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POTENTIAL MEDIATORS OF I.Q. CHANGES IN AN
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ABSTRACT

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AN EXPLORATORY STUDY OF SOME POSSIBLE ANTECEDENTS AND POSSIBLE CONSEQUENCES OF I.Q. CHANGES IN AN INNER-CITY ELEMENTARY SCHOOL POPULATION

The permanent records of 307 students, who attended an inner-city elementary school some 15 to 25 years ago were analyzed with respect to variables that might be related to or associated with IQ change.

Sex, incompleteness of family, grade one entry age and kindergarten, initial IQ level, school achievement and negative teacher comment were found to be significantly related to IQ change.

Family stability, preschool education and positive teacher comments were not associated with IQ change.

Changes in school performance and in student effort following IQ change did not vary with IQ change except in the case of increased academic achievement for IQ increase students. Changes in both negative and positive teacher comments following IQ change did relate significantly to IQ change.

Many of these findings were qualified by a sex factor.

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by

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CHAPTER I

THE RESEARCH PROBLEM

Introduction

"Some recent thinkers seem to have given their support to the deplorable verdict that the intelligence of an individual is a fixed quantity ... We protest this brutal pessimism; we shall try to show that it has no basis". Binet wrote these words in 1909. Despite Binet's warning the assumption of fixed intelligence became so established before World War II that many psychologists regarded all evidence of substantial shifts in IQ as merely the product of poor testing procedures.

Several studies, however, have pointed to the fact that intelligence test scores for many individuals show considerable variability from year to year. Brown (1933) reported 3 per cent of students retested after a 2-year period changed more than 30 points while 10 per cent changed between 21 and 30 points. In a longitudinal study covering a sixteen year span, Honzik, MacFarlane & Allen (1948) analyzed IQ change for varying intervals between 6 and 18 years. Variations of 30 or more points occurred in 10 per cent of a sample of 222 Berkeley children. Bayley (1955) found that 9 per cent of her sample changed 30 points or more,

58 percent changed 15 points or more and that only 15 percent changed less than 10 IQ points.

There seems to be little doubt about the reality of IQ change. The more urgent problem centers on the isolation of factors or conditions which contribute most to IQ change and their accurate measurement.

Research Defined

This research is an exploratory study of some personal and background variables e.g. sex, family stability, age on school entry, kindergarten, Gr. 1 reading level, academic achievement and teacher opinion, which may be associated with changes in IQ's in an inner-city population. Report card data for 307 Elementary school students, who attended the Royal Arthur School, Montreal, some 15 to 25 years ago were analyzed to determine which if any of these factors are related to the IQ changes, which were obtained from the IQ's reported on the permanent record cards. Academic performance, student effort and teacher comments subsequent to these IQ changes were also analyzed to ascertain whether any significant relationships exist.

Purpose of the Study

Because the IQ score is one of the most widely used concepts in psychology and education and, despite its many weaknesses and ambiguities, seems likely to be retained for many years, it becomes extremely important to understand the concomitant correlates of change in this variable.

Furthermore, it is generally acknowledged that the IQ is our best predictor of level of attainment in formal school subjects. Kemp (1955), who investigated the relationship of 28 environmental variables to 2 criteria of attainment (comprehension and language) in 50 London primary schools, concluded that intelligence had the most influence of all 28 variables. Similarly Mollenkopf (1956) in a study based on 18,000 U.S. students in 206 schools reported that the students' IQ predicted achievement considerably better (.90) than did the best weighted composite of school, parent and community characteristics.

In the school situation the student's IQ is a major factor in determining his academic and educational opportunities through streaming policies. As a result a student's IQ score has an important bearing on his future occupational level. Jensen (1969) cites the Duncan et al (1968) finding of a correlation of 0.55 between IQ and occupational status. In fact Jensen (1969) suggests that a correlation between IQ and occupational achievement was more or less built into IQ tests and that the bulk of the influence of IQ on occupation is through education. According to Bloom (1964) about 20 IQ points could mean the difference between a professional career and an occupation, which is at the semi-skilled or unskilled level. The criterion for mental retardation has been increased to IQ 85 in latter years by the Nat. Assoc. for Mental Retardation because an increasing number of persons with this IQ score are unable to get

along occupationally in today's world.

It also seems most likely that a student's IQ and/or "school stream" are major determinants of his academic self-image as well as his academic status among peers and teachers. From the perceptual viewpoint (Combs & Snygg, 1959) a student's effort and academic performance will be largely determined by his academic self concept. Teacher attitudes, effort, and instructional levels, may also be influenced by the intellectual ability image created by the IQ score. Hunt (1961) tells us that teachers have stated that "once you know the child's IQ you tend to see him through it and adjust your teaching to his ability or level of intelligence as revealed by the test". Beez (1967) provided evidence, which suggests that different teachers employ different teaching styles with students for whom they have different expectations. Jensen (1969) stated that even among children within the same family teachers will often give special attention and opportunities to the child who displays the highest abilities.

The crucial significance of the IQ score in the student's educational situation invites an exploration of the realm of IQ change. How can we reduce the incidence of low IQ's and increase the proportion of individuals reaching higher levels of measured intelligence? The urgency of this problem has become most obvious since 1960, when educational thought and research began to focus on the deprived child. The realization that many of these children

had low IQ's has intensified efforts to upgrade their measured intelligence. Furthermore, the fact that 30 per cent of the U.S. child population is currently classified as disadvantaged with the expectation that in 1970 one of every two children in the U.S. large city schools will be categorised as deprived (Goldberg, 1964) points to the immediacy of the problem of IQ change.

If we are to avoid an increase in the rate of the so-called hard-core unemployed, then these children must be educated to play a productive role in our shifting economy. Changing employment opportunities resulting from automation and ever-advancing technical know-how require higher and higher levels of educational attainment. Consequently, it becomes highly important as Hunt (1969) suggests "to raise the intelligence" of those people who comprise the bottom quarter of the average population.

Besides there is a growing concern that the measured intelligence of this type of child does not reflect a ceiling level of their intellectual and learning abilities (Bernstein, 1961; Kagan, 1969) and that society is thus losing this undeveloped potential. Kagan (1969) considers that school-related tasks are well within the range of 90 out of every 100 children.

If we are to continue assessing mental abilities in terms of measured IQ and allocating educational opportunities on this basis, then it seems to the writer to be vitally important to search out and establish which specific

factors are most relevant to improving IQ and which factors most relevant to preventing its decrease. This study attempts to identify some of the correlates of IQ change in an inner-city population, which received no crash program nor special intervention treatment. They experienced only the typical interactions of the normal inner-city schooling situation. Findings, it is hoped, will indicate areas in which more sophisticated and specific research may be required. Since certain of the variables investigated have particular significance for educators in the school situation, it is possible that results may have implications for teacher education programs and educational planning in general.

IQ Change and Intelligence

In this study we are primarily interested in accounting for the IQ changes, which are believed to be systematic rather than chance happenings in an inner-city group of elementary school children. Therefore, no attempt will be made to clarify the concept of intelligence, to debate the validity of defining intelligence in terms of IQ or to lend support to one or another of the theories of intelligence. The fact that the IQ has been accepted as the operational definition of intelligence since first employed in the 1916 form of the Stanford-Binet is assumed.

However, a brief glance at the historical development of the IQ score will provide some perspective of its significance in the field of measured intelligence. Soon after

the adoption of the IQ, which provided a uniform interpretation of intelligence regardless of age, it was realized that the conventional IQ remained constant only when the mental age unit shrank in direct proportion with age. Besides, differences in the variability of the Binet type IQ scores at different age levels meant that one IQ value at one age level would be equivalent in terms of relative position to a different IQ value at another age level. Test makers, governed by the prevailing notion of a fixed intelligence got around such problems either by providing correction tables to be used with IQ's at certain age levels or by replacing the ratio IQ with the deviation IQ (Anastasi, 1961). In 1939, the deviation IQ was first adopted as part of the Wechsler intelligence scales and has subsequently been employed in most group tests of intelligence.

The deviation IQ is computed so that a subject obtains the same score on successive testings unless his position in the age group changes. For the individual the deviation IQ transformation ruled out that part of change with age in the conventional IQ due to age changes in the means and variabilities. Hence fluctuations in IQ scores which are not attributable to these factors will remain after the transformation.

Average IQ scores by force of standardization maintain approximate constancy. However, the individual IQ is under no such requirement. On the contrary past research would seem to indicate that IQ inconstancy for whatever

reasons is the rule rather than the exception for most individuals. Unfortunately, even today many teachers, parents and lay people in general seem unaware of this fact (Goslin, 1967).

As recently as 1961, for the first time, a set of IQ change tables was published. Pinneau developed these relative to 9 different ages. They were based on the results of the Berkeley Growth Study subjects on the Stanford-Binet and the California Mental and Preschool schedules. For example his tables show that 50 per cent of subjects with a Stanford-Binet IQ 120 at age 9 years will change 6 points or more before they finish Grade 6 (12 years), that 25 per cent will change 4 points or less and that 25 per cent whose IQ's are the least stable change 8 or more points. The range of change is 0-29 points and changes of more than one standard deviation were found as late as age 11 (Table E15, p. 223).

It should be noted that the mean IQ of the sample upon which Pinneau based his tables was over 120. Besides, Pinneau's tables are concerned only with the amount of change in IQ regardless of whether it was an increase or decrease. Furthermore, he does not recommend these with IQ's obtained with group tests, which were used in this study. Again Pinneau's focus was IQ change with age as opposed to the mediators of IQ change in time.

In general it has been found that the probable error of the Standord-Binet IQ is approximately 5 points. The average difference between IQ's on Forms M and L (1937)

standardization) was 5.9 for cases with IQ's of 130 or above decreasing to 2.5 points for cases with IQ's below 70.

Jones (1954) tells us that the substitution of the deviation IQ has often been suggested as reducing IQ changes, particularly when the retest involves a different test instrument. Jensen (1969) recommends that in evaluating pre-school enrichment programs at least 5 points be deducted from the gain as having little or nothing to do with real intellectual growth. For the purposes of this study a difference of 6 IQ points or more was considered of sufficient practical importance to justify an enquiry into its possible causes.

It is important to recognize that there is no way in which we can be sure that the IQ changes registered are related to changes in absolute levels of intellectual functioning. As Pinneau (1961) pointed out, one cannot determine from a subject's deviation IQ score whether there has been any absolute change in his performance. For example a subject who at 10 years obtains an IQ of 100 on the Stanford-Binet and who shows an 8 point drop by age 11 and an additional 12 point drop by age 13 has at all three ages a mental age of 10 years 3 months. In absolute terms then there has been neither an increase nor a decrease. But in operational terms this subject, we know, is functioning intellectually at a level well over two years below his average age group. His intellectual development seems to have stopped. Why? What are the specific factors operating

in this situation? Research must isolate these conditions and factors, which can then be manipulated in order to avoid such IQ decreases.

Limitations

From a controlled experimental viewpoint the data in this study are crude. In some cases IQ's are from different tests and no attempt has been made to equalize these tests. Most have been group administered. We noted, however, that at least ten different tests were used in the Harvard Growth Study (Anderson, 1939), most of which were group tests. In this study, school grades, teacher assessments and teacher comments were analyzed. It is assumed that errors which may have crept into the data were random and do not systematically influence the findings.

It must be acknowledged that the longitudinal design is weakened by the fact that when students are tested over a period of years, scales with different content must be employed. Despite this drawback, the longitudinal approach yields patterns of change and trends not shown by data based on successive cross sections of development.

Notwithstanding these limitations, we were influenced by the phenomenologist, who suggests that regardless of the objective validity of any situation, it is the subjective assessments of the individuals involved that ultimately determine outcomes. Furthermore, we are following the advice of Bloom (1964), who suggested that school records may provide

an "especially good collection of data", which may be the
"basis for excellent longitudinal studies".

CHAPTER II

POTENTIAL MEDIATORS OF IQ CHANGE

Many researchers have recognized the need to explore the domain of IQ change for possible co-variation between such variables as age, socio-economic status, amount of schooling, institutional and other differential environmental effects. However, few longitudinal studies appeared before the early 1950's. Prior to this, most studies employed the cross-sectional method, which compares the IQ's of members of several different groups representing various age levels or covering some arbitrarily selected social or personal dimension. Few of the early studies deal with disadvantaged children residing in urban localities. HARYOU (Harlem Youth Opportunities Unlimited) and other recent studies are using urban subjects, but tend to use cross-sectional rather than longitudinal approaches.

At the present time it is generally agreed that although longitudinal evidence is more difficult to secure it is nevertheless superior to cross-sectional data, (Birren, 1959). An important feature of the longitudinal method is the opportunity it affords to investigate the antecedents or whys of intellectual change. Compared to the large number of studies relating IQ levels to a variety of concomitant

variables from which changes are projected, there are few studies attempting to account for IQ changes in terms of systematic variation of antecedent factors.

In this chapter we will review the more important past studies, which have investigated IQ change. In most cases, it will be seen that the dimensions related to IQ change are of a gross nature although in a few instances more precise factors have been studied.

IQ Change and aging

Several major longitudinal studies of mental growth as a function of age have been made. These have been based on repeated and highly focused measurements on well-defined samples. Tests of general intelligence such as the Stanford-Binet, Wechsler-Bellevue, Otis, Terman, Kuhlmann-Anderson, etc. have been administered to groups of children for periods ranging from 5 to 21 years. The Berkeley Growth Study (Bayley, 1949, 1955), the California Guidance Study (Honzik, Macfarlane & Allen, 1948), the Fels Study (Sontag, Baker & Nelson, 1958), the Brush Foundation Study (Ebert & Simmons, 1943), and the Harvard Growth Study (Anderson, 1939) have provided correlational data of changes in measured intelligence with increasing age. According to Pinneau (1961), correlational data are not easily understood by the teacher in the classroom, have little significance for him and consequently are of little use to him.

Bloom (1964), in his exhaustive review of longitudinal

studies, stated that these data question the notion of an absolutely constant IQ. In fact, results from these different studies indicate that the greater the interval between tests the greater is the tendency for the individual to shift in relative position, but there is greater constancy of relative standing with increasing age. Bloom (1964) estimates that half the variance in an individual's IQ at age 17 is accounted for by age 4, a further 30 per cent by age 8 and the remaining 20 per cent between ages 8 and 17 years. As mentioned earlier, Pinneau (1961) developed tables of IQ change for 9 specific age levels based on the actual amounts of change which were found for subjects of the Berkeley Growth Study.

It is well to remember that most of these longitudinal studies have been by design concerned with relatively small populations of above average intelligence. Subjects from Nancy Bayley's (1955) study were 61 children with a mean Binet IQ of over 120. The sample mean IQ for Sontag's (1958) Fels Institute study of 140 children "is considerably above the average and this limits to a large extent many of the kinds of generalizations to be made about the nature of mental growth in all children". Pinneau (1961) felt, however, that his IQ change tables did not deviate by any great extent from those which would be obtained from a truly representative sample of subjects, since they compared favourably with the IQ changes found by Bradway (1944) in retests of subgroups of the 1937 standardization sample of

the Stanford-Binet.

Several other reports of IQ changes with age are available, (e.g. Hildreth, 1926; Allan & Young 1943; Hirt, 1945; Sloan & Harmon, 1947). However, the subjects of such studies have frequently been heterogenous either with respect to age at the first testing or with respect to interval between test and retest or both. Since the amount of IQ change depends on both these factors, the reported values deviate an unknown amount from the true changes of specific age groups. Some studies have presented findings on subjects homogenous as to age and interval between tests (Bradway, 1944; Elwood, 1952; Bradway et al 1958). Nevertheless, these seldom permit direct comparison since samples at both testings are infrequently comparable as to age.

There appears to be little doubt that IQ changes in time. Now let us examine some postulated mediators of IQ change.

IQ Change and amount of schooling

Differences in amount of schooling received have been investigated as a potential factor in IQ change. Lorge (1945) found that for individuals roughly comparable in IQ at age 14, retest scores at age 34 proved to be higher for those who completed more grades in school. Owens (1953) reported similar findings for mid-western college students. IQ changes over a 10 year period were examined by Husén (1951), who compared tests given at induction into military service with test scores obtained in the third grade for 613

Swedish boys. Gains (found in all groups except those with the smallest schooling) were related to the number of school grades completed. Husén concluded that schooling at least for the three lower social groups, "has incomparably the greatest significance for the systematic change in IQ between 10 and 20 years of age". He reported mean IQ increases between 0 and 11 IQ units, with a mean IQ change of -1.2 IQ points for those having Primary schooling (grade 7) only. Bradway (1945) stated that "extent of education" between preschool and Junior High was a factor in Stanford-Binet IQ changes.

Tuddenham (1948) compared the Army drafts of the first and second world wars. The mean educational level of the U.S. Army draftees was 8 grades in World War I and 10 grades in World War II. This difference was considered as partly affecting the pronounced rise in tested intelligence for the World War II army population.

Gains in intelligence test scores have been usually reported in college populations (Livesay, 1939; Thorndike, 1948). Wellman & Pegram (1944) and McNemar (1945) both agreed as a result of two separate analysis of Binet IQ changes of preschool orphanage children that the IQ gains were associated with the amount and consistency of preschool attendance.

Gordon's (1923) famous canal-boat children attended school only a few days at a time when the boats were tied-up. The gypsy children were considered as having a better school

attendance and ranked 5 IQ points higher on the average.

The vexing question as to which dimensions of schooling are related to these reported increases and decreases in IQ still remains more or less unsolved.

IQ Change and environmental deprivation

There is sufficient cumulative research to show that there are significant differences in IQ score distribution between children who live in depressed areas, or who are classified as socially inferior and those who do not. Furthermore, one of the most consistent findings in research with children from such backgrounds is the decline in IQ scores with time.

Only recently has the term "cultural deprivation" been adopted to describe certain types of human environment in which cultural interaction is limited. Nevertheless, we can trace to the early decades of this century the growing awareness that deficiencies in home environment, schooling, and other areas of early experience may affect mental development.

As early as 1923, there were a few studies of extreme cultural deprivation as found in certain isolated mountain communities, gypsy camps and canal boats. Gordon (1923) reported a marked negative correlation between age and IQ for English gypsy and canal-boat children. Asher's (1935) study of children in the East Kentucky mountains showed a steady drop in the median IQ from 84 at 7 years to 60 at 15 years. Edwards and Jones (1938) reported IQ's which dropped from

around 100 at ages 7 to 9 years to 76 at age 14 years and to 70 for those older, for school children in the mountains of North Georgia. Jordan's (1933) study of mill workers in N. Carolina showed IQ decreases from 100 at age 6 to 85 at age 13 years. Chapanis and Williams (1945) studied 4,311 Tennessee children in "a fairly rich agricultural area". The mean IQ's for all cases decreased from 94 at age six to 76 at age 15 years. Both Shuey (1958) and Dreger & Miller (1960) reported wide differences in IQ between Negroes and whites. Again these differences were smaller for younger children.

A number of studies have emphasized the deprivational effects of institutional life. Children in these, it is thought, may receive less adult attention, less language stimulation, less opportunity to form affective relationships. Available evidence indicates that removal from such non-stimulating environments to a superior institutional environment (Skeels & Dye, 1939) or to superior foster homes (Freeman, Holzinger and Mitchell, 1928; Skodak, 1939; Skodak & Skeels, 1949; Davis, 1947) tends to raise IQ levels. Freeman et al (1928) reported greater significant gains for children placed in superior homes than for those placed in poorer homes. The mean IQ of the former was 111 as opposed to a mean IQ of 91 for the latter. Although foster-home studies are complicated by the problem of selective placement, Skodak & Skeels (1949) pointed out that in their case the IQ's of the 100 children (mean IQ at

14 years - 102.4) placed in foster homes fifteen years earlier were higher than would be expected on the basis of their familial origin.

The Skeels and Dye orphanage children who were transferred, increased their IQ's from an average of 64 at 19 months to 96 at age 6 years. Skeels (1966) has recently reported on this group. They are now average citizens and their children have an average IQ of 105. On the other hand, most of those left in the orphanage remained in mentally retarded institutions.

Most striking, of course, and perhaps a study that could tell us a great deal about raising IQ is the case of the girl, daughter of a deaf mute, who on being removed from her attic confinement at age six years, increased her IQ from 30 to normal within two years (age 8) (Davis, 1947). Specific individual tutoring in the first years of elementary schooling may be equally powerful in raising IQ's of most children.

Such evidence tends to suggest that the effects of environmental deprivation at least in the early years are not irreversible. Whilst Jensen (1969) agrees that deprivation "need not permanently result in below average intelligence", he qualifies this position by making a distinction between extreme environmental deprivation (e.g. Skeels & Dye, 1939; Davis, 1947) and the deprivation of the many children now called culturally disadvantaged. In the case of these latter children, Jensen appears to base his uncertainty of

intellectual amelioration on the results of such compensatory programs as he judged ineffective in his article. At this point, it must be noted that psychological opinion of his assessment of compensatory education is far from unanimous.

Furthermore, it appears to the writer that Jensen is splitting hairs here. On a continuum of deprivation, it would seem that the extreme case must eventually progress to the less deprived point of the culturally disadvantaged child. The question of subsequent differences in intellectual performances, assuming such differences do exist, still remains unexplained.

It is also possible that differences in IQ gains between different studies may be equally well explained in terms of the quality, quantity, intensity and individuality of the remedial action taken. As Jensen admits, the normally less intelligent parents of the disadvantaged child are less apt to provide the environmental conditions conducive to intellectual development in the important period between 3 and 7 years. The child who is selectively placed in a better home and educational setting may very well have the advantage through remedial action.

However, Jensen's argument rightly draws attention to the fact that deprivation is a complex and multifaceted variable. It invites the researcher to clarify the concept of deprivation by identifying the precise environmental conditions which are most likely to result in deteriorating

IQ's and IQ gains as well as the most effective and appropriate remedial actions.

IQ Change and improved cultural conditions

IQ changes have been attributed to broad economic, social and educational changes over a period of time. Comparable samples of the same population have been examined after an interval of several years during which improved secular trends are evident. Perhaps the most important study in this area is the comparison of Scottish 11-year olds in 1932 and in 1947. In the later testing, which involved over 70,000 children i.e. 88 per cent of total age group, Thomson et al (1949) found statistically significant improvement in mean scores. A similar study of American high school students over a 20 year interval suggested that the IQ had increased despite the marked increase in proportion of students enrolled in high school (Finch, 1946).

Wheeler's (1942) study of E. Tennessee children is another example of an apparent secular trend operating to change IQ. This study involved 3,352 children in 40 schools. In the ten year interval between testings the area had undergone conspicuous improvements in its socio-economic structure, transportation facilities and educational system. Table 1 shows the gains over this period.

TABLE 1

IQ GAINS OVER 10 YEARS IN COMPARABLE GROUPS OF
TENNESSEE MOUNTAIN CHILDREN

Age	Mean IQ	
	1930	1940
6	94.7	102.6
8	88.9	99.2
10	84.3	91.4
12	81.4	90.2
14	74.7	85.1
16	73.5	80.0

It is interesting to note from this table that the greatest changes in IQ took place at ages 8 and 14. As in 1930, however, schooling seems to make these children systematically decrease in IQ. The dimensions of schooling which contribute to this pattern need to be identified.

Yet another instance of differential environmental opportunity are studies of Negro migrants. Klineberg (1935) studied the intelligence of Negro migrants from the South in relation to their length of residence in New York City. The average IQ for children newly arrived was 81.4 as compared to 84.5 for those who had been in New York 2 to 3 years and 87.4 for those in residence longer than 4 years. Lee's (1951) study adds weight to Klineberg's findings. He too reported IQ increases based on a longitudinal study of Negro migration into Philadelphia schools. IQ increments were significantly correlated with the length of time

Negroes spent in northern schools.

IQ Change and compensatory education

Recent years have seen much deliberate effort on the part of educators to boost IQ. Since 1960, when educational thought and research began to focus on the deprived child, many specially developed programs and approaches have been operating in an attempt to compensate for such deprivation. Results of such efforts report IQ increases of 40 points or more (10 to 15 on the average). These gains are usually attributed to enriched and intellectually stimulating programs. Unfortunately, poor experimental design and inadequate controls have made many of these difficult to assess (Wilkerson, 1965). As pointed out by Wilkerson, (1965), Grotberg (1965), Gordon (1965) and Kagan (1969), there is need to determine which types of experiences are yielding the best developmental outcomes and for which children specifically.

Jensen (1969) has indicated that "massive compensatory programs have produced no appreciable gains in intelligence". Although no IQ gains for the Higher Horizons Program (64,000Ss, gr. 3 - 10, 1959-1962) were obtained compared with control schools, more favorable growth in arithmetic achievement, elementary school attendance, elementary school truancy rate as well as on many other student growth criteria were reported (Wilkerson, 1965). The Banneker School Program which involved 16,000 elementary school children, 95 per cent of whom were Negro, reported during the first

four years of operation that the median IQ increased from the middle 80's to the middle 90's, whilst Banneker graduates tripled in the top-ability high-school programs. Dr. Samuel Shepard, Jr., the assistant superintendent in charge of the Banneker district, warned that "unless planning and follow through" were given as much care and thought, it would be better to leave these children uninvolved. Many such children have few expectations of success in school. To raise their aspirations and hopes of academic performance without fulfilling these may lead to still further disillusionment and frustration with society. Conant (1961) has warned that these disadvantaged children are social dynamite, and could become more lethal than the atomic bomb.

Some researchers have reported that Headstart did not appreciably raise the educational IQ of the children who participated, (Jensen, 1969; Hunt, 1969). On the other hand, Brazziel (1969) cited Gordon's report (1969) to the Research and Evaluation Branch of Project Headstart, in which Headstart children, who were enrolled subsequently in middle class schools for kindergarten and Grade 1, maintained their IQ gains.

Two factors are suggested as influencing the outcome of Project Headstart. It is thought that the traditional nursery school approach with its emphasis on free play, which was used, was unsuited to the needs of these children. It is also suggested that the belief that a summer or two or even a year of nursery school would overcome the handicaps

of earlier environmental deprivation is somewhat naive. Indeed, Jastak (1969) speaking more generally, reminds us that one should not expect drastic changes in IQ even as a result of intensified teaching that lasts three years, that permanent boosts in IQ are very gradual and take many years to materialize.

Other defenders of the apparent failure of large-scale programs to elevate IQ permanently, claim that "far more was promised than we knew how to deliver" (Cronback, 1969); that the change from small to large programs may involve levels of attentiveness of teachers or students or both, resulting in less change in cognitive functioning in the expanded programs (Stinchcombe, 1969); that the mass of teachers are "dumber" than those involved in experimental programs (Stinchcombe, 1969); that attempts to use what has proved helpful in dealing with the middle class child with learning difficulties is not the answer (Wolfe, 1962; Goldberg, 1967); that so little is known about the process of learning that it is premature to judge the value of IQ gains be they ever so small (Voyat, 1969); that we should concentrate on the school's failure to teach rather than the child's failure to change his IQ (Gordon, 1969).

Small scale compensatory experiments, as Jensen (1969) admits, have produced IQ gains ranging from 5 to 20 IQ points. Most of these programs have been focused on the preschool child. The potential value of preschooling was recognized in the thirties, when an extensive and versatile program into the possible effects of nursery

school education was carried out at the University of Iowa and reported in the Thirty-Ninth N.S.S.E. Yearbook. In general, findings were interpreted to signify the potency of the preschool environment in generating marked and persistent changes in IQ. In 1945, Wellman reviewed results of twenty-two preschool groups. Most studies found slight differences in favor of nursery school subjects as compared with control groups, but these differences often failed to be statistically significant. As late as 1954, Jones remarked that disagreement still existed as to the worth of preschool education.

Recent compensatory education at the preschool level is attempting to develop cognitively stimulating programs and instructional ingenuity. These programs are invariably directed by a team of experts. (e.g. Bereiter & Engelmann, Deutsch et al). Evidence from preliminary evaluation of such preschool programs strongly suggests the validity of this general approach. Heber (1968) reviewed 29 such programs and found they resulted in average gains of between 5 and 10 points.

The amount gained depended on several factors. An enriched traditional nursery school approach without any special effort to develop specific cognitive skills usually resulted in a gain of about 5 IQ points. Special effort to develop cognitive skills such as language skills and number skills generally resulted in a 10 point average gain. More comprehensive programs which involved parents

(Bereiter - Engelmann, 1966) have reported gains of as much as 20 points. Bereiter & Engelmann (1966), on the basis of an analysis of 8 different preschool programs, suggest that in general the disadvantaged child's average IQ gain is half the way from their initial score and the normal level of 100. These investigators also reported that the scholastic performance of their experimental children was commensurate with that of children 10 to 20 IQ points higher.

Intensive preschool training of the mentally retarded has yielded similar but more spectacular results. Kugel (1967) reported IQ increases ranging up to 51 points over a 5 year training period. The greatest average increase 23 IQ points, took place in the 2-4 year olds. This led Kugel to comment "that working diligently with groups, when they are no older than 3 or 4 years of age" may modify the deleterious effects of prior psycho-social factors. In the well-known Kirk (1958) study, 70 per cent of the experimental children showed an acceleration in their mental growth rates and retained this accelerated level during the follow-up period. However, Kirk indicated that the opportunity for preschool education was not the only factor operating in changing the IQ of these children, that the home environment was also a major consideration. He suggested more intensive empirical research to identify the constellations of factors or the specific factors which were operating in the family.

Hunt (1969) states that we shall not know for at least

another twenty years how much IQ can be raised by deliberate intervention with children from birth to age five even if we proceed "no holds barred", (Jensen, 1969). Meantime, Deutsch (1969), director of the sophisticated study taking place at the New York Institute for Developmental Studies says "... long range enrichment with specially trained teachers, careful planning and supervision and adequate funding can produce positive effects on IQ scores ..." He strongly argues for more research to yield information as to the best operative procedures.

On the other hand, Jensen (1969) appears to suggest that the heredity component of IQ is so high (80 per cent) that we should not expect much change from compensatory programs. However, subsequent serious questioning of Jensen's measures of heritability and populations (Light & Smith, 1969; Crowe, 1969; Stinchcombe, 1969; Kagan, 1969) seem to suggest that it is far from definite how much variation in IQ is due to genetic factors, how much to environmental factors or how much to interactional factors. Whatever the outcome of future deliberations and research in this area, the educators's field of impact on IQ is through the non-genetic dimensions of IQ be they ever so small. Only indirectly can he mutate the underlying genetic structures.

It would seem that the question of deliberate intervention to change IQ is still in its infancy. To date, the preschooler has monopolized research effort and even here

the mediators of IQ change are far from clearly differentiated.

IQ Change and expectations

It is hypothesized that teachers' expectations of children influence their mental development. Rosenthal & Jacobson (1967) offered proof of this phenomenon in an experiment in which teachers were given the belief that certain children "bore watching", since they were expected to show unusual intellectual gains. Eight months later these children showed "significantly greater gains in IQ than the remaining children, who had not been singled out", ($p = 0.02$). Gains were greatest at the Grade 1 and 2 level, 47 per cent of the special children gained 20 or more IQ points as opposed to 19 per cent of the control children. Two years after the experiment the younger children lost their expectancy advantage over the controls whereas the upper grade children showed an increasing expectancy advantage. Thorndike (1968) subsequently analyzed some of the results of Rosenthal's study and claimed that the data on which they were based were unreliable and worthless. Nevertheless, he failed to question the general reasonableness of the self-fulfilling prophecy effect.

Beez (1967), in a similar type experiment with pre-schoolers, attempted to identify factors which might account for these expectancy gains. He reported that teachers given higher expectations of their students attempted to teach these students more. Yet when he controlled for the amount to be taught, significant IQ gains were still obtained.

It appears that the ground has scarcely been scratched in this area. Does a student's IQ score create his ability image with concomitant expectations for a teacher? Does the teacher then adjust learning content, teaching methods or styles and other unidentified subtle forms of interaction to these expectations? The answers to such questions await further intensive research.

IQ Change and nutrition

Jensen (1969) strongly emphasized the important role of physical and biological factors in improving IQ. In fact he suggests that they may contribute as much or more to ameliorating IQ as will educational and social manipulations. Whilst it is recognized that advances in medicine, nutrition and prenatal care may contribute much to elevating IQ, it is also a fact that the educator as such can play little if any part in this complex field. Nevertheless, a few studies have investigated the relationship between simple nutritional elements and IQ changes.

Seymour & Whitaker (1938) reported IQ gains for 25 - 6 $\frac{1}{2}$ year old underprivileged children matched with a control group, who were provided with daily breakfast in school. When the breakfasts were discontinued the superiority of the experimental group diminished. More positive results were reported by Poull (1938) and by Kugelmass et al (1944) for poorly nourished children who were given nutritional therapy. Marked IQ gains were noted for both mental defectives and

normals. The younger children gained the most. The writers inferred that early childhood malnutrition may be more readily overcome whereas prolonged malnutrition may involve irreversible effects.

Harrell (1946) reported greater gains for experimental subjects in a number of mental functions for 55 matched pairs of orphanage children. The experimental group were given 2 mg. of thiamine daily for a year. In a later study, Harrell et al (1955) gave vitamins and mineral supplements to pregnant women of low socio-economic status. These women gave birth to children who, at age 4, averaged 8 points higher in IQ than a control group of children whose mothers were administered placebos during pregnancy. Gadson (1959) summarized experiments using glutamin acid in one of several forms to stimulate mental development. Findings indicated that this had been most successful with the mentally retarded and in the first six months of treatment. Cravioto (1966) reported gains of as much as 18 points as a result of nutritional therapy in a group of extremely undernourished 2-year olds. Undernourished four-year olds who received therapy did not change significantly in IQ.

IQ Change and specific variables

Several investigators have attempted to examine the relation between more specific dimensions and IQ changes. Wellman and McCandless (1946) studied the factors associated with Binet IQ changes in 34 preschool children. They reported that those subjects, who had a higher vocabulary age

than mental age when tested in the Fall gained 7.6 IQ points over the following school year, whereas those subjects with a vocabulary age less than their mental age gained only 0.6 IQ points.

Kagan et al (1958) working with the Fels Institute data found significant relationships between four personality traits and IQ changes. Osborne (1960) attempted to identify sources of IQ changes in repeated measurements on 815 Whites and 446 Negroes (a representative sample of a South Eastern State in the U.S.). Apparent changes in IQ from 1954 to 1956 to 1958 (Gr. 6 - Gr. 11) were attributed "to the regression phenomenon of tests with less than perfect reliability". Both Negroes and Whites of lowest initial IQ's earned higher IQ's at later ages while bright children of both races tended to earn lower scores at subsequent testings.

In 1963, Eagle examined the relationship of certain cognitive variables to changes in IQ between Gr. 3 - 4 and Gr. 8 (N = 267). He found that for boys 9.4 per cent of verbal IQ change variance could be accounted for in terms of field dependence, spontaneous flexibility and acquiescence to cognitive habit. For girls, category width and field dependence accounted for 7.3 per cent of verbal IQ change. Low order but significantly different from zero correlations were found between verbal IQ changes and Category width ($r = 0.257$). Field dependence ($r = 0.291$) and spontaneous flexibility ($r = 0.189$). Sex differences ($p > .002$) caused Eagle to suggest that boys and girls be judged independently.

Justman (1967) studied the relationship of student mobility to IQ changes from Grade 3 to Grade 6. He reported that the records of 934 disadvantaged New York children indicated that those who attended a single school during the six elementary school grades taken as a group, increased their mean IQ significantly ($p = 0.05$ from Gr. 3 to Gr. 6). Student mobility had to be relatively high (4 or more schools during elementary grades) before mean IQ's decreased significantly ($p = .01$).

Freyburg (1968) examined the IQ's of 49 New Zealand primary school children tested every 3 months over a two year period. He reported a consistent pattern of no change in IQ's from the testing before to immediately after the Summer vacation. Zigler & Butterfield (1968) reported findings which indicated that reduction in the effect of debilitating motivational factors ($p = 0.05$) was related to IQ increases in deprived nursery school children.

It would seem from the literature just reviewed that IQ change is a complex topic, that IQ changes may reflect a large number of dimensions. Recent years have seen the beginning of a systematic search for the specific variables which have the most potent effect on IQ change. However, we are still a long way from knowing which factors will produce the best outcomes and for which children specifically. It is hoped that this longitudinal analysis of the IQ changes in inner-city children, who were not the subjects of a deliberate intervention program, will yield some significant

insights as to the specific variables which may be operating in their particular situation.

CHAPTER III

THEORETICAL BACKGROUND OF HYPOTHESES GENERATED

Deprivation theory and early experiences

There is little doubt that intelligence development is in part a function of the environment in which a child lives. Environments may be considered as abundant or deprived in terms of the opportunities they provide for verbal and language experiences, for direct as well as vicarious experiences of complex situations, for problem solving and independent thinking, for the type of expectations and motivations most suited to intellectual growth. More and more evidence is piling up that grinding poverty, because of its detrimental physical effects, its limiting of stimulation in the home and social milieu, its restricting or debilitating erosion of hopes and expectations may act as a powerful factor in curtailing intellectual development. Deutsch (1968) stated that slum environments "do not provide young children with a sufficient variety of stimulation and most especially do not provide the kind of figure ground, or signal noise ratio which is conducive to accurate and defined perception". The majority of inner-city children are children from poor homes.

Deprivation theory suggests that the low IQ's and low academic performance of children, especially evident in disadvantaged children, arises in part from the fact that these children enter school lacking certain necessary experiences and skills, which are pre-requisites for success in school. We are still a long way from knowing which experiences in particular are the vital ones. Research has just begun on this complex problem and this study hopes to contribute in its own small way. However, it is currently believed that a child's early experiences and familial setting are especially potent in affecting intellectual changes, and as a result have far reaching consequences for his conditions of life, career, sources of fulfillment and happiness.

Much research has provided evidence of the very rapid growth of intelligence in the early years of a person's life. Bloom's (1964) figures would lead us to expect that variations in experience have a marked effect before age 8, with the greatest effect likely to occur between ages 1-5 years. Luria now engaged in a series of experiments with young children, is reported (Times Ed. Supp. 1968) as claiming these show quite clearly that it is the quality of the child's experience, the quality of the stimulation which he receives during his early years, which make him ultimately capable of developing intelligence. Hunt (1961) seems so convinced of the importance of the quality and quantity of experience in the growth of mental abilities that he suggests we consider "ways to govern the encounters that children have with their environments

especially during the early years of their development to achieve a substantially higher adult level of intellectual capacity."

Hebb (1949) placed great emphasis on the role of experience during early development in the forming of neural connections and the more elaborate cell assemblies. He has also pointed out how in several animal studies later behavior patterns differed as a result of prior differential early experience. Hunt (1969) also subscribes to the view that later learning is largely dependent on earlier learning. He considers the development of intelligence as a "function of the cumulative effects of informational and intentional interactions with physical and social circumstances". The hierarchical learning models of such theorists as Gagné (1965) and Ausubel (1963) seem to fit equally well into such theoretical speculation. Research has also provided evidence that different patterns of mental growth are related to a large extent to differential early stimulation and experiences, (Lesser et al, 1965; Covington, 1967).

On the other hand, Jensen (1969) questions somewhat this line of thought. He does not believe young disadvantaged children are sensorily deprived, at least not in the same way as animals, upon which most findings of deprivation are based. Jensen bases his argument on Harlow's (1965) monkey research, which primates he reminded us are more closely related to the human condition than other animals. These monkeys were reared for prolonged periods

in isolated lighted cages with "few manipulanda". Subsequently, they showed no deficiencies in learning compared with monkeys raised in larger open cages. It is worth noting that Harlow's monkeys did not go unscathed. They showed severe social impairment. Since human learning, particularly in its initial stages, thrives on social interaction in terms of verbal give and take, dialogue, discourse, and above all question and answers, the question of the adverse effects of inadequate stimulation seems to the writer still an open one. Furthermore, it would seem that all animal research is complicated by the fact that the level of difficulty of the learning tasks required of animals falls far short of that expected from the average four year old much less that expected from older children.

More pertinent is Jensen's (1969a) reference to Kagan's (1966) findings that lower class children as early as 8 to 12 months of age showed slower rates of information processing, less rapid habituation, less clear differentiation among visual stimuli, and a higher threshold for saturation than middle class children. Jensen (1969) in accordance with his thesis of high IQ genetic determination, interpreted this study as indicating possible inherent and irreversible weaknesses in such children. On the other hand repeated research shows that in the first two years of life no significant differences in intelligence is found, (Gilliland, 1951; Knobloch & Pasamanick, 1953, 1960). Gordons's (1923) youngest gypsy and canal-boat children had IQ's close to

normal. It is possible that the intellectual needs of the young child can be satisfied as well in a culturally deprived environment as in a culturally enriched environment.

The value of infant tests in predicting later IQ scores is another aspect which complicates interpretation of such research. Bloom (1964) found a zero correlation between intelligence measured at age 1 with intelligence measured at age 17. However, by age 2 an IQ correlation of 0.41 with age 17 was obtained. Recent investigation by Hurst (cited in Pettigrew, 1967) and Knobloch & Pasamanick (1960) provide convincing evidence that properly administered infant tests do predict later scores.

Kagan's study also suggests the possibility that lower class children from deprived backgrounds may have slower learning styles than their middle class peers (Riessman, 1962). Little is known as yet about learning styles, but a slow one is obviously a handicap in any 'age-stage' situation, such as IQ testing. Learning speed as opposed to sensory deprivation may also be a factor in Jensen's (1969a) data on the deaf. He cited the fact that these severely sensory-handicapped children gradually catch up in intellectual performance to the level of hearing children despite marked early retardation amounting to one or two years. The average school, unlike a deaf institute, is not equipped to cope with the slow learner, assuming he is diagnosed. More often he finds himself a drag on his class and an embarrassment to his teacher with the usual consequences.

One other aspect of early training brought forward by Jensen (1969) suggests the need for persistent research to unearth the early mediators of IQ change. He pointed out that Harlow's (1965) work indicated the dangers of too early training. Monkeys which were trained early were not able to do as well as monkeys who were trained at a later age even when they reached the same age as the later trained monkeys. In the same vein, Elkind (1969) questions pre-school education since no evidence of its lasting effects upon mental growth to the adult stage are available. He suggests "that the longer we delay formal instruction, up to certain limits, the greater the period of plasticity and the higher the ultimate level of achievement".

Such speculation and theory, controversial as it is, indicates the desirability of searching the backgrounds and early experiences of children who change in IQ in order to establish which factors are the early mediators of IQ change. The problem is especially urgent in the case of those children who normally have low IQ scores. In the context of the foregoing theoretical speculation, we might expect that preschool education, such as day nursery and/or kindergarten would be associated with later IQ change, especially in the case of the inner-city child, for whom the school situation is generally conceived to be more intellectually stimulating than the home. It was therefore hypothesized that:

- 1a Students who had some preschool education in the form of either day nursery or kindergarten are more likely to increase in IQ than those who did not have preschool education;
- 1b Students with no preschool education are more likely to decrease in IQ than those who had preschool education.

Again in the context of early stimulation theory and again assuming that the school situation is superior to the home, it was further hypothesized that:

- 2a Students who entered Grade one youngest are more likely to increase in IQ than those who entered school oldest;
- 2b Students who entered Grade one oldest are more likely to decrease in IQ than those who entered school youngest.

Deprivation theory and disruptive familial experiences

If intellectual development is a function of the environment in which a child inhabits, then the family cannot be ignored for it is the dominant group in every child's situation. Many researchers (Fraser, 1959; Wiseman, 1966; Coleman, 1966) suggest that indeed forces operating outside the school walls are more pervasive and more powerful than those within in determining IQ. Wiseman (1966) on the basis of the Manchester surveys carried out over a 10 year period, reported significant correlations between maternal care and ability level, with adverse home environmental forces having greatest effects on children of above average ability. Honzik (1967) similarly reported that intellectual growth was positively related to maternal sensitivity

and to parental concern for the child's welfare.

Strodtbeck (1967) wrote of the "hidden curriculum of the middle class home", which prepares the child to deal appropriately with his first school experiences. The home of the inner-city child, on the other hand, is generally described as noisy, overcrowded, austere and disorganized. His family provides few of the experiences which produce readiness for academic learning either intellectually or attitudinally. Jones (1966) reported that in the case of 360 mothers with 'underfives', the working class mother took fewer steps than the middle class mother to prepare the child for the role of student. Moreover, she was more hostile towards the school and the teacher.

In many cases the mother of the inner-city child is likely to be working, and not from choice, as is often the case with her middle class counterpart. In fact, hard pressed to survive financially and embittered by the perpetual struggle for existence, the inner-city mother often sees her children as so many extra burdens and has little time or energy for them. Older children, especially girls, look after younger siblings and eventually resent this heavy responsibility. From a careful assessment of all research on the effect of maternal deprivation, the World Health Organization (1962) concluded that adverse results on children's development resulted not merely from stimulus deprivation, but also from inadequate mother-child interaction, which is believed crucial to the child.

Likewise, the father of the inner-city child may seldom or never be home and in either case pays little attention to the children when present (Wortis, 1967; Havighurst, 1966). Jensen (1969) using the Coleman Report data commented that father absence does not contribute independently to IQ variance. Deutsch & Brown (1964) stated that family cohesion was a possible environmental modifier of IQ since it accounted for a portion of the differences found between classes or experiential groups. Pettigrew (1967) cited Stetler's report that Negroes raised in broken homes had significantly lower IQ's than comparable Negro children from intact homes.

Pavenstedt (1965) stated that children from disorganized families suffered personality difficulties which present them with serious learning difficulties and that case work was necessary as well as enriched programs. On the other hand Pavenstedt found that despite the absence of intellectual stimulation in lower class lives, where there was a stable family group the children were able to learn and suited for compensatory intervention programs. Dave (1963) likewise demonstrated from his research that it is what the parents do in the home rather than their status characteristics or presence which are the powerful determinants in the home environment.

In this study the possible association between the presence or absence of either parent and the child's IQ changes was investigated. Since research is young in this area and is more descriptive than anything else, the

hypotheses proposed were based more on the belief that the presence of a parent should make a difference to a child's intellectual development. Therefore, it was postulated that:

- 3a Students who had both parents present in the home are more likely to increase in IQ than those who had one or no parents in the home;
- 3b Students who had one parent or no parents in the home are more likely to decrease in IQ than those who had both parents in the home.

In view of the foregoing speculation concerning the adverse effects of certain types of homes on IQ it was also decided to explore whether this dimension might also be as a possible mediator of IQ change. It was hypothesized that:

- 4a Students who came from stable homes are more likely to increase in IQ than students who did not come from stable homes;
- 4b Students who did not come from stable homes are more likely to decrease in IQ than students who came from stable homes.

Deprivation theory and verbal skills

Many investigators claim that language is the most important single factor which generates intellectual growth. Language is the child's most useful learning tool. Perhaps because of this, empirical animal research can furnish only limited insights into intellectual behaviour. Besides, since verbal ability represents a major part of most general intelligence tests, it is likely that environments which

include good models of language usage and which encourage the development of language will stimulate the development of IQ, whereas environments in which the models of language usage are poor and which discourage language development will retard or block the development of intelligence.

Wolf (1964) analyzed the relationships between particular aspects of the home and IQ scores. He found a correlation of 0.70 between "press for language development" variables in the home and the child's IQ. Such variables included emphasis on use of language, on corrections of usage, opportunities to enlarge vocabulary, availability of books, journals, etc., quality of language models and the nature and amount of assistance provided to facilitate learning in a variety of situations. Templin (1958) conducted a study in which 480 children from ages 3 to 8 were compared on articulation, sound discrimination, vocabulary, language complexity, sentence length. In 230 possible comparisons the lower class child was found to be higher in only 13 instances. Particularly noticeable retardation was found in articulation, grammatical complexity, vocabulary and, among preschoolers, sentence length.

Bernstein (1961) attributes the type of language a child develops to the type of social interaction that occurs between the young child and his parent. Freeberg and Payne (1967), Kagan (1966, 1969) and Hess and Shipman (1966) likewise suggest that the amount of verbalizations and the styles of communications influence the development of language and

verbal skills. The need for active dialogue in which a child's speech is corrected and modified is necessary according to Bernstein in the shift from labelling to categorizing. Hunt (1969) stated that Schoggen's current research found about twice as much social interaction between parents and their young children in professional families as in families of either urban or rural poverty.

There is little give and take between adult and child in the lower class home. The education level of most inner-city parents mitigates against their acting as sources of information, their ability to correct language usage as well as their ability to provide a good language model. Jones (1966) found that the middle class mother has a verbal communication richer in range and quality than that of the working class mother. Hess & Shipman (1966) reported a lack of cognitive meaning in lower class mother-child interactions. Their data revealed significant differences between families from lower and middle class backgrounds in maternal teaching styles, linguistic codes and mothers' task approaches. Deutsch (1968) tells us that compared to the middle class child the slum child is less often told the names of the objects and the noises he perceives, which hampers the development of discrimination skills. The inner-city child is generally not encouraged to question or to communicate his experiences; more often he is discouraged by perfunctory replies or by just being ignored. In fact Bernstein has gone so far as to suggest that all the middle and lower class

child have in common are the English words, that their abstract referents are not developed in the inner-city child's cognitive structures.

One other theoretical position influenced the choice of level of verbal skills to be explored in this study. This deals with the belief that cognitive deficits are cumulative. Gagne's (1965) hierarchical model of knowledge acquisition and his empirical studies based on this model appear to indicate that incomplete acquisitions of bits of elemental knowledge in early life may cause serious damage in the child's later learning ability. Ausubel (1967) likewise suggests that deficits in cognitive capacity result in the child's being less able to profit from more advanced levels of environmental stimulation. Piaget's work (Flavell, 1963; Isaacs, 1960; Wallace, 1965) and developmental theory in general, similarly suggests an epigenesis in the structure of intelligence. The Coleman et al (1966) survey, which involved more than 600,000 pupils demonstrated that public schools failed to change a child's class rank in achievement after the first grade.

In view of the foregoing theoretical speculation, Grade One Reading achievement was chosen as the best available measure of early verbal skills. It was hypothesized that:

- 5a Students who exhibited good reading achievement at the Grade One level are more likely to increase in IQ than students who exhibited poor reading achievement at the Grade One level;

- 5b Students who exhibited poor reading achievement at the Grade One level are more likely to decrease in IQ than students who exhibited good reading achievement at the Grade One level.

The self-fulfilling prophecy

The self-fulfilling prophecy postulates "that one person's expectations from another's person's behaviour can quite unwittingly become a more accurate prediction simply for its having been made". (Rosenthal & Jacobson, 1968). In their well publicised book, these authors offered proof of this expectancy effect in the form of experiments in the clinical field, in survey research, in animal research as well as in the classroom. The processes by which expectations are communicated are as yet almost entirely unknown. Rosenthal (1968) speaks of 5 categories of interactional effects, but admitted that after a six year study of sound films of research interviews he is little the wiser. It is believed that subtle vocal and visual nuances count, that facial expressions, touching, gestures, timing, positive intonation, praise and blame, may all act as subtle signals to elicit different responses (Mehrabian, 1968). Beez's (1967) experiment indicated that teachers' expectations may cause dramatic alterations in teaching style. Surprisingly, however, even when the amount of teaching was held constant, the children who were expected to learn more did learn more.

There are many determinants of a teacher's expectations of a student's intellectual ability, e.g. his reputation,

group membership, his IQ score, last year's grades, socioeconomic status, plus numerous other miscellaneous data. In this study student reputation as judged from teacher comments, academic grades, and the level of his initial IQ score were selected as potential expectancy variables through which the IQ score itself might be influenced. Bradway (1945) reported that a child's initial mental age was an important factor in subsequent mental development. An IQ of 100 or above has significant connotations for most teachers and could quite possibly be associated with positive expectations. It was, therefore, hypothesized that:

- 6a Students who had an initial IQ of 100 or more are more likely to increase in IQ than students who had an initial IQ of 99 or less;
- 6b Students who had an initial IQ of 99 or less are more likely to decrease in IQ than students who had an initial IQ of 100 or more.

It was hypothesized that a teacher's comment not only might reflect individual attitudes and beliefs towards a student's ability, but also create a student ability reputation for later teachers. These teachers in turn might relate to the student in terms of the image created by the remarks of the first teacher, and thus influence his intellectual development. It was, therefore, postulated that:

- 7a Students who increased in IQ are more likely to receive positive teacher comment than negative teacher comment;

- 7b Students who decreased in IQ are more likely to receive negative teacher comment than positive teacher comment.

A good academic record was also seen as creating a positive expectancy for a teacher, who then might relate to the student in terms of this positive expectancy thus affecting his IQ score. It was, therefore, hypothesized that:

- 8a Students who increased in IQ are more likely to have high academic achievement than low academic achievement;
- 8b Students who decreased in IQ are more likely to have low academic achievement than high academic achievement.

Furthermore, it was hypothesized that an IQ change itself might act as a signal and create its own expectancy for the teacher, in which case, a student who increases in IQ may create new increased expectations for his teacher, who in turn may subtly influence subsequent student performance accordingly. Similarly, students who decrease in IQ may diminish teacher expectations. Subsequent teacher-student interactions may well be in terms of these reduced expectations with still further deteriorating results in student performance. These assumptions based on the self-fulfilling prophecy phenomenon resulted in the following hypotheses:

- 9a Students who increase in IQ are most likely to increase subsequently in academic achievement and in effort;

- 9b Students who decrease in IQ are most likely to decrease subsequently in academic performance and effort.
- 10a Students who increase in IQ are most likely to receive subsequently positive teacher comment;
- 10b Students who decrease in IQ are most likely to receive subsequently negative teacher comment.

IQ Change and sex

There is little that can be said regarding differential performance of boys and girls in present day intelligence tests, for it is customary in developing and standardizing these tests to eliminate those items upon which males and females consistently perform differently. Consequently, most investigators have given little attention to this variable. Now and then statistically significant sex differences have been reported within normal populations especially when analysis gets down to subtests or individual items (e.g. Bradway & Thompson, 1962). These have invariably been attributed either to chance considering the number of groups tested, or to the possibility that test makers failed to eliminate all items to which boys and girls respond differently.

Nevertheless, it has long been suspected that males have greater environmental vulnerability than females. Nancy Bayley (1965, 1968) reported both a higher degree and a greater variety of environmental and personality correlates of mental abilities in boys than in girls. Stott (1960)

spoke of the greater vulnerability of male infants to prenatal impairment in accounting for the lower IQ's of male twins as compared to female twins. Brofenbrenner (1967) reported sex differences in achievement. These were more marked for Negroes than for whites, were found at every socio-economic level, and increased with age. Carter (1962) reported that sex of student was a factor in teacher-assigned marks, that boys were given lower grades than girls by both male and female teachers, even when intelligence and algebra achievement were controlled.

Pasamanick & Knobloch (1966) pointed out that reading disorders are 8 or 9 times more common in boys. Di Lorenzo (1968) analyzing a current compensatory preschool program (N = 1235) observed that IQ gains by experimental males were not maintained in kindergarten whereas experimental females not only maintained gains, but gained significantly in kindergarten. He concluded that this clearly indicated an interaction between sex and kindergarten curriculum. School itself has been described as a girl's world (MacFarlane and Hill, 1965). Such speculation led to the assumption in this study that girls may get along better in elementary school than boys with consequences in terms of IQ change. It was therefore hypothesized that:

- 11a Students who increased in IQ are more likely to be girls than boys;
- 11b Students who decreased in IQ are more likely to be boys than girls.

Summary table of hypotheses

Hypotheses based on deprivation theory and early experiences

- 1a Students who had some preschool education in the form of either day nursery or kindergarten are more likely to increase in IQ than those who did not have preschool education;
- 1b Students with no preschool education are more likely to decrease in IQ than those who had preschool education.
- 2a Students who entered Grade One youngest are more likely to increase in IQ than those who entered school oldest;
- 2b Students who entered Grade One oldest are more likely to decrease in IQ than those who entered school youngest.

Hypotheses based on deprivation theory and disruptive familial experiences

- 3a Students who had both parents present in the home are more likely to increase in IQ than those who had one or no parents;
- 3b Students who had one parent or no parents in the home are more likely to decrease in IQ than those who had both parents in the home.
- 4a Students who came from stable homes are more likely to increase in IQ than students who did not come from stable homes;
- 4b Students who did not come from stable homes are more likely to decrease in IQ than students who came from stable homes.

Hypotheses based on deprivation theory and verbal skills

- 5a Students who exhibited good reading achievement at the Grade One level are more likely to increase in IQ than students who exhibited poor reading achievement at the Grade One level;
- 5b Students who exhibited poor reading achievement at the Grade One level are more likely to decrease in IQ than students who exhibited good reading achievement at the Grade One level.

Hypotheses based on the self-fulfilling prophecy

- 6a Students who had an initial IQ of 100 or more are more likely to increase in IQ than students who had an initial IQ of 99 or less;
- 6b Students who had an initial IQ of 99 or less are more likely to decrease in IQ than students who had an initial IQ of 100 or more.
- 7a Students who increased in IQ are more likely to receive positive teacher comment than negative teacher comment;
- 7b Students who decreased in IQ are more likely to receive negative teacher comment than positive teacher comment.
- 8a Students who increased in IQ are more likely to have high academic achievement than low academic achievement.
- 8b Students who decreased in IQ are more likely to have low academic achievement than high academic achievement.

- 9a Students who increased in IQ are most likely to increase subsequently in academic achievement and in effort;
- 9b Students who decreased in IQ are most likely to decrease subsequently in academic achievement and in effort.
- 10a Students who increased in IQ are most likely to receive subsequently positive teacher comment;
- 10b Students who decreased in IQ are most likely to receive subsequently negative teacher comment.

Hypotheses based on sex

- 11a Students who increased in IQ are more likely to be girls than boys;
- 11b Students who decreased in IQ are more likely to be boys than girls.

CHAPTER IV

RESEARCH DESIGN AND PROCEDURES

The sample

The research sample consists of an available longitudinal data collection on 307 elementary school children, who attended the Royal Arthur School, Montreal some 15 to 25 years ago. This is an inner-city school and the majority of its students come from low income homes. The permanent record cards of 142 boys and 165 girls, which contained information for up to eight years, are the source of the longitudinal data.

Measurement of variables

IQ Change

The typical subject had 3 IQ scores on his permanent record card; the first having been obtained at the beginning of Grade 2, the second during Grade 4 and the third some time following Grade 4. Individual cases vary, some having as few as two entries and others more than five. IQ scores in general were obtained from conventional type group tests of intelligence. In some cases (less than 10 per cent), the IQ score is reported with the information that it was obtained by the Department of Health, but the

name of the test administered was not indicated. No attempt has been made to equalize IQ's as a result of the different tests used. We have good reason to assume that errors which may have crept into the comparisons are random and, therefore, do not influence the validity of the analysis. In any case the hypotheses generated by the self-fulfilling prophecy theory are independent of whether the IQ's are valid or not.

A difference of 6 IQ points was selected as constituting change. Students who increased in IQ by 6 points or more were assigned to the IQ increase category. Students who decreased in IQ by 6 points or more were assigned to the IQ decrease category. Students with IQ changes of 5 points or less were classified as having stable IQ's.

In relating IQ change to such variables as sex, home factors, preschool experiences, academic achievement, reading ability and teacher comments, the Grade 2 IQ score and the last IQ score on the record card were compared. In relating IQ change to subsequent academic achievement and effort as well as to subsequent teacher comment the IQ scores at the Grade 2 and Grade 4 levels were compared to establish the change categories.

Sex

The sex of the student was marked on the record card.

Presence of a father or a mother

This information was obtained from the permanent record card. Students were classified as having a) both parents b) one parent (whether father or mother was noted) c) no parents.

Home stability

The stability of the student's home was determined from entries made on the record cards. Where there were remarks indicating quarrelling, parents separated, divorced or common-law, fathers in prison etc. the student was assigned to the unstable home category. Otherwise the student was classified as coming from a stable home. Based on these definitions approximately 40 per cent of children were in the unstable home category.

Preschool education

Information as to whether a student attended kindergarten or nursery school was available on the record cards.

Grade one entry age

A student's date of birth was compared to his date of entry into Grade One to establish the Grade One entry age. Both of these data were noted on the record cards.

Academic achievement, effort, Gr. 1 reading ability

These variables were obtained from teacher assessments on the permanent record cards. Academic grades and teacher estimates of student effort were rated in terms of

unsatisfactory (U), fair (F), good (G), very good (VG) or excellent (E). For the purposes of this study, unless otherwise stated, unsatisfactory and fair grades were classified as low, whereas good, very good and excellent grades were classified as high.

In relating level of academic achievement to IQ change, an average for the student's whole school career was used. In order to obtain changes in academic achievement and student effort following IQ change, the grades given to each student prior to IQ - Grade 4 were compared with the grades given in the year following IQ - Grade 4.

Teacher comments

These were remarks made by teachers on the permanent record cards. They were tabulated and classified as negative, positive or neutral. Positive comments were considered to reflect a favourable teacher opinion and to create a favourable student image, e.g. eager to do well, good worker, splendid pupil and so on. Negative comments were seen as reflecting an unfavourable teacher opinion and creating an unfavourable student image ... e.g. slow thinker, does not attempt to do any work, lazy, sneaky, etc. Neutral comments were taken as reflecting neither a favourable nor unfavourable teacher opinion and therefore creating neither a favourable nor unfavourable student image ... e.g. quiet, shy, sensitive, self reliant.

Teacher comments were enumerated for each student

classified and related to IQ change. Number and type of teacher comment following IQ change were compared with number and type of comment prior to IQ change to obtain changes in teacher comment.

Statistical analyses

Simple cross tabulation of the data was made. Findings were analyzed for significance by the chi-square test. The five percent level of confidence was adopted as the criterion of significance. In cases where the direction of the relationship was hypothesized, the one-tail test of significance was used and results are annotated accordingly.

CHAPTER V

RESULTS, DISCUSSION AND SUMMARY

Statement of results

The findings obtained in this study will be presented under the following headings: Student sex and IQ change, Family dimensions and IQ change (family stability, completeness of family), School situational factors and IQ change (preschool education, grade one entry age, initial IQ, academic achievement, grade one reading ability, teacher comments), Potential consequences of IQ change (changes in academic achievement, changes in student effort, changes in teacher comments).

Results will be discussed in the following section of this chapter.

1. Student sex and IQ change

At this point, perhaps it should be stated that an analysis of these data ascertained that boys did not differ significantly from girls in their distribution along the IQ continuum. As postulated, however, boys differed significantly from girls in IQ change and in the directions predicted. The data in Table 2 indicates that boys seem more likely to decrease in IQ whereas girls appear more likely to increase

in IQ. About equal percentages of boys and girls were found to maintain their IQ levels.

TABLE 2
STUDENT SEX AND IQ CHANGE

Variable	IQ Change			Total
	Decrease	No Change	Increase	
Sex ($\chi^2 = 5.79$; $df = 2$; $p > .05$, one-tail test)				
Girls	25%	39%	36%	165
Boys	37%	38%	25%	142

2. Family dimensions and IQ Change

Home stability (Table 3) was not found to be significantly related to IQ change. In fact, contrary to our prediction, students from unstable homes seemed more likely to increase in IQ (34%) than students from stable homes (29%). They also appeared more likely to decrease in IQ (33%) than students from stable homes (29%). Home stability, on the other hand, tended to associate with IQ stability, but this relationship was not statistically significant.

TABLE 3
FAMILY DIMENSIONS AND IQ CHANGE: HOME STABILITY

Dimension	IQ Change			Total
	Decrease	No Change	Increase	
Home Stability ($X^2 = 2.75$; $df = 2$; $p > .30$)				
Stable	29%	42%	29%	193
Unstable	33%	33%	34%	114

Completeness of family (Table 4) is significantly related to IQ change, but not in the direction predicted. In these data, students who had both parents at home were more likely to maintain their IQ levels (45%) than to increase in IQ as predicted. On the other hand, students with only one parent at home were more likely to increase in IQ (42%) than either students with both parents (25%), or with no parents (36%). Although 63 per cent of students with a single parent changed in IQ, students with no parents had the least stable IQ's; 81 per cent of these changed IQ with 45 per cent showing a decrease and 36 per cent showing an increase. Further analysis revealed that it made no difference which of the two parents was absent from the home; the pattern of IQ increases was found in each case. Both students with a father absent and students with a mother absent were more likely to increase in IQ than to decrease or maintain IQ levels. The presence of either parent seemed to stabilize IQ.

TABLE 4

FAMILY DIMENSIONS AND IQ CHANGE: COMPLETENESS OF FAMILY

Dimension	IQ Change			Total *
	Decrease	No Change	Increase	
Completeness of Family ($X^2 = 14.7$; $df = 4$; $p > .01$)				
Both parents at home	30%	45%	25%	198
One parent at home	31%	27%	42%	98
No parent at home	45%	18%	36%	11
Mother presence ($X^2 = 7.97$; $df = 2$; $p > .05$)				
Yes	29%	41%	29%	269
No	39%	14%	46%	28
Father presence ($X^2 = 6.49$; $df = 2$; $p > .05$)				
Yes	31%	41%	28%	225
No	28%	29%	43%	75

* Incomplete data result in slightly different totals.

In these data, completeness of family was also found to be related to the sex of a student. Father presence or absence was significant for boys, but not for girls. Whereas 47 per cent of boys without a father increased in IQ, only 20 per cent boys with a father increased in IQ ($p > .02$) (Table 5). Mother presence or absence was also significantly related to boys' IQ change ($p > .05$), but not to girls', although in their case, a significant level was almost reached. However, the number of boys without mothers was small ($N = 6$).

TABLE 5

FATHER PRESENCE AND IQ CHANGE BY SEX

Factor	IQ Change			Total *
	Decrease	No Change	Increase	
Father Presence: Girls ($X^2 = 0.69$; $df = 2$; $p > .80$)				
Yes	25%	41%	34%	116
No	26%	34%	40%	47
Father Presence: Boys ($X^2 = 8.84$; $df = 2$; $p > .02$)				
Yes	37%	43%	20%	109
No	32%	21%	47%	28

* Incomplete data result in slightly different totals.

3. School situational factors and IQ Change

The findings for preschool education (Table 6) did not support the hypotheses that children with preschool education would be more likely to increase in IQ and that those without preschool education would be more likely to decrease in IQ. Former attendance at day nursery did not yield a significant relationship to later IQ changes. The differences between those who attended kindergarten and those who did not were

not even in the directions predicted. Kindergarten experience seemed to stabilize IQ and especially for girls -- 51 percent of those girls with stable IQ's having attended kindergarten as compared with only 30 per cent of girls not having attended kindergarten ($p > .05$).

TABLE 6

SCHOOL SITUATIONAL FACTORS AND IQ CHANGE:
PRESCHOOL EDUCATION

Factor	IQ Change			Total *
	Decrease	No Change	Increase	
Day Nursery ($X^2 = 0.57$; $df = 2$; $p > .80$)				
Yes	30%	33%	37%	27
No	31%	39%	30%	280
Kindergarten ($X^2 = 5.21$; $df = 2$; $p > .10$)				
Yes	26%	46%	28%	123
No	34%	33%	33%	157
Kindergarten: Girls ($X^2 = 6.60$; $df = 2$; $p > .05$)				
Yes	19%	51%	30%	69
No	30%	30%	40%	79
Kindergarten: Boys ($X^2 = 0.32$; $df = 2$; $p > .90$)				
Yes	35%	41%	24%	54
No	38%	36%	26%	78

* Incomplete data result in slightly different totals

The data on grade one entry age (Table 7) did not support the hypotheses for all students, but in the case of boys our prediction was confirmed. Those boys who entered grade one youngest were more likely to increase in IQ than those boys who entered grade one at an older age and vice-versa. Indeed, the younger a boy was on entry to grade one the more likely he was to show change in IQ. When we controlled for kindergarten and day nursery; the difference between younger boys with preschool education and older boys with preschool education in terms of IQ change increased to the .01 level of significance despite the smaller N. On the other hand, the original difference between younger and older boys disappeared for boys without preschool education. Further analysis controlling the student's initial IQ level (Grade 2) also reduced the original difference between IQ change and grade one entry age to chance.

No significant relationships were found for girls. Indeed the data on girls (Table 7) suggest a contrary trend to that found for boys with older girls more likely to increase in and less likely to decrease in IQ than younger girls. Controlling for preschool education and initial IQ level did not yield a different result.

TABLE 7

SCHOOL SITUATIONAL FACTORS AND IQ CHANGE:
GRADE ONE ENTRY AGE

Factor	IQ Change			Total *
	Decrease	No Change	Increase	
Grade One Entry Age ($X^2 = 1.32$; df = 2; p > .70)				
76 mos and younger	31%	36%	33%	190
77 mos and older	29%	43%	28%	115
Grade I Entry Age: Boys ($X^2 = 5.29$; df = 2; p > .05 one-tail test)				
76 mos and younger	34%	34%	32%	83
77 mos and older	40%	45%	15%	58
Grade I Entry Age: Girls ($X^2 = 2.01$; df = 2; p > .50)				
76 mos and younger	29%	38%	33%	107
77 mos and older	19%	40%	41%	57

* Incomplete data result in slightly different totals

Table 8 shows that a student's initial IQ (Grade 2) related to IQ change in the opposite direction to that predicted. It was hypothesized that students with an IQ of 100 or more would be more likely to increase in IQ than those with IQ's 99 or less and conversely, that students with an IQ of 99 or less would be more likely to decrease in IQ than students with an IQ of 100 and more. However, the analysis showed that students who decreased in IQ were more likely to have IQ's of 100 and over (40%) than to have IQ's of 99 and under (27%) ($p > .05$). When students with IQ's 79 and above were compared to students with IQ's 78 and less it was found that 56 per cent of those in the lower IQ group increased in IQ whereas only 29 per cent of the

upper IQ group were in this category ($p > .01$). In this latter comparison a similar relationship was found for boys ($p > .05$) but not for girls.

TABLE 8
SCHOOL SITUATIONAL FACTORS AND IQ CHANGE:
INITIAL IQ LEVEL

Factor	IQ Change			Total
	Decrease	No Change	Increase	
Initial IQ, Grade 2 ($X^2 = 4.88$, $df = 2$; $p > .10$)				
100 IQ and over	40%	33%	27%	85
99 IQ and under	27%	41%	32%	222
Initial IQ, Grade 2 ($X^2 = 7.70$; $df = 2$; $p > .05$)				
79 and over	31%	40%	29%	284
78 and under	22%	22%	56%	23

The data confirmed our prediction that negative teacher comment would be associated with IQ decreases ($p > .05$) (Table 9). On the other hand, there was no evidence in these data that positive teacher comment is significantly related to IQ increases. A sex factor was also found in the case of negative teacher comments. Boys who decreased in IQ received significantly more negative teacher comments. No significant relationship was found for girls.

TABLE 9
SCHOOL SITUATIONAL FACTORS AND IQ CHANGE:
TEACHER COMMENT

Factor	IQ Change			Total *
	Decrease	No Change	Increase	
Negative teacher comments ($X^2 = 8.52$; $df = 2$; $p > .05$)				
None	25%	44%	31%	185
Some	39%	30%	30%	122
Negative teacher comments: Boys ($X^2 = 6.55$ $df = 2$; $p > .05$)				
None	27%	46%	27%	71
Some	46%	30%	24%	71
Negative teacher comments: Girls ($X^2 = 1.75$ $df = 2$; $p > .50$)				
None	24%	42%	34%	114
Some	29%	31%	39%	51
Positive teacher comments ($X^2 = 0.29$; $df = 2$; $p > .90$)				
None	30%	39%	30%	214
Some	31%	36%	33%	91

* Incomplete data result in slightly different totals

The findings on school achievement and IQ change are presented in Table 10. These confirmed the predictions that students with high academic achievement would most likely have IQ increases and vice-versa. Reading, Language, Spelling, Arithmetic, French, History, Geography and Art & Handwork were all significantly related to IQ change and in the directions predicted.

TABLE 10
SCHOOL ACHIEVEMENT AND IQ CHANGE BY ACADEMIC SUBJECT

Subject	IQ Change			Total *
	Decrease	No Change	Increase	
Reading ($X^2 = 36.02$; $df = 2$; $p > .001$)				
High (Good, very good, excellent)	23%	41%	36%	245
Low (Fair unsatisfactory)	61%	27%	12%	62
Language ($X^2 = 25.07$; $df = 2$; $p > .001$)				
High	22%	41%	37%	215
Low	50%	33%	17%	92
Spelling ($X^2 = 33.33$; $df = 2$; $p > .001$)				
High	23%	42%	35%	245
Low	61%	24%	15%	61
Arithmetic ($X^2 = 20.19$; $df = 2$; $p > .001$)				
High	22%	41%	37%	190
Low	46%	33%	21%	117
French ($X^2 = 32.83$; $df = 2$; $p > .001$)				
High	18%	46%	36%	191
Low	50%	27%	23%	111
Geography ($X^2 = 16.97$; $df = 2$; $p > .001$)				
High	20%	42%	38%	184
Low	42%	35%	23%	111
History ($X^2 = 11.37$; $df = 2$; $p > .01$)				
High	20%	43%	37%	155
Low	38%	36%	26%	133
Art & Handwork ($X^2 = 11.9$; $df = 2$; $p > .01$)				
High	27%	40%	33%	262
Low	52%	30%	19%	44

* Incomplete data result in slightly different totals

It is interesting to note that the less academic subjects, Handwriting, Industrial Arts and Physical Education were not associated with IQ change (Table 11).

TABLE 11

SCHOOL ACHIEVEMENT AND IQ CHANGE BY NON-ACADEMIC SUBJECT

Subject	IQ Change			Total *
	Decrease	No Change	Increase	
Handwriting ($X^2 = 2.77$; $df = 2$; $p > .30$)				
High	29%	39%	32%	249
Low	40%	33%	27%	58
Industrial Arts ($X^2 = 2.14$; $df = 2$; $p > .50$)				
High	27%	39%	24%	217
Low	36%	33%	31%	64
Physical Education ($X^2 = 2.47$; $df = 2$; $p > .50$)				
High	30%	39%	31%	300
Low	57%	29%	14%	7

* Incomplete data result in slightly different totals

With regard to Grade One reading ability we had predicted that good reading grades at the grade one level would be associated with IQ increases and conversely that poor reading ability at this level would be associated with IQ decreases. Results (Table 12) strongly supported these hypotheses.

TABLE 12
GRADE ONE READING ABILITY AND IQ CHANGE

Variable	IQ Change			Total *
	Decrease	No Change	Increase	
Grade One Reading Ability ($X^2 = 28.74$; $df = 2$; $p > .001$)				
High (Good, very good, excellent)	21%	43%	35%	198
Low (Fair, unsatisfactory)	58%	25%	18%	57

* Incomplete data result in slightly different totals

4. Potential consequences of IQ Change

The findings with regard to change in student achievement, in student effort, and in teacher comment following IQ change, are presented in Tables 13, 14, 15, 16. It was hypothesized that students with IQ increases would be most likely to increase subsequently in academic achievement, in student effort and to receive subsequently positive teacher comments. The converse was also postulated.

An analysis was made by comparing achievement grades obtained prior to the Grade 2-IQ measurement with those obtained after the Grade 4-IQ measurement. A significant difference ($p > .05$ one-tail test) was obtained between students whose achievement grades increased and those whose grades did not increase in terms of IQ change (Table 13). Whereas 47 per cent of those with IQ increases showed improvement in grades, 31 per cent did not receive higher grades. When a shorter time interval was analyzed, i.e. change from achievement grades before IQ-Grade 4 to grades

after IQ-Grade 4, the relationship between these and IQ change appeared to be one of chance. In neither instance did grade decreases yield a significant relationship with the IQ change categories (Table 13).

TABLE 13

POTENTIAL CONSEQUENCES OF IQ CHANGE:
CHANGE IN ACADEMIC ACHIEVEMENT

Grade Changes	IQ Change			Total *
	Decrease	No Change	Increase	
Increased Grades ** ($X^2 = 5.13$; $df = 2$; $p > .05$ one-tail test)				
Yes	16%	38%	47%	32
No	28%	46%	31%	113
Decreased Grades ** ($X^2 = 2.55$; $df = 2$; $p > .30$)				
Yes	31%	40%	29%	72
No	19%	48%	33%	73
Increased Grades *** ($X^2 = 0.79$; $df = 2$; $p > .70$)				
Yes	31%	44%	25%	59
No	26%	43%	31%	134
Decreased Grades *** ($X^2 = 0.04$; $df = 2$; $p > .98$)				
Yes	28%	44%	28%	80
No	27%	43%	30%	113

* Incomplete data result in slightly different totals.

** Ave. academic grade prior to IQ-Grade 2 compared with ave. academic grade after IQ-Grade 4.

*** Ave. academic grade prior to IQ-Grade 4 compared with ave. academic grade after IQ-Grade 4.

Further analysis of changes in academic achievement controlling the IQ change categories revealed that in the case of both IQ increase students and IQ decrease students, changes in grades appeared to be determined by a grade level factor. For example, all students who increased in IQ and who had low grades (unsatisfactory or fair) increased in grades after the IQ increase whereas those in this IQ change

category with high (good, very good, excellent) grades tended to decrease in grades after IQ change. This difference was significant beyond the .001 level. Similarly, students with IQ decreases and low grades were more likely to increase in grades (78%) than to decrease in grades (13%) whereas students with IQ decreases and high grades were more likely to decrease in grades (88%) than to increase in grades (22%). This finding was also significant ($p > .001$).

We cannot report any significant relationships between IQ change and changes in subsequent student effort (Table 14).

TABLE 14

POTENTIAL CONSEQUENCES OF IQ CHANGE:
CHANGE IN STUDENT EFFORT

<u>Effort Changes</u>	<u>IQ Change</u>			<u>Total *</u>
	<u>Decrease</u>	<u>No Change</u>	<u>Increase</u>	
Increased Effort ** ($X^2 = 1.61$; $df = 2$; $p > .50$)				
	24%	41%	35%	51
	30%	44%	26%	140
Decreased Effort ** ($X^2 = 2.58$; $df = 2$; $p > .30$)				
	36%	43%	21%	47
	26%	43%	31%	144

* Incomplete data result in slightly different totals
 ** Assessment prior IQ-Grade 4 compared with assessment after IQ-Grade 4.

Figures in Table 15 support the predictions with regard to teacher comment subsequent to IQ change. Students who decrease in IQ are most likely to receive subsequently negative teacher comment ($p > .05$). Students who increase in

IQ are most likely to receive subsequently positive teacher comment. Findings also indicated that teachers were more inclined not to comment than to comment ($p > .01$). This latter difference resulted mainly from the fact that teachers appeared more likely not to comment than to comment on stable IQ's ($p > .01$), although in the case of IQ decrease students, a significant difference ($p > .05$) was also in evidence, but in the opposite direction. Students with IQ increases did not differ from others in terms of receiving or not receiving teacher comments.

TABLE 15

POTENTIAL CONSEQUENCES OF IQ CHANGE:
CHANGE IN TEACHER COMMENT

Teacher Comment	IQ Change			Total
	Decrease	No Change	Increase	
Negative Teacher Comment ($X^2 = 8.62$; $df = 2$; $p > .05$)				
Yes	50%	29%	21%	42
No	28%	40%	32%	265
Positive Teacher Comment ($X^2 = 12.43$; $df = 2$; $p > .01$)				
Yes	28%	12%	60%	25
No	31%	41%	28%	282
Teacher Comment: Any Polarity ($X^2 = 9.90$; $df = 2$; $p > .01$)				
Yes	42%	22%	36%	67
No	28%	43%	30%	240

A sex factor was also in evidence with regard to teacher comments following IQ change (Table 16). Boys were more likely to receive comments than girls and these were more often negative than positive. On the other hand girls

were more likely to have positive rather than negative comments written on their permanent record cards.

TABLE 16

STUDENT SEX AND TEACHER COMMENTS FOLLOWING IQ CHANGE

Teacher Comment	IQ Change						Total
	Decrease		No Change		Increase		
	Boys	Girls	Boys	Girls	Boys	Girls	
Positive Comment	-	-	-	.05	-	.05	.01
Negative Comment	.05	-	.05	-	-	-	.05
Comment, any Polarity	.05	-	.01	-	-	-	.01

Discussion of results

This research was designed primarily to explore the relationship between certain personal and background variables and IQ change in an inner-city elementary school population, which had not been subjected to any special intervention treatment. The study is attempting to identify potential mediators of IQ change in the hope that future research and educational endeavours may be facilitated in their efforts to elevate IQ and to counteract IQ decrements.

Sex. - - Possibly the most salient result of this research is the finding that boys are more inclined to decrease in IQ than girls and vice-versa. Furthermore, in many instances (e.g. parent presence or absence, kindergarten, experience, grade one entry age, initial IQ, teacher comment)

results were different for boys and girls. These findings suggest that it may be advisable to judge boys and girls independently when investigating IQ change. For example a sex factor may have contributed to the opposed viewpoints of Deutsch & Brown (1964) and Jenkins (1969) on the importance of the presence of a father in the deprived home.

Family factors. -- We cannot report that family stability as defined in this study, is related to IQ change. It is easy to think of homes characterized by drunkenness, conflict, rejection, deviance as not facilitating intellectual ability despite the fact, that these elements must themselves constitute some kind of intellectual stimulation. However, the factors which may contribute to a child's measured IQ may not necessarily improve or depress it. Possibly new research which can measure these particular aspects of the environment more precisely may furnish further insights into their potential association with IQ change.

Incompleteness of family was related to IQ change with high percentages of those having one parent (63%) or no parents (81%) changing in IQ. The presence of both parents tended more to stabilize IQ whereas the absence of one parent appeared to be associated with IQ increases. It is difficult to explain these findings, but it is possible to speculate a little in terms of McKinley's statement (Roberts, 1967) that lower class boys do not identify with their fathers. It is thought that the lower class father's poverty of resources, his lack of familial and societal status, his severity in

dealing with sons all militate against his becoming a figure to be admired or imitated. If this is so, the lower class boy may tend to seek male identification figures outside the home. Where a father is absent altogether, outside identification may occur more readily and without the boy experiencing conflict as a result of this. In this case, some boys may identify with a teacher or other outsider, who may act as a stimulant to increased intellectual effort and accomplishments.

At the same time, identification figures having negative influences are equally possible. This may account for the fact that 31 per cent of those with one parent decreased in IQ as well as 45 per cent of those with no parents whatsoever. It is worth noting that those with no parents had the least stable IQ's (81 per cent changing IQ), perhaps suggesting that these were the students most open to the influence of factors, which may result in intellectual advances or decrements.

Preschool education. - - This study did not shed any light on the value of day nursery in terms of IQ change. Although the investigator has no way of knowing, a recent report on this type of facility in Montreal (Townsend, 1968) indicated that these establishments are far from conducive to intellectual gains. It seems highly possible that this type of preschool education amounted to little more than "mass baby sitting" for working mothers, in which case, Bereiter's

suggestion (1966) that mere attendance in nursery school or kindergarten does not of itself mean anything may be relevant. If the quality and quantity of the learning experiences offered are worthless or non-existent, then probably it makes little difference whether the child is present or not.

It is somewhat puzzling to find that kindergarten did more to stabilize IQ than to change IQ and this only in the case of girls. This result reminds us of Coleman's (1966) finding that schooling tended to fixate a child's relative position in academic achievement. Di Lorenzo (1968) also reported an interaction between kindergarten and boys, which resulted in boys losing prior IQ increases gained in a compensatory program. Several early reports from compensatory programs seem to indicate that many experimental subjects have difficulty in achieving further IQ advances once they enter the regular schooling situation. These findings all tend to suggest that factors in the schooling situation may act to fixate or stabilize a student's measured IQ rather than to elevate it. If this possibility exists then there seems an urgent need to take a good hard look at our schools.

It is also possible that these early educational experiences have importance only for IQ changes registered during these experiences and such IQ changes were not available in this study. This possibility, however, suggests the advantage of ongoing research in which IQ changes are related at regular intervals to relevant contemporary variables.

Furthermore, it is tentatively suggested that the self-fulfilling prophecy phenomenon may contribute to the fact that kindergarten tended to stabilize a student's IQ in these data. The kindergarten student has had a year longer to create his ability image for himself and for his teachers. As Rosenthal suggests, most children are obliging creatures, who strive to live up to our expectations of them.

Grade one entry age. -- This variable was significantly related to IQ change, but only for boys. Furthermore, it seems that this relationship in these data is dependent on preschool education. When this latter variable was controlled, it was found that grade one entry age alone did not yield a significant difference. On the other hand, the younger the boy with kindergarten on entry to grade one, the more likely he is to increase IQ. This finding tends to substantiate deprivation theory in the speculation that for many children the more stimulating school situation, if provided early enough, may reverse intellectual deficits caused by deprivation. However, it still leaves us questioning why girls did not respond similarly.

It is interesting to note that when a student's IQ level was controlled, the relationship between age of entry into school and IQ change also became insignificant. Do these findings tend to question the desirability of "age" as the criterion of school entrance? They seem to suggest that a uniform date of entry for boys and girls may not be

advisable. Furthermore, they appear to imply that the younger a boy is when exposed to the educational experience, the more likely he is to increase in IQ.

Initial IQ. - - This research questioned whether a student's initial IQ level might not act as a self-fulfilling prophecy. The data did not support the prediction that students with average or higher IQ's might create positive expectations and consequently increase IQ's and vice-versa. In fact results obtained were in the opposite direction and attained significance ($p > .05$) when IQ decrease subjects were opposed to all others. This reverse trend (low IQ's increasing and high IQ's decreasing) was even more pronounced when a student's IQ dropped to 78 and under ($p > .01$). This latter relationship was determined by boys.

It would seem that what is known as the "regression effect" has achieved statistical significance in this population. Whilst there is no denying that the IQ test has less than perfect reliability there is evidence in this study that sex and level of IQ score may contribute to this effect.

It is possible this finding may be partially interpreted in terms of Wiseman's claim (1966) that above average ability students are most affected by adverse environmental factors. This explanation, however, does not contribute to an understanding as to why low IQ students tended to increase in IQ.

Teacher comment. - - Teacher comments were related to IQ change as predicted except in the case of positive teacher

comment. One possible explanation of this latter result is the suggestion that teachers are intrinsically motivated by student success. When students fail to reinforce teacher effectiveness by decreasing IQ, teachers may blame factors internal to the student. It was noted in these data that negative teacher comment was more common than positive comment.

This does not, however, account for the fact that whereas positive teacher comment was unrelated to IQ change positive comment subsequent to IQ change was found to be related to IQ increase ($p > .01$). We question whether in this case the IQ change may not itself constitute a factor. One further finding that strengthens this notion is the significant association between teacher commenting or not commenting and IQ change ($p > .01$). Students who changed in IQ, no matter in which direction, most often received teacher comments. Is it possible that teachers are motivated to rationalize an IQ change? Goslin (1967) has told us that most teachers still think in terms of a fixed IQ. If this is so, then teachers may view IQ changes with some uncertainty and may be motivated to comment thereupon.

It is noteworthy that boys were more likely to receive teacher comments than girls, that boys were more likely to be given negative comments and less likely to be given positive teacher comments than girls. A somewhat similar situation of "male double jeopardy" was reported by Carter (1962) for school grades. If teacher comments are indicative

of teacher expectation, evaluation and possibly reinforcement techniques, then these findings appear to invite further research into teacher-student interactions in order to establish whether these are likely to vary with the sex of the student or, for that matter, the sex of the teacher.

School achievement. - - It has long been recognized that the IQ score is a good predictor of school achievement. This study has provided evidence that IQ change is also related to school success in the same way as the IQ score is. Those students with a high academic standing were more likely to increase in IQ and vice-versa. This seems to add to speculation about the academic nature of the IQ score. The fact that the less academic subjects, writing, physical education and industrial arts were unrelated to IQ change tends to support this possibility.

In any case, if IQ gains can be mediated through good levels of school achievement then perhaps it is advisable to seek out the dimensions within the teaching-learning situation, which are most productive of scholastic success and thus indirectly increase IQ. These factors can be manipulated and controlled by the educator.

Results of this research indicated that reading ability at the grade one level is strongly related to IQ change. This suggests that at this early stage of a student's educational experience a concentrated effort might be made to ensure that each student acquires this learning tool before

proceeding to more difficult academic demands, which presuppose its possession. If all students are to achieve a good verbal rating at this level, then verbal deficits as well as the verbal prerequisites for adequate achievement must be identified. Furthermore, research must indicate the precise means and methods whereby deficits may be eliminated and language skills successfully acquired. Several possibilities deserve consideration, e.g. specialists with assistants to teach reading; reduced teacher-student ratios in the early school years; frequent diagnostic testings of teacher and student performance; the elimination of age and the substitution of reading readiness as the criterion of ability to do grade one work. Unless research can provide some specific answers in the near future, it may be wiser to follow the example of the Norwegians and delay the formal acquisition of this vital skill to a later age, when perhaps some of the current reading difficulties may never arise.

Potential consequences of IQ change. -- Since the data were accumulated over a period of years, this research attempted to identify some possible consequences of IQ change in terms of changes in school achievement, student effort and teacher comment. Results shed little light on achievement or effort changes following IQ change except to indicate that students who increased in IQ are likely to increase grades at one and the same time ($p > .05$). Is it possible that improved scholastic performance is more an antecedent of IQ increase

whereas deteriorating scholastic performance might tend to follow IQ decrease? If this were the case, these data may not have extended over a sufficient time interval following a decrease in IQ to register a decrease in academic achievement.

Grade level seems to complicate even this tentative interpretation. In this study, there was a significant tendency for low grades to increase and high grades to decrease irrespective of change category. Does the fact that grades have an upper and lower ceiling have anything to do with this result or do students in reality perform less well or better as the case may be? Progressively more difficult content possibly may contribute to this effect for high grade students, but this explanation merely compounds the problem for low grade students.

Another factor may bear on the question of change in student grades; that is, the effect of prior teacher assessments on the teacher about to enter a student's grades. It is doubtful if fellow teachers could be prevented from comparing notes on individual students; nevertheless it might be interesting to compare results of a control group for whom teachers did not write up the permanent record cards.

Although the data did indicate that effort was related ($p > .001$) to IQ change and in the directions one would expect, changes in effort following IQ change appeared to be chance happenings. Effort is possibly more like a second-order factor when considered in terms of IQ or academic

achievement. Furthermore, effort may be much more determined by other variables such as motivation, aspirations, and expectation, than by measured intelligence. Consequently, changes in effort may be less obvious.

Changes in teacher comment did reflect student IQ changes. Were teachers influenced by these IQ changes or did they respond to a personally identified change in student intellectual behaviour? It would seem to the investigator that a teacher's existential criterion of change might be change in school performance. If such changes parallel and are in the direction of IQ change then possibly teacher comment following IQ change may reflect a personal recognition of such change. If this is so, one questions why positive teacher comment related to IQ change following the IQ increase and not before. On the other hand, an IQ change itself may result in a teacher then conceiving student ability in terms of this changed IQ and commenting to this effect. Again it would be interesting to investigate teacher comments where IQ's are unknown to teachers.

One final comment is offered on the findings of this study. Although in many instances the variables were significantly related to IQ change, results only partially supported deprivation theory. Perhaps this is because our present knowledge of deprivational indices is very inadequate and for the greater part unconfirmed. It is customary to think of having only one or no parents, or not having preschool education, as constituting deprivation. However, as pointed

out by Bereiter (1966) and Dave (1963) this is not necessarily so. Rather it is more the quality, quantity, and variety of parent-child interaction or the educational experience that may determine intellectual outcomes. Nevertheless, one suspected deprivational index was again confirmed in this research and this concerns a child's early verbal skills. This area undoubtedly merits the aggressive attention of researchers.

Results to some extent also tended to substantiate the self-fulfilling prophecy phenomenon. Scholastic performance and teacher comment varied as might be expected from such speculation, but the expectations we had hypothesized a student's initial IQ score might create were not fulfilled. Because of the exploratory nature of this study and the paucity of empirical evidence of this phenomenon in the classroom setting, any conclusions in this area are premature. However, future research in which perhaps IQ's, previous student grades or other "loaded information" are not disclosed to teachers may yield further insights as to how such dimensions affect student performance as well as IQ change.

Summary and conclusion

The purpose of this study was to investigate the relationship of certain personal and background variables (sex, family stability, family completeness, preschool education, grade one entry age, initial IQ level, academic achievement, grade one reading ability and teacher opinion) to the changes

in the recorded IQ's of an inner-city elementary school population. An analysis of an available longitudinal data collection on 307 students, who attended a Montreal inner-city school some 15 to 25 years ago was made. Simple cross tabulation of the data was performed and the chi-square test was used to determine the probability that the associations were significant. The five per cent level of confidence was chosen for the significance criterion. Where the direction of the relationship was predicted, a one-tail test was applied and the result marked to this effect.

From a controlled experimental viewpoint the data in this study seem crude. IQ tests were group administered and in some cases the IQ's are from different tests. No attempt has been made to equalize these. School grades, teacher comments and assessments were used. These data despite their questionable statistical validity are, according to the phenomonologist, real and powerful factors in each student's educational situation. Since this was not an experimental study and we did not manipulate or control the variables in the experimental sense, co-variation only is reported and causal relationships are not inferred.

Several correlates of IQ change were found. Sex, incompleteness of family, grade one entry age and kindergarten, initial IQ level, academic achievement, grade one reading ability and negative teacher comment were significantly related to IQ change, whereas family stability, completeness of family, preschool education and positive

teacher comments were unrelated to IQ change. Changes in school achievement and in student effort following IQ change did not relate to IQ change except in the case of increased academic achievement and IQ increases for a time interval more or less equivalent to that between the two IQ's compared. Changes in both negative and positive teacher comments following IQ change were significantly related to IQ change.

A significant difference between boys and girls was obtained with boys tending to decrease in IQ and girls tending to increase in IQ ($p > .05$). Having two parents appeared to stabilize IQ ($p > .01$); having one parent seemed to favour IQ increases ($p > .05$) especially for boys ($p > .02$); having no parents resulted in the greatest tendency to change IQ but in no significant direction. These data did not indicate a difference in terms of stability of the home.

In the school situation day nursery did not contribute to IQ change and kindergarten acted to stabilize IQ ($p > .05$) especially for girls ($p > .05$). Grade one entry age by itself did not relate to IQ change, but the younger the boy who had kindergarten on entry to grade one the more likely he was to increase in IQ ($p > .01$). IQ changes and a student's initial IQ level appeared to exhibit the "regression effect", which was significant in the case of IQ decrease students at or above 100 IQ when compared to those below 100 IQ. This difference increased to beyond the .01 level of significance when students at or above 78 IQ were opposed to those below

78 IQ.

Achievement in most school subjects such as Reading, Language, Spelling, Arithmetic, etc., related strongly to IQ change ($p > .001$). Relative achievement in the less academic subjects, handwriting, industrial arts and physical education resulted in no significant differences. Grade one reading ability was highly significant ($p > .001$). Differences in negative teacher comments were associated with IQ change ($p > .05$) especially for boys ($p > .05$). Positive teacher comment was unrelated to IQ change.

These data did not show any significant changes in effort following IQ change. Changes in academic achievement were also unrelated to IQ change except in the case of grade increases for IQ increase students over a time period somewhat similar to that between the two IQ's compared ($p > .05$): Changes in both negative ($p > .05$) and positive teacher comment ($p > .01$) following IQ change were significantly related to IQ change. The former result was mostly determined by boys ($p > .05$), the latter by girls ($p > .05$).

In reviewing the outcome of this investigation as a whole, several points seem worthy of emphasis. First of all, results in many instances indicated a sex factor in IQ change. There is evidence in this study that boys and girls differ in IQ change with regards to parent presence or absence, age of entry into school, kindergarten experience and type of teacher comment. This together with the overall tendency for males to decrease in IQ and females to increase in IQ

would seem to suggest that girls and boys should be treated independently when studying IQ change.

It appears important, at least from a practical viewpoint, that in this population a high percentage of those with low academic achievement in all school subjects are consistently in the IQ decrease category. School performance is the educator's arena and this finding seems to invite a concentrated effort by all concerned to elevate achievement levels and perhaps thereby IQ itself. Furthermore, this study indicates that a student's reading ability in grade one may well be an excellent starting-point.

As with most exploratory studies this research gave rise to many questions and uncovered unforeseen contingencies. For example, why do family stability and family completeness tend not to correlate with IQ increases in this population? Why should these dimensions seem more to fixate IQ? Would this same result be found in a middle class population or is it specific to this class of student? Why were kindergarten and early school entry age important only in the case of boys? What were the essential characteristics of kindergarten and/or of the students which facilitated these IQ gains? Why did girls who had kindergarten not exhibit similar increases in IQ? How would measures of reading readiness relate to IQ change? Are teachers of all populations equally prone to negative comment? Do boys and girls usually receive differential teacher comment or is this characteristic only of a lower class population? Would this finding be repeated in

middle-class schools?

A fundamental problem that kept recurring in this study centers on what might be described as the "deprivation continuum". For example, how different in terms of intellectual deprivation, is the student with no parents from the student with one or two parents? It would seem that new research instruments are necessary to enable the specification and measurement of intellectual deprivation in terms of more precise indices. Indeed the whole question of aspects of environment, deprivational states and specific cognitive deficits seems to require systematic organization before the researcher can advance much further into the realm of intellectual change, real or measured.

One final thought may be worthy of consideration. This study, except in one instance, did not control for IQ, although approximately 72 per cent of the sample had IQ's of less than 100. Future research might, however, ascertain the relevance of these results to specific IQ levels within the below average IQ range.

It would appear from this research that much more work is required to identify the specific mediators of IQ change in inner-city children; nevertheless results of this investigation seem to indicate the possibility of this endeavour even within the school situation. To achieve advances, there is need of new measures to specify the various dimensions of intellectual deprivation, to spell out the prerequisites of

successful scholastic achievement and, finally, to provide the educator with the tools and know-how to accomplish IQ change.

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