During the last few decades many attempts have been made to locate the main factors, which stimulate the intellectual growth, and those which prevent large sections of a community from realizing their full potential. In most of these studies tests of general mental ability or primary mental abilities have been used as the measure of intellectual functions. The factors that influence the performance on these tests have been classified by Vernon (1969) under three heads: (1) Genetic (2) Environmental (3) Extrinsic i.e., involved in the testing situation.

The available evidence regarding the influence of genetic factors is mostly from the experiments done on animals where mating can be controlled. For human subjects the inferences about genetic transmission of abilities are drawn from the correlational studies of identical and fraternal twins. In general it has been found that correlations between pairs of identical twins on ability scores are much higher than those of fraternal twins. Assuming that environmental influences are about the same for both types of twins the difference in correlations is attributed to genetic factors. The assumption, however, can be questioned.

The extrinsic handicaps are: (1) unfamiliarity of the testees with the test situation, and lack of motivation,
(2) difficulties due to particular form of items and conditions of testing, (3) anxiety, excitement, suspicion of tester, and (4) linguistic difficulties in understanding instructions or communicating responses. Schwarz (1961) has shown that the interference due to these factors can be minimized, perhaps fully overcome, by teaching the testees beforehand precisely what they have to do while taking the tests.

Much of the evidence regarding the effect of environment on the growth of intelligence has been obtained from the studies of twins reared apart, children brought up by foster parents and in the reformatory schools, children brought up under barren and stimulating environment, and children brought up under poor and good nutritional and health conditions. Such studies have been conducted at the cross-cultural, cross-sectional, and longitudinal levels.

In spite of much work in this direction, confusion still prevails and part of the trouble, as pointed out by Vernon (1969), is due to the fact that the term intelligence is used in different senses. Some refer to it as innate capacity inherited through the genes, others use this term to refer to the child or adult who is clever and mentally alert. Yet another meaning for intelligence is derived from the score on one of the widely used intelligence tests. Such distinctions in the meaning of this term have been
 overlooked by some investigators. Their studies have been severely criticized on methodological grounds. It has also been pointed out that they do not tell us which factors are crucial in the development or retardation of mental growth mainly because the independent variable in most of these studies is very complex and tends to interact with other variables making it difficult to establish a clear-cut relationship between independent and dependent variables. Thus most of the inferences, reported in these studies, are suggestive rather than conclusive. However, there are quite a few well designed studies which provide comparatively clear-cut information.

While reviewing the studies in this area Vernon(1969) summarized the important environmental factors influencing the growth of intelligence as under:

(1) Brain damage due to pre- or post-natal malnutrition, maternal stress, or disease. Birth injury; later brain pathology and deterioration.

(2) Reasonable satisfaction of biological and social needs, including exercise and curiosity.

(3) Perceptual and kinaesthetic experience; varied stimulation, encouragement of exploration, experiment and play.

(4) Linguistic stimulation encouraging a 'formal code' and clarity of concepts.
(5) 'Demanding' but 'democratic' family climate, emphasizing internal controls, responsibility, and interest in education.

(6) Conceptual stimulation by varied environment, books, TV, travel, etc.

(7) Absence of magical beliefs; tolerance to non-conformity in home and community.

(8) Reinforcement of Nos. 4 and 5 by school and peer groups.

(9) Regular and prolonged schooling, also demanding-democratic; emphasising discovery rather than rote learning only.

(10) Appropriate methods to overcome language problems.

(11) Positive self-concepts with realistic vocational aspirations.

(12) Broad and deep cultural and other leisure interests.

The list does not include the socio-economic status, emotional security or maternal warmth, and ecological and climatic conditions. They are, however, covered by some of the above mentioned broad categories.

Studies also suggest (Bloom, 1964; Deutsch, 1965; Deutsch and Brown, 1964; Douglas, 1964; Kelinberg, 1963; Nisbet and Entwistle, 1967; Piaget, 1950) that the
environmental handicaps continue to operate cumulatively, that their impact in the first few years of childhood is far more marked than that in the later period, that unfavourable conditions sometimes fail to develop some basic capacities to the degree they might have developed under rather more varied programmes of encounter with environment appropriately matched to the intellectual structures developing within the individual.

In general it is felt (Jensen, 1967a) that environmental effects intellectual development mainly as a 'threshold variable'; it is extremely important in the lower ranges of ability, but above a certain minimum has little further effect; in other words, it operates quite like a diet in relation to physical growth.

From our discussion so far it is apparent that the observed differences in the intelligence test scores of compared groups can be explained either genetically, or developmentally or in terms of test bias. It is also apparent that we cannot, as with rats, study the effects of a single factor while holding other relevant conditions constant. Even in longitudinal studies, apart from administrative limitations, it would be difficult to introduce arbitrary changes in the course of the natural lives of the subjects.

In all such studies it seems practically impossible
to disentangle the precise effect of any one factor. In cross-sectional studies of the type one can at best aim at selecting comparable samples to the extent it could be possible and interpret the results keeping in view the many alternative explanations.

In Haryana schools (a State newly created by dividing East Punjab) we have two groups of students who are comparable on certain parameters and very contrasting on certain others. One of these groups studies in the model schools run by the State or some private organizations and the other in the schools run on the "Gurukula" system.

In the model schools, students are admitted at the age of 5 years to the preparatory class. They can go up to the 10th class by yearly promotions. The school staff is highly qualified and trained in the modern techniques of imparting instructions. They also avail themselves of the "school broadcast" programme of All India Radio and frequently display educational films before the students. In teaching, their main emphasis is on Science, Mathematics, and Social Studies. The medium of instruction is Hindi (the national language). English is introduced, as a second language, from the beginning. Laboratories and libraries are well equipped. Students come to the schools in the uniform prescribed. Classes are held in adequately furnished rooms. The teacher-student ratio is about 1 : 30.
for instructional work and 1:20 for practicals and tutorials.

In addition, two to three excursions are arranged for each class every year. Inter-house tournaments, in different games (hockey, football, cricket, athletics, gymnastics), debates, dramas, and music competitions are regular features of the school programme. Students are also encouraged to participate in all such activities at the district or state level competitions. Most of these schools are situated in big towns where reasonable modern facilities are available. Students are day scholars and live with their parents or guardians. In the higher classes each student has to pay about Rs. 15 p.m. as school fee, whereas no fee is charged in the ordinary schools of the State. Thus only those parents who can afford to pay fees and are interested in good education send their children to these schools. Presumably they are from the middle and upper-middle classes. It may also be mentioned that for the children of rich parents there are residential "Public Schools" where the fees are much higher.

In contrast, the "Gurukula" system, as the name implies, involves the students living with their teachers as family members. The teacher takes full responsibility for the growth and development of his wards. The system has its roots in the ancient Vedic culture. It was revived
by Swami Dayananda, the founder of Arya Samaja, in the later part of the nineteenth century (Swami Dayananda, 1875). Soon after his death in 1883 the educational policy of the Arya Samaja took two distinctly opposite directions. One group led by Mahatma Hansraj established the Dayananda Anglo-Vedic (D.A.V.) educational organization and the other led by Swami Shradhananda established the "Gurukula" system. The former emphasized the modern outlook in education and the latter the ancient Indian (Vedic) culture.

The chief characteristics of the "Gurukula" system (Inder, 1957; Lajpat Rai, 1915) of education are:-

The educational institutions are located at places far off from the towns. There are separate schools for boys and girls.

Once a child is admitted to the school he/she is not permitted to leave the school premises till he/she has completed his/her education. Apart from parents, no outsider is permitted to meet the students in the school. Students, however, can write letters to their parents. If the child is ill he is attended to by an Ayurvedic trained doctor (Vaid) of the institution.

Education is totally free. The parents may contribute voluntarily by way of donations.

Winter or summer, the students put on the ancient
Indian dress i.e., "Longot\(^1\)", "Tahamat\(^2\)\(^3\)" and "Chaddar\(^3\)". They are always bare-footed and keep their heads clean shaved except for a long pig-tail in the centre.

The teacher-student ratio is about 1:10. The students and their teachers live in the dormitories and sleep on mats on the floor.

The teachers also wear "Longots", "Tahamats", and "Chaddars" but of a saffron colour. They, too, are bare-footed but are permitted to grow their hair if they like.

There are two categories of teachers: (1) those who take up teaching after completing their formal education in a "Gurukula", (2) those who take up teaching at the age of 50 years or more. Teachers in the former category do not marry, whereas those in the latter renounce their wives and children before they take to teaching in these schools.

It is important to mention that the followers of this organization divide the life span of an individual into four stages (Ashramas).

(a) "Brahamcharya Ashrama", i.e., student period: from birth to 25 years of age during which the main aim of

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1. Loin cloth.
2. A type of sarong.
3. A sheet wrapped around the body.
an individual is to acquire education from parents and teachers.* The child is not expected to take active interest in the activities of society. The teacher accepts the ward as his child and takes full responsibility for his mental as well as physical development.

(b) "Grihastha Ashrama" i.e., married life: from the age of 25 to 50 years. After acquiring education they are permitted to get married and live and work in society. Generally they take to such professions as farming, medicine, teaching, private business, etc. They seldom look for work in government or private organizations.

(c) "Vanprastha Ashrama" : from the age of 50 to 75 years. During this period they are supposed to cut off their connections with their families and take to social services or farming or teaching in the "Gurukulas."

(d) "Sanyasa Ashrama" i.e., the period of renunciation. At the age of 75 years they renounce the world and take to meditation and preaching.

In teaching, the main emphasis is on teaching of Sanskrit (a classical language). During the first six years of schooling, apart from teaching Sanskrit, they give

*For the first eight years parents act as teacher. Later the child is entrusted to the teacher in the "Gurukula".
instructions in Hindi, Mathematics, Science and Social Study. The prescribed books for the latter set of subjects are the same as in model schools up to the 8th class. This standard they achieve by the age of about 14 years. There is no laboratory for science practicals. Even during this period the main emphasis is on memorizing essentials of Sanskrit grammar (Ashtadhyayi). After having achieved this standard the emphasis is shifted to interpretation and application of grammar in Sanskrit literature. Even though they learn Hindi the medium of communication is Sanskrit.

The last phase in this system of education is that of specialization in philosophy, literature, medicine, and history. Students are free to take any combinations of these courses.

The libraries in the schools have books, magazines, and newspapers mostly published by the 'Arya Pratinidhi Sabha' or some related organizations. Their literature is concerned with values cherished in Vedic culture.

Classes are usually held in the open under the trees. The use of black-board or such other devices is not made. Group teaching is avoided as far as possible. Lessons are given to each student individually although students under the charge of a teacher sit in a group.

Students can sing devotional songs or recite vedic rhyme. Modern entertainment, films, radio, television, etc.,
have no place in the educational programme.

Students follow a rigorous daily routine. They get up at 4 a.m. and follow their specified schedule of exercise, class-work, rest, meals, and games. The standard of personal cleanliness is very high. Even in winter they take cold baths twice a day. They also wash their own clothes and utensils etc. In winter they get two meals and in summer three meals a day. Food is purely vegetarian but is supplemented with milk, milk products, and fruits. In cooking they use neither common salt nor spices. Vegetables or pulses are boiled and served with ghee (clarified butter). The nutritional value of the food is indeed good.

In respect of physical exercises, the stress is on the "Yogic" system and traditional games (e.g., wrestling, kabaddi, weight lifting, shot-put, short and long distance races etc.).

Students are never taken out for educational tours. Senior students who are at the specialization stage can participate as observers, in the annual functions arranged by other schools run by the Arya Pratinidhi Sabha. Such visits are, of course, few.

In their free time students can move about in the school agricultural farm and the orchard. The farm is maintained by volunteers, who are usually above 50 years of age.
Each school has a contingent of about 20 teachers (Acharyas), 200 students, few Ayurvedic doctors (Vaids), a few cooks, and 30 to 40 farm workers. Normally students are not to work on the farm, but in an emergency they may offer their services.

No formal type of examinations are held nor are degrees awarded. Students are not prepared for any specific profession nor do they intend to take up jobs in government or private organizations.

In recent years one of these institution called "Gurukula Kangri" near Hardwar, has been recognized as a University. It holds formal examinations and also awards degrees. Many other restrictions of the old "Gurukula" system as described earlier, have been relaxed in this institution. The new reforms, however, have not as yet been accepted by any other "Gurukula."

From the above description of the "model school" and "Gurukula" systems of education it becomes apparent that a large majority of the students studying in these schools come from the middle or upper-middle socioeconomic groups. Presumably the children in these schools are well fed and well looked after right from their childhood. In both types of institutions, in their own way, special attention is paid to educate the children. The objectives of education, methods of teaching, emphasis in learning,
and the curricula in the two types of schools, however, differ considerably. They also differ in so far as the aspirations and attitudes of the parents and children are concerned. One group looks to the modern way of life and the other cultivates the values of the Vedic cultures. Further, the children studying in the "Gurukulas" live under strict controls away from their parents and have no contact with the opposite sex of their or their siblings. Whereas the children in the "model" schools live with their parents and their life outside the school is comparatively free. Moreover, the model school children are exposed to the problems of society and are encouraged to move about and see the country for themselves. "Gurukula" students, on the other hand, live under protected conditions away from society and its problems. They also lack opportunities for varied mental experiences.

The description of the two school systems clearly indicates that the students in the "Model Schools" live and study under flexible and varied conditions, whereas those in "Gurukulas" have to live under inflexible and narrow environment. We would prefer to call the flexible environment as stimulating and the non-flexible as non-stimulating.

The students of Model schools and "Gurukulas" are of special interest to us as they provide an opportunity to
study the impact of stimulating and non-stimulating environments at their level and pattern of mental abilities and personality characteristics.

**Problem**

There are two sections of this study. The first part is devoted to study the effect of stimulating and non-stimulating environment on level and pattern of fluid and crystallized intelligence. The terms stimulant and non-stimulant are synonymous to flexible and non-flexible environment respectively. The crystallized and fluid intelligence was measured by Hundal Verbal Test of General Mental ability (Amir Singh, 1966) and SAT Culture Fair Test of Intelligence (Cattell, 1961).

Following Cattell's argument (Cattell, 1963a) the former test measures crystallized intelligence ($G_c$) and the latter fluid intelligence ($G_f$). It is also maintained that the performance on the former set of tests is greatly influenced by learning in the schools and society, whereas it is not equally so in the case of the latter tests. Cattell's assertion has, however, been challenged by other investigators (e.g., Eysenck, 1967; Kidd, 1962; Tannenbaum, 1967; Vernon, 1969). It would, therefore, be unsafe to propose hypotheses regarding the differential effects of a stimulating or non-stimulating environment on the measures
of Cf and Gc. The study can be treated as exploratory and is designed to find the effect of stimulating and non-stimulating environment at the level and on the pattern of Cf and Gc measures.

The scope of the investigation was further extended by including some personality variables to study the effect of stimulating and non-stimulating environment on them.

In comparing the performance of the two groups the significance of differences have been checked by the usual parametric t-test. The patterns of abilities were located by the principal axis method of factor analysis and varimax rotation to the criterion of simple structure.

A review of literature in this area indicates that it is not the first study of its kind. It, however, has certain advantages over the earlier studies of foster home placements, or of special schools for institutionalized children, or of barren and stimulating environment, or cross-cultural studies. Its main advantage lies in the fact that the two groups of children are from the same stock, belong to the same socioeconomic strata, are well nourished, live in healthy environments, and are equally free of social stigmas. They are thus more comparable than most of the compared groups in the earlier studies. The contrast in the physical and educational environment of the two types of schools is very sharp. The gap in the environment of two
types of schools is further increased because the parents of the children in these schools have different social and vocational expectations from their children. Another advantage of the study lies in distinguishing between fluid and crystallized intelligence and measuring the impact of environment separately on the two abilities. Further, the impact is checked, both, at the level as well as in terms of the factorial structure of the two types of intelligence developed under environmentally stimulating and non-stimulating conditions.

The second part of the study is concerned with the growth of, both, fluid and crystallized intelligence over 14 to 54 years age. The design of the study is on the lines of Horn and Cattell (1966b). The following hypothesis were proposed:

1. The means for different age levels for the measures of Gf would not increase in adulthood, but instead would usually decrease from the late teens onwards.

2. The means at different age levels for measures of Gc would continue to increase in adulthood.

3. Ability tests, which have a variance split up nearly even between Gf and Gc, would show a variable relationship to aging.

Here too, fluid and crystallized intelligence were measured by HAT Culture Fair Test of Intelligence.
(Cattell, 1962) and Group Test of General Mental Ability (Jalota, 1960). The methods and findings of the two studies are described separately in the first and second part of the report. Chapters II and III are devoted to the discussion of "Related Studies" and "Nature of Fluid and Crystallized Intelligence" respectively.