occur with some-not-all-group tests. They do not seem to be confined to any particular type of test material. With repeated testing the effects tend to diminish, i.e. the greatest increase is from the first to the second test. These authors also claim that practice on one test affects that test only and does not extend to other slightly different tests.

Commenting on this Vernon (1949) says "some, but not all of these results are confirmed by British investigations, and we would suggest that the difference lies in the greater degree of 'test-sophistication' among American children and adults. Not only do they habitually take more intelligence tests, but also most of their examinations are new-type ones, which are made up of questions similar to those in intelligence tests. We would therefore expect rises to be larger in this country, and spreading to occur from any one test to other dissimilar ones ".

Rodger's (1936) Work: He applied six parallel tests at fortnightly intervals to 95 British 11-12 year old pupils and claims that the average increase was about 1 per cent., or 1 I.Q. Point, per test.
His figures suggest, however, a rise of 3.8 per cent. between the first and third tests and thereafter no further change. The Honey House tests which he used have a fore-exercise or practice sheet, which probably minimises the susceptibility of the tests themselves to practice. Pedger also states that the rise was greatest (1½ points) in brighter children of I.Q. about 120, and lower (½ point) in dull children of I.Q. about 80. Dearborn and Rotnsey make a similar claim. It is a nice theory that the most intelligent, because of their intelligence, improve most. But all our evidence, cited below, shows the greatest rises among those scoring least.

**Mellen's (1943) Work:** He likewise gave sets of six tests to small groups at weekly intervals and confirms the diminishing effects of repeated practice. He concludes that when tests vary initially in their previous familiarity with tests, a single test will act as a sufficient 'shock-absorber' to bring them all on a par. He also noted, when giving parallel versions of a test, that the effects on Form B of actual coaching on Form A were no greater than the effects of merely doing Form A in the ordinary way.

**Dempster's (1938) Work:** He found that some types of test are much more affected by practice than others, non-verbal and spatial items apparently being more susceptible than most verbal items (cf. Recent researches by Nais, Wallace and Carpenter reported by Vernon, 1949).

**Vernon's Report:** Vernon et al. (1944), referring to work in the Forces, reported that the Matrices test was re-taken by 537 seamen in an entry establishment one to six months after it had been done at recruiting centres. The average rise was 4.7 points or 8.6 per cent.
But as the reliability of this test is rather low, the correlation between the two sets of scores being only .77, the alterations were irregular. Some men actually declined on the second occasion, and the total range of changes was from 25 points increase to 13 points decrease. A natural consequence of what is called the regression effect is that very high scores showed least improvement, very low scores most.

An experiment in the Army where the same test was re-taken by 277 men after only one day yielded almost the same rise, and other later work suggested that practice effects are much the same after several months as they are immediately. But a possible alternative explanation is that military or Naval training, including the taking of proficiency examinations, also helps performance at tests, hence a rise after six months may be partly due to this and only partly to recollections of the previous testing. Sometimes, of course, the training received is directly relevant to the abilities tested, e.g. mathematical or mechanical. This would account for the different findings in the major Naval and Army experiments on test reliabilities and re-test rises.

Another experiment reported by Vernon et al. (1949) was based on re-testing 500 men, representative of the total intake, after eight weeks of primary training (which involved little or no book work). In Navy, however, 500 air mechanics were re-tested after six to eight months of mechanical training. The percentage rises along with the tests used are as follows: (1) Abstraction (Army: 2, Navy: 3.2); (2) Bennett Mechanical (Army: 4.6, Navy: 10.4); (3) Arithmetic Mathematics (Army 2.1, Navy 6.6); (4) Squares (Army 0.0, Navy 10.6); (5) Verbal (Army 3.3, Navy -); (6) Clerical (Army 6.6, Navy -); (7) Assembly (Army 6.0, Navy -).
(8) Morse Aptitude (Army 3.9, Navy -);
(9) Agility (Army 7.2, Navy -).

Despite the longer interval their increase on Tests 2 and 3 are far larger. Squares (Test 4) is slightly larger, but Abstraction (Test 1, not taken in the Army) was probably uninfluenced by their training, hence it shows only a small rise.

Vernon (1957) reported three studies out of which one was that of Lovell (1955) who carried out the work under the former's supervision. Hence, the first two studies are being reported to show the method and the tests used along with the conclusions reached by him. These two studies are extremely important in this investigation as the present study follows closely the instructions given by Vernon (1957) in these two studies.

1st Study: In 1955 he re-tested almost all the boys in a large English city at the age of 14 with the Neyes House Adult Intelligence Test, who had been tested at the time allocation to secondary schools 3 to 4 years earlier with a standard Neyes House Test. Thus two I.Q.s were known for 865 boys who had attended one or other of three grammar, one technical, and ten modern schools.

The resulting gains or losses clearly suggest that the grammar and technical schools do more to stimulate the intellectual development of their pupils than do the modern schools, and that some of the modern schools are more successful at this than others. The former schools show relative rises equivalent to between 6.9 and 9.0 points (average 4.9), and the modern schools show changes ranging from + 0.4 to - 5.9 I.Q. points (average -1.9 points).
Among the ten modern schools also an F - ratio of 4.75 was obtained where a figure of 3.1 would be significant at the .001 level.

From the results obtained Verma (1957) concluded: "There is no justification for supposing that, in some modern schools, boys have actually declined in intelligence. They have all developed intellectually from 11 to 14; but it is true that those in some schools have developed faster than others. Secondly, it would be false to attribute the changes wholly, or even mainly, to the schools as such. Boys in grammar schools tend to come from better homes, where they have better facilities for home work, and are encouraged in many ways. Those in modern schools were often come from poorer homes where the parents may be uninterested in, or even opposed to, education. Thus the attitudes to study among pupils in different schools will depend largely on environmental factors outside the school. Nevertheless it is extremely probable that differences do exist in the traditions and routine of the schools, in their staff - pupil ratios, in the provision of buildings and equipment, and in the degree to which the staff either stimulate the pupils or allow them to become apathetic or resentful. The Education Officers of the city, before they saw the above results, were asked to rank the 14 schools in order of 'stimulatingness'; and their judgments correlated as high as + 0.767 with the actual order of relative gains or losses."
2nd Study: In this study the scores on intelligence and several attainment tests (namely, (1) Arithmetic and Mathematics problems and knowledge of operations, (2) English Composition, (3) Abstraction test of intelligence, (4) General knowledge of current affairs, Science, art, etc., (5) Reading Comprehension, and (6) Spelling, of 167 14-year-old pupils were analysed. Of these 43 attended the grammar schools and 124 the modern schools of a small English country town. No scores obtained at 11 years, on allocation to one or other of these types of schools, were known. However, the differences between the mean of the schools at 14, if expressed in terms of sigma scores, will tell us on which tests there has been relatively greatest or least divergence; in other words, which test tend to show greater or lesser effects of the differing stimulation provided by the two types of school (plus the accompanying out of school environment).

As might be expected, the grammar schools forge ahead of the modern schools to the greatest extent in Mathematics. There is least superiority of improvement in reading comprehension and spelling, presumably because the modern pupils also receive a good deal of practice in these skills. Indeed differences approximating 1.2 sigma would be anticipated purely on the basis of the selection which occurred 3 to 4 years previously. However grammar school education would seem to have brought about small, though appreciable, superiority in English Composition writing, General Knowledge, and in the reasoning capacity measured by the Abstraction Test. Thus the findings of the first investigation cannot be explained simply by gains in mathematical and English
attainments abilities that would normally be classified under intelligence are also affected.

(11) Genes - Sectional Studies:

As our purpose here is to note down the methods and results, it is not binding on our part to begin with the first work reported in the history. Hence, from our point of selective display, let us discuss the researches relevant to the present investigation:

Keenen et al.'s (1927) twin: Keen Keenen, Freeman and Helsinger found the correlation between the I.Q.s of identical twins has been found to be as high as .90 or .86. The average difference between their I.Q.s has been found to be 5 points in the case of identical twins reared together, but the range of the difference may be from 0 to 20 points.

Robert's (1940) study: Out of 3,400 children of school age is investigated the siblings of the brightest 4 per cent, and the dullest 4 per cent. He found that 62.3 per cent. of the siblings of the brightest were bright and 6.6 per cent. were dull, whereas of the dullest 36.7 per cent. of their siblings were bright and 56.3 per cent. were dull.

Wellsen (1921) study: He compared the performance of children who had had nursery school training with that of children who had not and she declares that 1 A permanent change in intellectual standing can be affected in one to one-and-one-half years that will last four to eight years.

Lewis's (of Royal Commission on population vol.7, p.45) study: We found that the level of intelligence in some villages, judged by the results obtained with group tests given to the school children, compared very favourably with that of urban population.
The disposes of the hypothesis that all migrants are more intelligent than the stay-at-homes, and that therefore the superiority of urban scores is due to selection. Clearly, sometimes it is the go-ahead who migrate, sometimes those who are unsuccessful, and sometimes migration is due to factors which affect bright and dull alike such as a famine or the arrival of the bull weevil.

Freeman, Follear and Mitchell's (1928) study. They investigated some 401 foster children in and about Chicago. They found that there was a difference between the I.Q.s of the ones brought up in poorer homes and those brought up in better ones. When 74 of them were re-tested after they had been four years in their foster homes the ones who went to the 'better' homes had gained 5.3 points while those in the poorer ones had gained 0.1. The effect of the environment is greater the younger they were adopted, and when they were adopted into different kinds of homes the correlation between their I.Q.s was reduced to .19, which contrasts with the average correlation of siblings brought up together which is about .50. They go so far as to say that the 'maximal effect of the best home environment rises the I.Q.20 points.' Indeed it was found that when the average I.Q.s were classified in accordance with the occupation of the foster father, the order in which they were lined up from highest to lowest corresponded to the order found in all the studies relating the intelligence of children to the economic status of their parents. This piece of evidence is slightly weakened by the possibility that the foster parents of the professional class may have chosen the brightest children for adoption, but there is no evidence that they made any determined effort to do so.
Burke's (1928) study: She compared 214 foster children with 105 children living with their parents. She found in the first place that the correlation of test scores between foster-child and foster-father was .07, between foster-child and foster-mother .19, which are lower than those found by Freeman and his colleagues (.37 with foster-father and .38 with foster-mother), and that the correlation between children and their parents in the control group was .45 for child-father, and .46 for child-mother. This might be taken to indicate the operation of inheritance. The correlation between the I.Q. of the foster children and the quality of the home was .42, which is like Freeman's estimate of .43. The correlation of I.Q. and measurable home environment was subjected to further analysis and as a result Burke arrived at the estimate of the relative weights of home and innate factors: about 17 per cent. for the home, about 33 per cent. for parent intelligence, while the total contribution of innate and heritable factors is probably not far from 75 to 80 per cent.

Commenting on the results obtained by Burke, Gwinn (1932) says "that this celebrated estimate is quoted with approval by Sir Cyril Burt (1946), but it is not universally accepted. One of the difficulties is that Burke had to calculate her correlations on 'measurable' features of home environment, and that does not provide an entirely satisfactory basis for so definite an estimate; in any case, what about school, friends, neighbours and so on? Burt himself, in the same paper gives a rather more restrained estimate of 'one-half' at the very least attributable to 'nature' as distinct from 'nurture'.
Burt's (1921) Study: Expressing complete dissatisfaction with
the conventional methods of experimentation in connection with the
influence of educational attainment upon tests of intelligence, Burt
(1921) suggests a statistical technique of 'partial correlation' to
eliminate the influence of one factor on another, keeping a third
factor constant. For example, age factor can be eliminated to show the
influence of educational attainment on intelligence. While eliminating
the factors, influencing the individuals' scores on Binet-Simon
scale, obtained with this technique, he records the following observations:

"For every child in an entire school, comprising just over three
hundred pupils aged between seven and fourteen, I have secured the
following measurements: first, the child's age; next, his school attainments,
measured by an educational examination, the results being revised
by the teachers; thirdly, his intelligence measured by special tests
of reasoning, the results, again being checked by the teachers; and,
lastly, his mental age, given directly by the present version of the
Binet-Simon scale, uncheckd and unrevised."

Lovell's (1955) study: He applied a large and varied battery
of tests to four groups of about 50 persons each, two aged 14 and
two aged 17-20. One was being educated in a good and stimulating
modern school, another in a Further Education Centre. By contrast
the third was attending a depressing and unenterprising modern school,
and the fourth consisted of young criminal who had likewise received
little intellectual stimulation from their schools or jobs. The tests
used by Lovell were as follows:

Test 1. E. I. I. P. Group Tests 70/2 and 70/3.
Test 2. Watts - Vernon Reading Test.

Test 3. Arithmetic Test. This consisted of fifty problems similar to the problem section of the Neway House type of Arithmetic Test and thus similar to the Wesleian - Reifens Arithmetic Test but much longer.

Test 4. A shortened version of the Wesleian Vocabulary Test.

Test 5. A group version devised by the writer of the Wisconsin Sorting Test. This test was scored in two ways - for the principle of classification ('labels'), and for sorting the pieces correctly ('pieces').

Test 6. A group version devised by the writer of a sorting test suggested by Visscher (1911). This test was scored in two ways as in the case of Test No. 5.

Test 7. A group test prepared by the writer based on the Trist-Engelmann test (Semenoff, 1933). This also was scored for the principle of classification as stated, and for the pieces correctly classified.


Test 9. A non-verbal classification Test. The test was scored for the underlining of the correct figures and for stating the principle of classification.


Test 11 Test of Memory for stories.

Test 12 Babcock Test of Memory for Sentences.

Test 13 Test of Memory for Designs including fourteen of the designs used in the Bender Visual Gestalt and Ellis Tests.

Test 14 Creative Effort Test. The writing of 239 forward and then in reverse as

Test 15 Creative Effort Test. The writing of 239 forward and then in reverse.

Test 16 Creative Effort Test. The letters were written first in the normal way and then upside down.

Test 17 A Creative Effort Test in which there were 46 very simple addition and subtraction exercises but whenever there was a plus sign the testee had to subtract and vice versa.
Test 18. Similar to Test 17 but consisting of interchanged multiplication and division exercises.

Test 19. Creative Effort Test - Seasons. Here the subject had to associate a month of the year with a season, e.g. August with Summer, but sometimes the process had to be reversed, e.g. April had to be associated with autumn.

Test 20. This was the first of three tests which in themselves are entirely original although of the type used by Lucas. It involved the simplification of very easy fractions and was in two parts the first of which measured basic speed of working.

Test 21. Hidden Words. The test was in two parts, the first of which measured the basic speed of working.

Test 22. Beginnings and Endings of words. Again the test was in two parts, the first measuring the basic speed of working. In each of tests 20, 21 and 22 there was an attempt to develop a mental set in Part I of the test and to measure the extent to which this set interfered with the workings of part 2.

Test 23. Three different operations were first performed separately and afterwards similar operations had to be performed in quick rotation. This was suggested by the Army Clerical Test (Vernon & Paynter, 1949).

Test 24. Guttman and Figures: 42 items from Thurstone's revision.


Test 26. A group version of the Kohs Blocks Test devised by Hay (1951).

Commenting on the results obtained by Lovell, Vernon (1957) writes: "Here also we cannot be certain how far the two pairs of groups differed in their initial intelligence level; actually the third and fourth were probably slightly superior. But the differences in mean sigma scores for different tests will indicate which psychological functions are most, and least, affected by environmental stimulation during adolescence."
Here again, reading comprehension shows the lowest difference. A score difference of -1.0 may be taken as kind of base-line, and any score above that probably represents some effect of stimulating adolescent environment. Vocabulary, Abstraction and non-verbal intelligence are least affected. But clearly the functions most affected are those involving flexibility and originality of thinking, capacity to form new concepts as contrasted with rigidity or mechanization of thought and perseveration - that is very much the same functions as are found, in clinical practice, to deteriorate with advanced age, with brain injury, and in such psychopatological states as Schizophrenia. Naturally there are many other differences between our two pairs of groups, besides schooling, which may have played a part in the development (or the inhibition) of thinking capacity; for example the home, job and leisure environments, or the social and emotional adjustment of youths' personalities, may be more important."

The general implications of these three studies are that we should cease to classify the abilities of adolescents and young adults under the simple headings of attainments (affected by schooling) and 'g' or intelligence (dependent purely on maturation or innate factors). Certain aspects of intelligence, in particular flexibility of thinking, are as much, or more, affected by the stimulation that different environments and different types of schooling provide as are the conventional attainments. Clearly, far more research is needed into the nature of these abilities, and into the type of education that best helps to develop them.
(3) Tests Used:

While discussing intellectual stimulation and methods used in the present section, lot of tests with comments made by various workers in the past have also been furnished with. Still, for clarity and pointed emphasis on the nature of tests, it is desirable that we must make out a separate sub-heading of tests used by previous workers, so that either at the time of selecting the tests in the present investigation or at the time of concluding the results to be obtained from the present investigation we do not find any difficulty to show that from our survey over the mistakes of the past, workers lot of precautions were taken in the present investigation.

Goldstein & Scheerer (1945), Kafman & Kasarin (1937), Berg (1948), and others, have devised a number of concept formation or sorting tests. In a typical test the subject is presented with a series of objects which can be classified in various ways and he is told to sort them according to a given principle or pick out others similar to a given object. When the subject has mastered one principle of classification he is given a new and more complex problem. It is claimed that brain-injured patients and some schizophrenics can cope with these at the concrete level, but cannot realize and formulate abstract principles of classification, nor can they switch from one principle of classification to another.

Walker, Staines & Lema (1943), and Gattell (1946) now state that the earlier tests so often used to measure perseveration (e.g., the alternation type of test and miscellaneous anxiety tests) are useless; but that 'creative effort' tests, where the subject has to break down some well-established habit, are more consistent and measure a quality
which has been termed 'disposition rigidity'. Cattell claims that a person with low disposition rigidity is a person of strong age development and capable of modifying his habits. Little, however, seems to be known of the validity of tests of disposition rigidity.

Lashins (1945, 1947) maintains that inefficient methods of education may produce rigid rather than flexible minds and has devised a number of paper-and-pencil tests. Subjects are given a series of problems which can be solved by the application of one principle. Half way through the principle alters, but the original 'set' may delay or prevent them entirely from realizing this. The interference in such tests is established temporarily during the course of the test, whereas in disposition rigidity tests the interference is with a fully automatized habit. Yet another concept of the main characteristics differentiating the personalities of the feeble minded from those of normal children. When given a choice of drawing tasks, feeble-minded children tend to persist longer at a single task, whereas normal children prefer a change.

Again, there is a mass of literature dealing with tests of the type included in the Wechsler - Bellevue Battery (1944), the Wechsler-Lewy Battery (1940) and the Shipley - Hartford Test (1940). The performance of psychotics, especially those of the organic type, is poorer than expected on some of the tests; performance also declines in aphasic conditions, in cases of brain lesion and to some extent with age. The decline is least marked in tests of what Cattell calls 'crystallised' intelligence, such as vocabulary. Tests of 'fluid' intelligence, which are most affected, include speed tests and tests
of abstraction or conceptualization.

Halstead (1947) applied nineteen tests to fifty patients. Neglecting the analysis which led to an oblique factor structure and concentrating on the analysis performed by Halvinger which gave a general and orthogonal group factor solution, it seems clear that the general factor is general intelligence or 'g', while Halstead's A Factor is possibly the ability to group to a criterion for it has its highest loading 0.6 on a category test. This work has been criticized by Vernon (1950).

Crom (1951), in a review of the literature dealing with psychological changes following prefrontal leucotomy, comments on the lack of consistency between investigations on the issue of whether or not abstraction is affected following the operation. This lack of agreement is not surprising, he maintains, considering the variety of tests which have been used to measure abstraction. He divides these tests into two main types:

1. Those which are primarily intelligence tests - e.g., Block, vocabulary tests, Shipley, proverbs, fables and abstract words.

2. Tests which appear to conform to Halstead's definition of abstraction as the basic capacity to group to a criterion. Tests of the latter type involve the comprehension of essential similarities and differences - as in, say, the Goldstein-Schoener Colour Form Sorting Test. "It is suggested", writes Crom, "that, in factorial terms, sorting tests, if included in a test battery with other cognitive tests would cluster together, these tests having, addition, moderately
high correlations with intelligence. Whether the abstraction group factor would be different from group factors already widely recognized remains a problem for further research. In the opinion of the writer, Green's suggestion comes remarkably near the truth. But, as the commonly known factors of intelligence are also dependent on intellectual development, probably Green's suggestion may be regarded as extra-precautionary measures for studying the development in the cognitive aspect.

III Influence (or effect) of intellectual stimulation on intelligence during adolescence.

From the above discussion we may conclude that, although no satisfactory solution has been found to the problem of the fundamental nature of intellectual stimulation, there is less difference of opinion regarding the intellectual development (or changes in intelligence), especially at the adolescent stage. As the origin of the present investigation lies in Professor P.E. Vernon's (1937) comments on the results he has observed in three consecutive studies including the study of Lovell (1935), it is quite obvious that the problems in the present investigation are those that were suggested by studies reported by Professor P.E. Vernon. The first thing that has been discussed in the above section is the unsatisfactory methods of classifying any groups in terms of intellectual stimulation, the exact nature of which is still controversial. Secondly, the tests which have so far been used were not all factorized. Probably, the above controversy arose due to the obscured knowledge of the nature of the tests. Hence, Anastasi (1963), Burt (1921), Vernon et al (1949), Vernon (1957), Lovell (1955), (1958), Luckins (1952, 1947), Neisser
and others thinking over the problem have made the future workers cautious about the selection of proper tests. Vernon et al. (1949), Lovett (1955), Dockrell (1959) and others have therefore preferred factor analysis of the test batteries, so that any mistake, whatever, coming out of the investigation might be scientifically interpreted.

However, at this stage let us introduce the problems which constitute the present thesis. There are four of these:

1. Firstly, whether school-going adolescents may be consistently classified under best stimulating, better stimulating, and least stimulating schools in terms of the external criterion of the schools' previous record of the results of former students' (scholastic or) educational attainment, supposed to be the concomitant of intellectual stimulation.

2. Secondly, whether the groups of the adolescents may be satisfactorily graded in terms of the internal criterion of the subjects' educational attainment, as concomitant of intellectual stimulation.

3. Thirdly, whether the adolescent subjects are to be classified under any other groups suggested by the analysis of the educational attainment patterns.

4. Fourthly, whether any of the above classifications of the adolescents under external criterion of different degrees of intellectual stimulation groups or internal criterion groups would yield any significant pattern of overlapping or difference with intelligence (or ability) test scores, and suggest the influence of intellectual stimulation on Intelligence.
Lovell (1955) picked up four groups of adolescents from three different stimulating schools and one from the criminals. He studied the consistency of the classification with the point-biserial hypothesis of Lovell. But our second hypothesis which can be split into several other logical sub-division is a deviation from Lovell's (1955) suggestion, though quite compatible with the suggestions of Vernon (1957) who has repeatedly mentioned that one should not ignore the influence of educational attainment factor or schooling proper.

Esenburg (1921) has quite clearly discussed the possibility of studying the influence of educational attainment on intelligence and vice versa. And as has already been mentioned in the section of 'intellectual stimulation' of this chapter, the amount of educational attainment in any group of subjects may be taken as equivalent to the amount of 'mental' (or intellectual) stimulation the subjects have had. Naturally, in Lovell's (1955) plan no attempt has been made to study this aspect. It seems quite promising to accept this factor of educational attainment as an important criterion to classify the groups of adolescents under different degrees of intellectual stimulation.

Thirdly, Lovell's (1955) planning of the research could not afford to cast any suggestion as to whether the adolescents should be re-grouped under the educational attainment factors themselves whereas this might have been a very prospective line of research.
Fourthly, Levall (1935) has applied 26 tests with the expectations that he would find differences in some newly discovered areas. But, contrary to his expectations, the areas of intelligence (i.e., factors) that showed significant differences were practically the already discussed factors which were emphatically suggested earlier by Vernon (1930).

Hence the present study emphasizes not so much on the theoretical controversy but rather on the methodological controversy which should be regarded as the main enquiry or the essence of the present investigation.