Chapter I.

INTRODUCTION

The study of children and their development in various aspects, such as physical or biological growth, cognitive or intellectual processes, personality development and social behavior, offers not only a huge mass of theoretical knowledge about children, but contributes enormously in a practical way to human betterment. A better understanding of children has many implications for a theory of human behavior. Undoubtedly, the greatest potential contribution of the study of children to human welfare stems from the special importance of childhood to the achievement of mental health and consequently the type of growth of adult personality. The programme and practices in child education are based on child-development research. However, the current state of child education, with its educational or rearing practices shifting rapidly from one to another and its genuine failure to advance more rapidly, clearly points to a basic lack of solid empirical data on fundamental processes. A vast amount of research to understand basic growth processes as well as problems of physical and motor development, language development, problems of learning and thinking and of emotional and social development of children needs be carried

out, confirmed and then applied to the practical problems in child education.

The most important contribution of child study to practical problems in child education results in the development of a sound theory of human behavior. This presupposes the constant maintenance of a broad research front involving studies of humans and animals, adults and children, normals and abnormals. It is fair here to recognize also some of special contributions that the study of child development can make to the development and testing of theoretical hypotheses. For example, children pose a theoretical problem. A behavior theory must encompass the behavior of children as well as adults, and its parameters must describe the differences between individuals at different age levels. Secondly, children are strategically valuable subjects for those whose aim is to add to general psychological theory, especially in the elucidation and investigation of symbolic processes, learning problems, effective responses and structure of defence mechanisms and personality. Thirdly, child development is the ultimate problem of the study of developmental psychology. Psychologists study the development of other species and comparative psychology, but their interest in animal development lies in the potential contribution of these studies to

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the understanding of child development.

There are many aspects of child development. Physical growth and development, physiological development, motor development, mental development, speech and language development, personality development, developmental stages in perception, cognition and motivation - these are some of the aspects which together make the organismic whole. The research methods in child development are brought together by Mussen (1960).

It is a common observation that human beings change as they grow older. Whether the psychologist studies physical growth or language or motility or personality, he can confirm the common sense principle that assigns to age an important place in the description of human behavior. From the early days of the study of child development the researchers have attempted to make systematic and reliable statements about this fundamental relationship.

These statements contain two variables : a description of behavior or state and chronological age or developmental status. William Kessen of Yale University gives a summary form

$$R = F (A)$$

to describe the work of developmental psychologists; R is the

response which is a function of A which represents not only chronological age but includes such variants as physiological age and mental age as well. According to Kessen " a characteristic is said to be developmental if it can be related to age in an orderly or lawful way " (Kessen, 1960).

The establishment of a relationship between behavior and age is not, however, the only task of the child psychologist. Many aspects of development are dependent, at least in part, on variables other than child's chronological age.

One of the goals of scientific explanation is to provide directions for the control of phenomena. The age functions do not suggest how to change behavior. The statement R = F (A) does not say anything about causes of or explanations for the effect. Also, such a statement does not take into account individual variation. Children not only change with age but also show differences one from the other at the same age. Thus age-functional statements have limited usefulness. With all the limitations of the formula R = F (A) it expresses a good part of what is known about children. Until the researcher can get more precise information about other variables which affect child behavior, he must be content with the relatively simple statement of variation with age.

The theories of child development are thus proposals

about the processes that lie behind changes in behavior with age, but in absence of a generally accepted theory of development, we must continue the slow accumulation of evidence expressed in age-functional generalizations. Control of behavior becomes possible and prediction of behavior often becomes more precise when it is possible to relate behavioral change to an aspect of the environment.

The most general statement of developmental change in children seeks to establish relationship between some aspect of behavior and some indéx of age or level of maturity. The aspects of development include physical development, physiological development, mental development, speech and language development, personality development etc.

Development

Development consists of a progressive series of changes of an orderly coherent type toward the goal of maturity. There is a definite relationship between each stage and the next in the development sequence. Each change is dependent upon what preceded it, and it, in turn, affects what will come after.

The observations of development are made from different view points; those of anthropologist, psychologist, educationist etc. are some of them. We have to consider all these

aspects to form an integrated picture of total development.

The most obvious change with respect to growth, of course, is the change in physical dimensions of weight and height. At the same time changes also occur in the structure and organization of the parts of the body in which changes are more qualitative than quantitative. Changes in the brain, for instance, are largely maturational in nature in early childhood.

Maturational changes go side by side and simultaneously with growth. The two, indeed, are inseparable. The bodies of children of different ages differ not only in size but in proportionality and quality.

Development is result of interaction between organism and environment. In this process a stage is dependent upon the preceding stage and it, in turn, is a determinant of the following stage.

The functioning of a structure begins when it is developmentally ready to function.

Physical development is studied in various ways, which include external physical measurements of the whole body or its parts, skeletal development, dental development (Dentition) etc. Various techniques of measurements may be used to assess the state of development. These may include X-raying

(Tanner, 1960, 1961), photographic measurements, somatotyping (Sheldon, 1954) etc.

Sheldon (1954) has developed the concepts of somatotypes and morphogenotypes based on the belief that function is always and ever related to structure. The morphogenotype is the hypothetical biological structure of which the observable somatotype is the concrete manifestation. The sequences of development do not move at a steady pace. The growth period shows sudden spurts which appear in regular sequence. These are the milestones of development.

All aspects of growth do not show the same pattern of growth in time. The growth of the whole body, however, is admirably balanced and integrated.

Knowledge of the stages of growth is desirable. It enables one to know what to expect from children and at what age. It also helps making provision for the development of whatever capacities they have. Parents who do not know that there are slow growers and fast growers may either underrate or overtax the capacities of their children. Again the knowledge that there is a wide but perfectly natural variation in growth rates among children would relieve the parents of much anxiety.

A number of studies of physical growth have provided sets of norms (Thorndike, 1903; Krogman, 1948; Meredith, 1968; Tanner, 1960, 1970). The children involved in these studies were representative of the European and North American populations and such studies in other parts of the world are necessary. Tanner (1961) has noted the secular trend as one of the most striking findings in human biology in recent years. This makes it imperative that norms be revised periodically.

These methods include measurement of oxygen consumption and urinary creatinine excretion. The rate at which an individual is utilizing oxygen without the influence of food or muscular work is the basis for computing BMR, the basal metabolic rate. It is the measure of the energy requirement of the body for the fundamental processes which must go on to keep the body alive. It is thus a measure of the protoplasmic tissue which is metabolically active. Urinary creatinine excretion per twenty four hours is also considered an index of the amount of active protoplasmic tissue in the body. Basal heat production and creatinine excretion are related and increase with body size and age. These methods are useful in assessing chemical growth and physiologic function and nutritional adequacy and status.

Growth is the harmonious development of composite organs

and tissues from protoplasmic cells. Development, growth and vital activity all depend upon the factors of environment like nutrition which influence the manifestations of the genetic potentialities of an organism. Child development includes two types of growth, visible and invisible. Increase in the body size and change in its shape and proportions constitute the visible growth. Chemical and physiologic growth is described as invisible growth which is concerned with the subtler chemical, metabolic and physiologic functions; it is the bulwork of physical growth. Neither visible nor invisible growth can exist in isolation.

Growth and nutrition may be studied by physiologic methods which are useful, accurate and readily applied.

Depending upon the problem to be studied, the state of the research done in the area, the social and ethical considerations and the guiding philosophy of the investigator the method followed in a particular investigation, is chosen. These methods include observational child study (closed and open methods) diary keeping, interview, questionnaire, clinical investigations, study of reports and records, laboratory-experimental study, and projective techniques.

Methods in observational child study include diary description and specimen description which are described as

open methods and time sampling event sampling, and trait rating which are classified as closed methods (Wright, 1960). Field unit analysis is open in some applications and closed in others.

The 'open' methods are comparable to those of the biographer. They are open to diverse phenomena. The 'closed' methods are more like those of the classical experimenter with eyes for only one descriptive target. Time and event sampling and trait rating are closed to every-thing except rather uniform and sharply limited phenomena. Some observational techniques of these methods have often been used in manipulative experimental study.

Diary

This is the oldest method of studying child development (Wright, 1960). It deserves re-examination and practical attention by students of child development whose households include young children. It is a recording technique to maintain a sequential account of growth changes and behavioral episodes from the life history of the child. The notings are selective in the face of innumerable events that pass in an endless procession. The entries record in sequence new behavioral events in the behavioral continuum of one subject. A special feature of the method has always been close and essentially continuous contact between the subject and the

observer. Diary records may include reports of casual interviews and of improvised psychological tests. Diary records may be defective in being biased in selecting procedure but as a basic method it has unique advantages. It gives a multidimensional picture of simultaneous and successive factors in behavior and circumstances of an individual child. It saves for later study at any time and for any purpose comparatively intact specimens of behavior with its context. Diary description takes into account the continuity of behavior. It records the actual unfolding of one stage after another and the steps by which the changes come about. The longitudinal principle in this method is better implemented than in any other method. Trained students of child behavior could keep diary records without bias and error. So much of the work of psychologists on growth problems has been piecework in the absence of the best assembly line - the growth stages of a single child.

Specimen Description

In this 'open' method a behavioral sequence under chosen conditions of time and life setting is recorded (Wright,1960). The observer aims to make a faithful record of "everything" as it comes in the behavior and situation of the child. These records are far more intensive than typical diary descriptions. They provide lasting specimens of the behavior and immediate

situations of children in these settings. Records of this type differ a good deal in setting or locale. Such records need as many reliability coefficients as they contain classes of statements about different facets of behavior and situation. Inspite of their limitations in being accurate these records have some value. These records can register almost every thing observers can see of behavior. They describe behavior in context by recording behavior with situation. The specimen records tell less about the continuity of behavior than diaries. A specimen record preserves much of behavior as it appears without either the omissions of selective observation or the alterations of theory. Also. they have permanency.

Time sampling

This closed procedure fixes attention of observer and analyst upon selected aspects of the behavior stream as they occur within uniform and short time intervals (Wright, 1960). This method is defined primarily by its temporally uniform observation intervals. Time sampling has several attractions which include systematic controlled selection of phenomena to be observed, representativeness and reliability, economy of time and effort. Its coding schemes minimize equivocal judgements and it achieves standardization of observer and analyst. However, on the other side, it is limited to problems

of incidence. It has been concluded that if the behavior to be observed occurs less than once in fifteen minutes on the average, some other method is indicated. It does not often link behavior with coexisting situation. The evident aim of the method in its more typical applications is normative. Time sampling may be at its best in providing an efficient way of testing hypothesis about how often children behave in given ways in life settings under specified conditions.

Event Sampling

Each event is a sample of its class in the behavior streams of classified children in selected life settings (Wright, 1960). The method tells something about behavior in context. Perhaps the most distinctive good point of event sampling is that it structures the field of observations into natural units of behavior and situation. An important practical asset of the method is that it can be adapted to study naturally occurring behavioral phenomena that happen only once in a fairly long while. Possibly the greatest limitation of event sampling is that it breaks up the larger continuity of behavior.

Trait Rating

Most of the observational methods deal with behavior in progress. In applications of Trait rating (Wright, 1960), however, stable ways of behaving are described and observations

are recorded after they are made. What the observer records is more an assessment of personality than a description of behavior.

Field Unit Analysis

In this method there are two phases : (1) a behavior sequence is divided into consecutive units in the field and (2) descriptive categories are applied to the phenomena of each unit (Wright, 1960). The method is comparatively new. It is a way to scan systematically the continuous social behavior of a child. The technique must be about as good as its main facility : a set of terms for describing social and other behavior.

As concluded by Wright (1960), what is necessary for observational study is a basic unit that (1) can be used in the field, (2) takes in a diversity of behavior and situation variables, (3) has psychological integrity, (4) has clear meaning in terms of some central criterion and (5) permits behavior in context.

Interview

The interview is a technique to uncover subjective definitions of experiences. It may be the principal technique in studies on concept development (L.J.Yarrow, 1960). It may

also be used in pilot studies for developing hypotheses to be tested subsequently with other techniques. Interview as a technique depends on an interpersonal relationship, hence it may be more suitable for certain types of problems than others. A major problem in interviewing children is their limitations in language. It cannot be used at a preverbal stage of development or with children having auditory or language handicaps. Special care must be exercised by the interviewer to avoid influencing the child to give the response he thinks will win adult approval. The interviewer must convey to the child his genuine interest in him and in his feelings and ideas.

In the standardized interview the questions are completely formulated prior to the interview session and are presented to each subject in the identical way. In the free interview the structure may consist merely of an outline of suggested topics to be introduced at any point it seems meaningful to do. In the directive approach the interviewer may maintain complete control of the contents of the interview whereas in the non-directive approach the interviewer may simply open up an area of discussion and follows the leads of the child.

Piaget's Methode Clinique is a creative approach to interviewing children and to the formulation of questions appropriate to the child's level of comprehension (Inhelder and Matalon, 1960). Dolls and pictures have been used as

adjuncts to the interview.

The form in which the data are collected and recorded will determine the kinds of analyses that will be possible.

Compared with the written questionnaire, the interview has a number of advantages. The interviewer is in a position to clarify the questions.

Questionnaire

The written questionnaire in contrast to the interview with its personal relationship, creates very different subjective setting for the child as it involves a minimal personal relationship between subject and investigator. Whenever possible, the attitude questionnaire should be tested as an interview to establish a feel for children's reaction to it, before applying it in the field. The technique of asking questions requires a combination of various kinds of knowledge and skill if it is to be used fruitfully with children. (K.R. Yarrow, 1960).

A questionnaire is relatively free from the biassing influence from the race or sex, attitudes, age and such characteristics of the interviewer. On the other hand, better control of the influence of question sequence and the context of questions is possible in the interview than in the questionnaire.

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Clinical Investigations

The convenience of clinical and field methods have brought them into frequent use to understand child development. When dealing with preschool social development a survey has shown six times as many field or clinical studies as experimental studies (Bijou and Baer, 1960).

Most research on the neonate and young infant has been conducted in laboratories in maternity wards. Outpatient research clinics have been the setting for both experimental work and extensive longitudinal studies. Such clinics are usually part of a medical school and operate in conjunction with a child care advisory programme. Mothers bring their children in for observation at regular intervals and receive professional services free in exchange for their cooperation.

It must be recognized that most methods of obtaining infants for study yield biased samples. The parents who cooperate would constitute a group in education and socio-economic status. A research clinic can, of course, handle a large number of cases and may get enough cases to form a near-representative sample.

Clinical reports, in spite of their deficiencies with respect to precise definitions of psychological concepts often contain valuable information.

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The Laboratory - Experimental methods

The experimental technique is most commonly applied to study a suspected causative relationship between a phenomenon (dependent variable) and one or more other factors (independent variables) (Bijou and Baer, 1960). A situation is constructed in such a way that the dependent variable is readily observable. The independent variable is varied in a systematic manner and all other veriables are controlled to prevent them from influencing the dependent variable. Changes in the dependent variables are then stated as a function of the preceding changes in the independent veriable. The essential concept involved in the experimental technique is that of control. The basic principle of design of the experiment is that effects of the independent variable is to be evaluated unambiguously.

Causal factors can be brought under the investigator's control more easily in a laboratory than elsewhere. In an experimental technique the measurement of changes in both the independent and the dependent variables is done, whenever possible, by objective mechanical means. The human observer is often (not always) less sensitive and less reliable than a mechanical device and identical mechanical instruments can be more readily produced in large numbers.

The experimental techniques are aimed at the quantification of precise, reliable and unambiguous laws of child

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behavior in relation to the present and short-term past environments and at evolving a general system of behavior theory from such laws and finally at the extension of such a body of fact and theory to include more variables from the child's long-term past environment to produce a more comprehensive theory of behavior and its development.

Projective techniques

These techniques are categorized on the basis of the nature of the response required in the subject; the categories are termed constitutive, interpretative, cathartic and constructive (Henry, 1960).

The constitutive techniques are those that require the subject to assign a form or structure to a stimulus relatively unstructured. The interpretative technique relies more upon the subject telling what a stimulus means to him. In the cathartic techniques the stress is upon the expression of feeling and affect as when the child plays with toys. In the constructive techniques the child is required to create an order and organization by the manipulation of, say, blocks to build a specific unit.

There are other categories of the projective techniques also. The associative techniques are those in which the

subject responds to a stimulus with the first word, image, or thought that occurs to him. In the expressive techniques the actual process of manipulating the materials by the subject is seen as relevant data. Here possibilities exist of some direct expression of attitudes and viewpoints, an expressive process that is often felt to be not merely diagnostic but in some way therapeutic.

The projective method for the study of personality involves the presentation of a stimulus-situation as it means to the subject. The subject responds to his meaning of the stimulus-situation. The projective instruments are characterized by sensitivity to unconscious or latent aspects of personality, multiplicity of response permitted to the subject, the lack of awareness of the subject to the purpose of the test and by the amount of response being substantial in quantity and complex in quality. The projective techniques and psychoanalytic theory possess many congruent elements. Efforts have been made to integrate projective instruments with stimulus-response theory.

Challenging and fertile opportunities await those with imaginative and creative minds who apply these methods and develop other procedures to broaden the scope and contribute greater depth and meaning to child development.

Methods of Data Collection

In the cross-sectional method a limited number of observations are made on different groups of subjects. In the longitudinal method repeated observations are made on the same subjects. The repeated-measurements or longitudinal programme extends over a longer period of time than the cross-sectional even though the amount of time spent gathering data is the same in both cases. There are relatively few reports of longitudinal studies over long periods of time. There are, however, advantages of the longitudinal method.

The cross-sectional study is indicated to provide the rough outline of a phenomenon when an investigator has a general interest in some developmental behavior but without explicit hypotheses concerning subpopulation variation or the details of change. When more specific hypotheses are formulated on the basis of the data obtained in such a cross-sectional study, one may take up a longitudinal analysis with an increased chance of finding significant relationships.

A cross-sectional survey enables a researcher to set off subpopulations for the study of differences within the age groups, when more precise observations of child behavior can be made. Then studies of the type R = F (A, S) - with specified aspect of the environment interacting with age, or R = F (A,P) type - with specific limited subpopulations.

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A cross sectional study can show the variance of behavior changes, never the systematic direction in the change for which, the repeated measurements or longitudinal study is called for.

The variation study represents the most effective present day use of longitudinal study, when research goals are specified with the concentration on a limited set of observations on a limited subpopulation, the longitudinal study offers the advantages that come from "matched" subjects.

One of the chief merits of the longitudinal study is the fact that after-the-fact analysis can be made. This gain for longitudinal study carries with it a serious danger, that of "discovering" merely accidental relationships in post hoc longitudinal analysis. Replication or cross-validation is the major safeguard against this danger.

Successful maintenance of an intensive longitudinal contact depends on the degree to which the researcher supports the need of the parents for reassurance, advice, and a listening ear.

A practical decision the researcher must make in selecting his sample is concerned with the optimal number in the sample. One can never overestimate the effort required to collect repeated measurements data.

Distinction has to be made between longitudinal study as an exploratory search for relationships and as a technique of confirmation.

Again, a single observational technique may not be applicable throughout the developmental span under study. The difficulty underlying shifts in observational procedure calls for research to compare different observational modes. Perhaps, the most profitable approach to this problem is the overlapping of different techniques.

It must be recognized that the longitudinal researcher is not observing his subjects in a perfectly natural state for they are likely to change their normal behavior in presence of the investigator. The validity of the researcher's findings is not seriously reduced if he keeps this possibility in mind. (Kessen, 1960; Tanner, 1970).

It may be concluded that the creative use of longitudinal observation is an important part of child-development research and it permits the presentation of an integrated sensible picture of the developing child.

Research in child development offers some special problems, some unique challenges and some unusual opportunities. In the first place, to conduct research with children, one must understand them. In the matter of the techniques of research,

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children fall between adults and animals. For very young children the techniques used with animals are necessary. As the child grows older, we can begin to utilize language as a research tool. The lack of docility of children to verbal procedures is a problem. In many experimental complex situations the investigator must ensure that the subject knows the possible courses of action. Also, differences between children of different ages make it difficult to plot development from one age level to another. Bayley believes that intelligence is not a comparable measure at all age levels. Change in height is another variable which does not always mean the same thing; it may mean growth in the length of legs in some cases and change in sitting height in others.

The most serious technical problem is the real inability to control the environment of a child over any long period. Many measures of physical growth are, however, relatively uninfluenced by the disturbances found in the normal life of the child. Attempts to identify meaningful individual patterns in psychological development analogous to the various physical growth patterns have not yet been very successful. The problems of longitudinal investigations of child-development have already been discussed.

Characteristics of children's growth and development

The main features are changes in size and bodily

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proportions, disappearance of old features and acquisition of new features (Hurlock, 1956).

Growth is a continuous process. There is no trait which develops suddenly even though a trait like cutting of teeth may appear to do so. Certain features may appear to be dominant at particular stages.

Development follows a pattern particular to the species. There is regularity of sequence and pattern which makes it possible to make predictions. The sequences which follow an orderly pattern show interdependence. A stage is influenced by one that precedes it and it, in turn, influences the stage that follows. There are wellmarked milestones in these orderly growth sequences.

The rates of growth of different parts of the body differ and the rates of growth of a particular part of the body may also differ at different ages. This results in changes in size and especially marked changes in proportionality of body parts. The head, for instance, accounts for more than three-tenths of the stem length in a five months old baby whereas at the age of twenty five years the head contributes a little more than one-tenth of that length. Again the leg length of the baby is about one-fourth of the total length of the body when in an adult the leg length may be fifty per cent or more of the stem length.

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The differences in proportionality between body parts of a baby compared to the adult body are responsible for "baby" features. As the child grows the proportions of these parts change; old features disappear and new features make their appearance. The sequence of development is described as cephalocaudal which means the control of the body as well as improvement in the structure develops first in the head and progresses later to regions farther from the head. Similar sequence appearsin motor functions also.

The life span is divided into periods, each with its problems of adjustments. At different ages certain general forms of development are taking place which distinguish that age from the ones which precede and follow it. Five major developmental periods are recognized :(1) prenatal period (from conception to the time of birth); (2) infancy (from birth to two weeks); this is the period of neonate or the newborn; (3) babyhood (from age of two weeks to two years); it is the age of helplessness ; (4) childhood (from the age of two years to puberty; development at this age is characterized by growth of control over the environment); most people regard preschool children as infants and in the eyes of the English law any one under the age of twenty one years is an infant; (5) adolescence (from the onset of puberty to the age of maturity, twenty one years). By the end of late adolescence, the individual is regarded as mature.

To have a complete picture of human growth, it is necessary to understand how life begins and through what stages the new organism passes before it becomes a mature individual.

Prenatal development

The prenatal period is approximately 280 days long from the time of fertilization of the ovum by a sperm. This period is characterized by growth and development more rapid than at any period of similar length in life. The sex of the baby is determined at the time of fertilization. In the human cells there is a pair of unmatched chromosomes, the X and Y chromosomes. The process of sperm formation is such that half the sperms contain an X chromosome and half, the Y chromosome. The ovum always contains an X chromosome. If an X sperm fertilizes the ovum the resulting embryo cells will have the X X constitution and the sex of the baby will be female; if a Y sperm fertilizes the ovum the embryo is X Y and the baby's sex is male.

Mother's food, her health, her habits - addiction to alcohol, Tobacco, etc., emotional experience of mother during pregnancy, and age of parents are some of the factors which affect the pre-natal development of the fetus besides, of course, the genetic factors.

The pattern of development is similar for all new born

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infants; the variations are quantitative rather than qualitative. Differences in personality are apparent during the first few days of life.

One of the most rapid forms of development during the early years of life is the motor development that of control over the different muscles of the body. Development of control over the body parallels the development of the motor areas in the brain. Development of muscle control comes partly as a result of maturation and partly from learning. After the gross motor activities concerned with the larger movements of the body the child begins to learn skills or finer coordination in which the smaller muscles play a major role. Delayed motor development is serious primarily because it interferes with the social development of the child.

Language has been defined as the ability to communicate with others. Speech is a form of language in which articulate sounds or words are used to convey meanings. Speech is a skill and it must be learned. While the pattern of speech development is much the same for all children there are marked variations in the rate of development and contents of speech. Health, intelligence, socio-economic status, sex, family relationships and bilingualism are some of the important factors affecting speech development.

At birth and shortly afterwards, the first sign of emotional behavior is general excitement to strong stimulation. Emotional development is due to maturation and learning. The emotions of the young child differ markedly from those of the adult. Children's emotions are brief, intense and transitory; they appear frequently and can be detected by symptoms of behavior. Children of different ages show wide variability in their emotional responses.

Social development means the attaining of maturity in social relationships. The first social group for the child is his family and this group plays an important role in establishing his attitudes and habits.

At birth there are clearly discernible differences in structure and behavior. While the personality of the individual is not developed at that time, the potential qualities are there. No two individuals have the same environment and hence they tend to exhibit increasingly different personality patterns as they grow older.

Physical growth influences behavior and behavior, in turn, influences physical growth. It is important to understand the interrelationship between physical growth and behavior. The relationship is one of correlation rather than compensation. The development of the nervous system is concerned with

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intelligence. The muscular growth is concerned with motor capacities and strength. Changes in the functioning of the endocrine glands result in new and shifting patterns of behavior. The influence of the physique of the child on his attitude towards the social group is very great.

Some extremely important relationships between the physical and other aspects of development have been observed. Apparently behavior is related in important ways to physical makeup. This is reflected in the concept of somatotypes and morphogenotypes (Sheldon, 1949). Important relationships between physique and certain behavior characteristics in the nursery school children have been observed (Stott, 1967). There are, however, differences of opinions among psychologists regarding the physical types and temperament or personality and investigations are continued to search for more general relationships. Stott concludes that bodily attributes in their combinations and patterning can be important factors making for uniqueness, both in an immediate, direct sense and indirectly as they influence behavior. The noted expert on child development, Elizabeth Hurlock, also states that physical and mental growth are interrelated (Hurlock, 1970). From the organismic view point it has been concluded that growth and learning are inseparable (Millard, 1958).

The factors influencing the physical development of the

child include the genetic makeup which he inherits from the parents, the prenatal development, nutrition, family background, and community environments.

The elementary school period is characterized by growth. Motor and physical growth have important effects upon the child's personal - social development (Millard, 1958). By now it has become a well-established fact that children differ widely in their rate of physical maturation (Tanner, 1961; Meredith, 1968). The extent of this variability is considerable. Tanner finds that the majority of teachers (he met) have a strong feeling that behavior and thinking cannot be considered in isolation from body and brain. According to him growth is in general, a very regular process and subject to certain limitations it is possible to predict to a surprising degree an adult's size and shape from his size and shape as a child.

Estimates of growth and development through different techniques :

Physical development (especially the aspect of growth) involve quantitative changes in the dimensions of the body. The overall size is a complex dimension which is the resultant of changes in actual dimensions of the different parts of the body and in their proportionality.

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While referring to literature one should be exercised in understanding the sense implied in usage of a term. Mental growth, for instance, refers to really mental development. Breckenridge and Vincent (1965) use growth synonymously with development.

Many techniques have been developed to assess physical development. Some of the widely used techniques include Wetzel's Grid technique, the Standard Score Method, Fels Composite Sheet, the Iowa Curve, Skeleton Development, and Dental Development (Stott, 1967; Tanner, 1961; Lovell, 1969).

Wetzel's Grid technique is a device for depicting graphically the longitudinal growth of individual children in terms of changes in body size and shape. It is a chart of growth to be used for the age period 2 to 18 years. The basic assumption in this technique is that height and weight tend to keep pace with each other in normal healthy growth. The technique has been modified to study the age period from birth to three years also (The Baby Grid). Some researchers think the Grid technique does not allow sufficient latitude for normal fluctuations.

In the Standard Score method, all measurements are converted into standard scores which are the differences between the child's measurements and the averages for his age group, as expressed in standard deviation units. These scores

show the child's relative status in his group at each age level.

The Fels Composite Sheet is (designed by the Fels Research Institute) to record and interpret developmental data in terms of standard scores.

The Iowa Curves are plotted against the normative data. They give the actual growth picture in both height and weight and denotes the position of the individual within his group.

The skeletal age has been considered to be the most useful index of physiological age. In this method the present status of bone formation is studied using X-rays. Substantial positive correlation has been shown between skeletal and sexual maturation.

Use may also be made of the calcification of teeth, as indicated by X-rays of jaw. The dental maturity may be used as an index of maturity.

It is questionable whether techniques which depend on the use of X-ray equipment can be used as a standard technique in countries like India.

There is thus ample evidence and agreement on the importance of the knowledge of the physical aspects of development in understanding child behavior and yet sufficient and reliable

data are not available on many aspects of physical growth, their norms and interrelationships, more particularly for Indian children. The present thesis presents data collected in an attempt to fill the lacuna present in this important aspect of human development for the period of infancy.

Most studies of the physical development of children are confined to height and weight measurements (Meredith, 1968). As far as India is concerned we have not yet established norms of physical growth for our children. The few studies already made are mentioned in the review of literature that follows. In the present investigation many components of growth besides height and weight have been included with a view to obtaining a more complete picture of the physical development to ascertain whether correlations exist between various aspects.

At this stage, it will be pertinent to review related studies the results of which may be compared to those of the present study. The review is given in the next chapter.