The effects of age at the beginning of reading instruction on reading achievement

Phyllis G. Wacker

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THE EFFECTS OF AGE AT THE BEGINNING
OF READING INSTRUCTION ON
READING ACHIEVEMENT

by
Phyllis G. Wacker

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THE EFFECTS OF AGE AT THE BEGINNING OF READING INSTRUCTION ON READING ACHIEVEMENT

by

Phyllis G. Wacker

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Arts in Psychology in the Graduate School of the University of Richmond

August 1965
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"Development throughout life is not a continuous, unbroken process... Embryologists find that there are critical periods for the development of each organ... If something happens to arrest progress during this particular period, the deficiency is never completely overcome.

"...the idea of developmental stages appears in another guise in the work educators have done with regard to 'readiness' for different kinds of school learning... There seems to be a period in which a child is ripe for reading, intellectually and emotionally. Instruction given before this stage is reached produces little effect, except perhaps to discourage the child and set up attitudinal barriers to later learning. On the other hand, if we delay reading instruction too long, we may find that other kinds of activities have been learned during the period, and that they serve as substitutes for reading, thus reducing the motivation to learn it. The popular notion of 'the psychological moment' takes on new meaning with regard to development." (Goodenough and Tyler, 1959).

All too often, the first part of the above quote, or a minimum age for learning to read has been an issue of great discussion and debate. Far less often has one seen references
to the last part of the quote, a maximum age, or upper limit to the age at which reading instruction should begin. There has been a lack of data on an upper limit to the "critical period" for learning to read since the only samples available heretofore were isolated cases of one or two children.

In the experimenter's previous work with several hundred Negro children who had not attended school until they were well past the usual starting age of six, it was quite apparent that the group of children whose school entrance had been delayed longest was also the group that was progressing the slowest. This discovery led to an attempt to find similar cases, and to compare groups, but the search was in vain. Nowhere was there information on a similar phenomena. The situation was unique.

General sources, textbooks, etc., gave mounds of information on "reading readiness", but always on the lower end of the readiness scale. One reference, Havinghurst (1957), did report that reading is learned by most people, as well as they will ever learn it, by the age of twelve or thirteen. At this rate it wouldn't give these educationally deprived children (some were already nine years of age, and had never been to school) much time in which to develop their reading skills.

Durkin (1962) observed that children with intelligence quotients of 120 or less profited from an early start in
reading, and that the lower the child's intelligence quotient, the greater seems to be the advantage of starting early.

Certain measures were taken to try to accelerate the rate of achievement for these older groups. Special remedial reading teachers were used, special equipment was used, and special techniques in teaching reading were employed. Some few responded well, but for the most part, these older children were slow in acquiring reading skills. The question was, were they significantly slower achieving than younger groups who had entered school at the same time as these older children? And if so, why? Had some "critical period" passed, and what was the upper boundary of this "critical period"? Huttenlocher (1965) in her review of the literature on children's intellectual development cited Piaget's work, especially his "developmental stages" (Inhelden and Piaget, 1958). Chronbach (1960) also discussed the work of Piaget, how he has devoted his lifetime to the study of developmental changes. "How," he asks, "do perception and reason differ in the older and younger child? Do older children show different processes of thought, or merely superior speed and complexity (Piaget, 1947)?

Hunt (1961) found that in lower socio-economic groups training provided by the child's natural environment was often too haphazard for the efficient development of ideas of which he is capable. Limited experiences, or few "learn-
ing sets" may be the cause of lack of achievement. These questions led the experimenter, a year later, to undertake a study of these children after each had had two years of formal, in school, reading instruction, and to test the following hypotheses:

1. Four groups of children who had entered school at the same time, but at four different ages, would differ significantly in their reading achievement at the end of two years.

2. The oldest group (nine years old at the time of school entry) would have the lowest mean reading achievement score.
CHAPTER II
PROCEDURE

Two different tests were given to four groups of Negro children. One test, the Gates Primary Reading Tests, PWR, PSR, PPR, (form 1) was given to obtain a reading achievement score. The Gates Primary Reading Tests consists of three parts, Word Recognition, Sentence Reading, and Paragraph Reading. These subtests will form the three levels of one factor of the experimental design. The time allowed for each test is generous, and they are not, therefore, primarily tests of speed. They are designed to give the range, accuracy and level or power of reading ability.

The following information about the tests was taken from the Manuel for the Gates Primary Reading Tests.

The three tests measure different phases of reading ability. The Primary Word Recognition Test was designed to test the ability to read words representative of the primary vocabulary. It consists of 48 individual exercises. Each exercise contains four printed words, and a picture which illustrates the meaning of one of the words. The directions are to circle the word which tells the most about the picture. The words in the first exercises are easy and commonly used, and grouped with words only slightly similar (same number of letters, etc.). The exercises become pro-
gressively harder and less common, and are grouped with words more similar in detail. The test measures the degree to which a pupil can identify these words. The score on the Primary Word Recognition Test is the number of items correct, minus one-third the number wrong. Items not attempted are not counted.

The Primary Sentence Reading Test measures the ability to read sentences of increasing length and complexity. There are 45 sentences in the test, grouped in threes, making up fifteen exercises. The child reads the first sentence of an exercise, and marks with one single line the picture which illustrates its meaning. Next he reads the second sentence, and marks the appropriate picture with two lines. Finally he reads the third sentence in the group and marks its proper picture with three lines. This test measures ability to read and understand representative sentences composed of words most commonly found in primary reading material. Many skills are employed in reading and understanding sentences, which are not involved in mere ability to recognize words. Context and other clues must be utilized for intelligent reading of sentences. The score on the Primary Sentence Reading Test is the total number of items correct.

The Primary Paragraph Reading Test consists of 26 paragraphs, each accompanied by illustrations which are to be marked in such a way as to indicate the meaning of the
paragraph. The sentence structure and vocabulary of the test units gradually increase in difficulty and complexity, and the passages become progressively longer. The test measures the ability to read primary grade passages with reasonably thorough understanding. To get only a phrase, word, or sentence here or there is not sufficient. The total thought must be clearly understood in order to successfully follow the directions. The reading and understanding of paragraphs is more complex than the reading of sentences, and requires abilities not involved in the reading of words and sentences alone. The score on the Primary Paragraph Reading Test is the total number of items correct.

The Manual states that other things being equal, the average score for two tests in a battery is more reliable than that for one test, and in general the larger the number of tests included in the average, the more reliable it is.

The Gates Primary Reading Tests were revised and restandardized in 1957, using 4600 primary grade children. They are designed for use in Grade One and the first half of Grade Two. Classes of lower reading ability may use these tests throughout Grade Two. For this reason the primary test was chosen.

Harris (1965) in his review of the literature on reading, cites Sipaz's (1964) study comparing standardized read-
ing tests. He found that the Gates overestimated the instructional reading level by .29 of a grade level, which was less than other tests compared.

The second test, the *Otis Quick Scoring Mental Ability Tests: Alpha Test, Short Form* (form As), was given to obtain an ability score. The content of the Short Form is entirely pictorial and geometric and does not depend on the subjects ability to read. This type of test was chosen in order to minimize the influence of reading difficulties on the scores. Neville (1965) found that grade 4.0 achievement level in reading is the critical minimum for obtaining a reasonably valid I.Q. for children using a verbal intelligence test. Lennon (1964) cited the use of the Otis in the "anchor test" approach for equation non-parallel test scores, because it was known to correlate consistently from .55 to .75 with editions of tests in the series.

Split-half reliability coefficients of .87 and .88 were computed for the Alpha Short Form, As, using two samples of third grade pupils. The *Manual for the Otis Quick Scoring Mental Ability Tests* has the following to say about validity:

"Because one of the major purposes for which a school uses an intelligence test such as Alpha is to provide a basis for estimating ability to handle school work successfully, it is proper to think of 'validity' as the extent to which the Alpha scores are related to, and can be used to
predict, school achievement. Thus, the relations between Alpha scores and reading test results constitute a useful kind of validity evidence. Reading, despite the rise of radio and television, continues to be essential to academic and frequently vocational success. Davis says, 'Among authorities in the field of reading there is general agreement that reading is fundamentally a thinking process.' Thorndike says, 'In fact, we shall find that the act of reading and answering simple questions about a single paragraph... includes all the features characteristic of typical reasonings.' Put another way, if there were low or negligible relationship between Alpha scores and an accepted, reliable measure of reading, the test would almost certainly be failing to measure salient aspects or factors of mental ability.

"As evidence of this kind of validity, the correlations between Alpha Short Form As and the average of two reading subtests of the Metropolitan Achievement Test for two independent samples were .63 and .62 respectively. When corrected for attenuation, these coefficients become .69 and .68. This relatively small increase is, incidentally, a tribute to the reliability of the two measures.

"In order to establish more firmly and to expand the basis for the 'correlation with achievement' kind of validity, the following procedure was undertaken. Within random samples of Stanford Achievement Test results, Otis Alpha
scores were converted to Short Form scores and correlated with the subtests of the Stanford Achievement Test. The resulting coefficients are shown in Table I. These correlations tend not only to substantiate the findings with the Metropolitan Achievement Test, but they also afford estimates of the relationship between Alpha Short Form scores and achievement in spelling, language, and arithmetic skills.

"Since for all practical purposes the Alpha Tests and achievement tests were administered at the same time, the kind of validity claimed here is essentially 'status' validity. However, since the sole difference between this and 'predictive' validity is the time factor, it seems reasonable to suppose that, barring serious organic or functional changes in pupils, the test has predictive validity as well. ...A word of caution is in order with respect to the low-scoring child. Other avenues of approach to his evaluation should be explored before he is judged a slow learner. It may be that home environment, unsatisfactory school adjustment, or some other not wholly intellectual factor may be contributing to the low score. If this is not considered and the test identifies as a slow learner one who is not, its true validity suffers." (Otis, 1954).

According to Chronbach (1960), IQs tend to be lower on the Otis than for other group tests, but predictive vali-
TABLE I

CORRELATIONS BETWEEN ALPHA SHORT FORM AS AND STANFORD ACHIEVEMENT TEST

<table>
<thead>
<tr>
<th>stanford subtest</th>
<th>grade 1</th>
<th>grade 2</th>
<th>grade 3</th>
<th>grade 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Par. Mean.</td>
<td>.31</td>
<td>.56</td>
<td>.56</td>
<td>.62</td>
</tr>
<tr>
<td>Word Mean.</td>
<td>.32</td>
<td>.57</td>
<td>.55</td>
<td>.60</td>
</tr>
<tr>
<td>Spelling</td>
<td>.43</td>
<td>.50</td>
<td>.34</td>
<td>.44</td>
</tr>
<tr>
<td>Language</td>
<td></td>
<td></td>
<td>.48</td>
<td>.55</td>
</tr>
<tr>
<td>Arith. Reas.</td>
<td>.51</td>
<td>.60</td>
<td>.52</td>
<td>.63</td>
</tr>
<tr>
<td>Arith. Comp.</td>
<td>.48</td>
<td>.46</td>
<td>.43</td>
<td>.53</td>
</tr>
</tbody>
</table>

number of cases 374 395 424 276

Taken from Manual of Directions, Otis Quick Scoring Mental Ability Tests, Alpha Short Form. p.12.
ties against school achievement compare favorably with other tests, Durost (1962) reports a correlation of .86 between the Otis Quick Scoring Mental Ability Test and the Pintner General Ability Test which was given six months later.

For the remainder of this paper, reading achievement is defined as the score on the Gates Primary Reading Tests, and ability is defined as the score on the Otis Alpha, Short Form.

The method used for testing for significant differences within the four groups was an analysis of covariance. This method was chosen in order to adjust the criterion score (the score on the Gates Primary Reading Tests) for any differences in ability among the four groups.

There were ten subjects in each group, randomly selected from Negro children, in one school, all of whom started school at the same time, but who had been of different ages at the time they entered school. The four groups which made up one factor in the analysis of covariance were determined by age at entering school. Group I entered school at 6 years old (no delay). All subjects in this group were born between October 1, 1956, and September 30, 1957. The mean age at entering school for Group I was 6 years and 5 months. Group II entered school at 7 years old (one year's delay). All subjects in this group were born between October 1, 1955 and September 30, 1956. The mean age at entering school for
Group II was 7 years and 3 months. Group III entered school at 8 years old (two year's delay). All subjects in this group were born between October 1, 1954 and September 30, 1955. The mean age at entering school for Group III was 8 years and 6 months. Group IV entered school at 9 years old (three year's delay). All subjects in this group were born between October 1, 1953 and September 30, 1954. The mean age at entering school for Group IV was 9 years and 3 months.

There were 15 males and 25 females in the study. Girls and boys were evenly matched in Groups II and IV, but in Group I girls outnumbered boys 8 to 2, and in Group III the boys were outnumbered 7 to 3. While there has been much evidence that girls consistently outscore boys, Edmunds (1964) reports no significant difference between verbal ability of boys and girls in 63 rural communities in the deep south. The parents of these children were largely laborers, and from the report, the socio-economic level of the group corresponds to that of the current study. Powell, O'Connor, and Deutsch (1963) found no sex differences in the reading achievement of 5020 pupils in grades two through eight in urban Ohio schools.

This particular school was chosen for the sample because it represented a cross section of the Negro population of the locality, both urban and rural (actually urban is hardly the correct term, as the town is quite small).
All subjects had been in school for 19 months at the time of testing. The same examiner tested all subjects, and the instructions given to each group were the same. All subjects had had prior experience in taking standardized tests, as a number of tests had been given the previous year. The results of these tests were unavailable to the experimenter at this time.

The independent variables in this study were age at entering school (either 6, 7, 8 or 9 years of age), and number of years in school, which was constant for all groups (two years). The dependent variable was reading achievement, or more specifically, reading achievement after adjustment for ability.

A two factor analysis of covariance with repeated measures on one factor was done. One factor was Reading Achievement. The three levels of this factor were the three tests of the Gates Primary Reading Tests: Primary Word Recognition, Primary Sentence Reading, and Primary Paragraph Reading. The measures were repeated across this factor. The second factor of the two factor design, age at entering school, had four levels; Group I (6 year's old at entering school), Group II (7 year's old at entering school), Group III (8 year's old at entering school), and Group IV (9 year's old at entering school).

The scores on the three subtests of the Gates Primary Reading Tests were not directly comparable, as they had
different ranges. For example, the Primary Word Recognition Test ranged from 0 to 48, while the Primary Sentence Reading Test ranged from 0 to 45, and the Primary Paragraph Reading Test ranged from 0 to 26. In order to compensate for this difference, all scores on the Gates Primary Reading Tests were converted to standard scores, or "T" scores, with mean 50, and standard deviation equal to 10.
CHAPTER III

RESULTS

The overall analysis of covariance is summarized in Table II. Under the analysis of covariance the F ratio for the test on the main effects of age at entering school was 4.06, with degrees of freedom 3 and 35. This F ratio was statistically significant at the .05 level. In Figure I the marginal means of reading achievement scores for the four groups are plotted. The adjusted means are shown beside each corresponding unadjusted mean for that group. The adjusted means are shaded. Before adjustment, Group II (7 year olds) had the highest mean - 53.4, followed by Group I (6 year olds) - 51.8, Group III (8 year olds) - 48.8, and Group IV (9 year olds) which had the lowest mean - 46.3. After the covariate adjustment for differences in ability, the relative position of all these means except one changed. The lowest mean, 46.3 for 9 year olds became even lower. The position of the means after the covariate adjustment was: Group I (6 year olds) - 55.04, Group III (8 year olds) - 50.39, Group II (7 year olds) - 50.30, and Group IV (9 year olds) - 44.71. These adjusted means for the main effects due to age at entering school were obtained by adjusting the original reading achievement (criterion) means by the ability (covariate) means. This linear adjustment was made for the effect of variation due to differences
### Table II

**Analysis of Covariance**

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Between Subjects</strong></td>
<td>38</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>3</td>
<td>271.13</td>
<td>4.06</td>
</tr>
<tr>
<td>Subj. within groups</td>
<td>35</td>
<td>66.82</td>
<td></td>
</tr>
<tr>
<td><strong>Within Subjects</strong></td>
<td>79</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reading</td>
<td>2</td>
<td>1.87</td>
<td>.01ns</td>
</tr>
<tr>
<td>Interaction (Reading X Age)</td>
<td>6</td>
<td>17.49</td>
<td>.13ns</td>
</tr>
<tr>
<td>Residual</td>
<td>71</td>
<td>133.03</td>
<td></td>
</tr>
</tbody>
</table>

**Total** 117

*F .95 (3, 35) 2.88*
FIGURE I

ADJUSTED AND UNADJUSTED READING ACHIEVEMENT MEANS

Standard deviation for all groups equal to 10.0
in ability, as measured by the covariate. The adjusted means on reading achievement were obtained by subtracting from the unadjusted reading achievement means for each group, the product of the between subject regression coefficient, and the difference between the ability score mean for that group and the grand mean for the ability scores.

In this particular study, the same subjects were used for all levels of the Gates Primary Reading Tests. There was a single covariate measure associated with all the criterion scores for an individual. In this case, only the between subject comparisons were adjusted for the effect of the covariate. The within subject comparisons all had adjustments which were numerically equal to zero. The regression coefficient for the between subject effects which was used in making the adjustments on the marginal means of the four age groups was .69. This regression coefficient was obtained by dividing the sums of products for the variate and covariate for each subject in each group, by the sums of squares for the covariate for each subject in each group. The regression coefficient for within-subject effects was equal to zero, as the covariate measure was constant for all criterion measures on the same subject.

The ability score means for the four groups are shown in Figure II. Group II (7 year olds) had the highest mean - 55.4, Group IV (9 year olds) next highest - 53.2, followed
FIGURE II

ABILITY MEANS OF THE FOUR GROUPS AS MEASURED BY THE RAW
SCORES ON THE OTIS ALPHA SHORT FORM

<table>
<thead>
<tr>
<th></th>
<th>Group I</th>
<th>Group II</th>
<th>Group III</th>
<th>Group IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>(6 year olds)</td>
<td>46</td>
<td>54</td>
<td>48</td>
<td>52</td>
</tr>
<tr>
<td>(7 year olds)</td>
<td>48</td>
<td>54</td>
<td>52</td>
<td>58</td>
</tr>
<tr>
<td>(8 year olds)</td>
<td>50</td>
<td>52</td>
<td>56</td>
<td>60</td>
</tr>
<tr>
<td>(9 year olds)</td>
<td>52</td>
<td>58</td>
<td>60</td>
<td>60</td>
</tr>
</tbody>
</table>

Standard deviation for the four groups equal to 8.95
by Group III (8 year olds) -48.6, and Group I (6 year olds) -46.2. These were the means of the raw scores on the Otis Alpha, Short Form which were used in the analysis of covariance and in order to obtain the adjusted criterion means. When these raw scores were converted to Mental Ages, it was found that Group I had an average Mental Age of 7 years and 2 months, Group II had an average Mental Age of 8 years and 0 months, Group III had an average Mental Age of 7 years and 5 months, and Group IV had an average Mental Age of 7 years and 9 months. Using these Mental Ages to obtain mean IQs for the four groups, it was found that Group I had a mean IQ of 91, Group II had a mean IQ of 92, Group III had a mean IQ of 75, and Group IV had a mean IQ of 73.

After having found a significant difference due to the main effects of age at entering school, the Duncan Procedure was performed, in order to determine which of the four groups differed significantly in their reading achievement.

The results of the Duncan Procedure are summarized in Table III. At the .05 level of significance, Group I (6 year olds) was found to be significantly higher in reading achievement than Group IV (9 year olds). No significant differences were found between Groups I, II, and III, and II, III, and IV.

The original hypothesis, that there would be significant differences between the four groups was upheld, and further-
TABLE III

DUNCAN PROCEDURE ON ADJUSTED READING ACHIEVEMENT MEANS

<table>
<thead>
<tr>
<th>age group</th>
<th>9</th>
<th>7</th>
<th>8</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>ordered means:</td>
<td>44.71</td>
<td>50.30</td>
<td>50.39</td>
<td>55.04</td>
</tr>
<tr>
<td>k:</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>q^*.95(k,36):</td>
<td>2.89</td>
<td>3.04</td>
<td>3.12</td>
<td></td>
</tr>
<tr>
<td>s^<em>q^</em>.95(k,36):</td>
<td>7.46</td>
<td>7.84</td>
<td>8.05</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>differences between ordered means</th>
<th>9</th>
<th>7</th>
<th>8</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>5.59ns</td>
<td>5.68ns</td>
<td>10.33*</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
<td></td>
<td>4.74ns</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
more, the fact that the oldest group (9 years olds) would have the lowest mean reading achievement score was substantiated.
CHAPTER IV
DISCUSSION

Previously, the question of whether or not there might be a "critical period" for beginning reading instruction was raised. If there is such a "critical period", it would appear from the results of this study that an upper boundary for this "critical period" seems to lie below nine years of age. It has been noted that while the seven and eight year old groups did not have a significantly lower reading achievement score than the six year old group, neither was it significantly higher than the nine year old group. These two ages, seven and eight, lie in the middle between two significantly different extremes. As a result of this study, one could not say that the six year old group's reading achievement was better than the seven and eight year old group's reading achievement, but it was certainly better than that of the nine year old group.

There were certain variables which the examiner was unable to control. One of these variables was the teacher whom the subjects had as their reading instructor. Each subject had had several reading teachers during the two year period. For the first year, most of the subjects had the same teachers, as "team teaching" methods were employed, and the same teacher taught reading to several different groups. The second year a more conventional procedure was
followed, however some "team teaching" was utilized, and most of the children within an age group had the same reading teacher. Certainly there were teacher differences, overall, and in interaction with individual subjects, but there is no reason to assume that the effects of this variable have not distributed themselves normally among the subjects.

Another variable for which there was no control, was home environment and background. The effects of this variable should also have been distributed normally, as it would hardly be conceivable that one socio-economic group would have more six year olds than nine year olds, or more seven or eight year olds.

The Gates Primary Reading Tests was chosen for this study because the experimenter wanted a test that would best determine the reading level of the majority of the subjects in all groups. This test was designed for primary level children, and in normal circumstances would only be used for the first half of grade two. The Manual states, however, that with a slower group, the test can be used all the way through the second grade. Although the subjects in the study were in ungraded sections, this was the second year in school for each. Not one of the subjects was unable to answer some of the items on the test correctly, and conversely, not one subject was able to answer all of the items on the test correctly.
When the averages for the Gates Primary Reading Tests were converted to reading grade and reading age scores, it was found that the two groups that were significantly different, differ in reading age by 4 months, and in reading grade by 0.3. The mean reading age for Group I, whose average age at entering school was 6 years and 5 months, was 8 years and 0 months. The average age of these children at the time of testing was 7 years and 10 months. Therefore they were reading, on the average slightly ahead of their chronological age. The average reading grade for this group was 2.8, and they were in grade 2.6, which was also slightly ahead of the norms.

On the other hand, Group IV, whose average age at entering school was 9 years and 3 months, was reading at an average reading age of 7 years and 10 months, four months behind Group I. The average age of this group at the time of testing was 10 years and 8 months. The average reading grade for this group was 2.5, slightly below the norms for the test.

The question might be raised at this point as to the practical significance of a difference of 4 months in reading age, or of 0.3 of a reading grade. In the analysis of covariance the difference between these two groups was found to be significant at the .05 level. Davis (1959) has the following to say about the practical significance of such
a difference.

"In practice, differences between test scores large enough to have a probability of occurring by chance 15 times, or less, out of 100 may be regarded as worth interpreting. This level of significance for the two tailed test of the null hypothesis may seem unduly lenient to psychologists accustomed to using the .01 or the .05 levels in experimental work. It must be remembered, however, that the designation of any level of probability as "significant" is arbitrary and represents a balance between the test interpreters' desire to avoid accepting differences as attributable to something other than chance when in fact they are not, and his desire to avoid attributing differences to chance when in fact they are not. For interpreting test scores, several factors suggest a rather lenient level of significance as appropriate. First, scores derived from most achievement and aptitude tests are sufficiently unreliable as to make their practical utility doubtful if only differences among individual scores significant at a stringent level (such as .01) are interpreted. Second, the penalty for accepting a difference as owing to something other than chance when, in fact, it is a chance deviation from a true difference of zero is not usually great, because test results are ordinarily only one of several factors entering into the making of any important decision about a child's
schooling" (Davis 1959).

It is interesting to note, that whereas this study was primarily concerned with Reading Achievement, the results of the Otis Quick Scoring Mental Ability Test fall into a peculiarly interesting pattern. In Table II it may be seen that the raw score on the Otis was highest for the group beginning school at age seven. Chronbach (1954) has noted that a child arrives at his intellectual capacity at about age seven. One might account for the fact that the six year old group scored lower than the seven year old group by saying that perhaps the children in this group had not arrived at their full capacity. The interesting thing about this study is that the score drops for age eight, and at age nine is still below age seven. It would appear that possibly some motivational factor was at work here.

The IQs for these four groups follow the same pattern as that found by Wheeler (1932) in his studies of East Tennessee mountain children. He found that the mean IQ in Grade I was 84.1, Grade II was 85.4 (a slight rise, possibly indicating some developmental peak had been reached). In Grade III it was 83.9, and in Grade IV it was 81.5. This pattern is identical to that found in the current study, except that the IQs for Groups I (6 year olds) and II (7 year olds), 91 and 92 respectively, fall within the range of normal intelligence and Groups III, with an IQ of 75, and IV, with an IQ of 73 are classified as borderline. Perhaps the
similarity in relative position of groups, but dissimilarity in interval between groups lies in the fact that the two older groups of East Tennessee children had not been deprived of school for two or more years, as had the two older groups in the current study.

Hirsch (1928) working with Eastern Kentucky Mountaineers found also that the average IQ decreased with an increase in chronological age.

This has been a study with many unanswered questions. On the basis of the information obtained, it would appear that there is an upper limit for beginning reading instruction in order to obtain satisfactory reading achievement. This upper limit seems to lie between eight and nine years of age.

The second question raised, what determines this upper limit of the "critical period" will be far from answerable. It may be as Goodenough and Tylor (1959) have suggested, that the child has acquired other habits which have interfered with his learning to read. It might be that social factors have been keeping the older children from learning to read adequately. Perhaps the primary reading material used in the instruction was too immature or juvenile to motivate him or arouse his interest.

It might have been that at six years old, these older children were looking forward to school with anticipation. At this age something new was an adventure. When these
children did not enter school at six, or seven, or even eight, something happened. Perhaps the wait simply got too long, and when it did finally come, it was anticlimactic. Personalities change also, and the nine year old was perhaps, not quite so ready to accept a new situation as a six year old. Especially a situation he knew was designed for a child younger than himself. It might have been that three extra years in a poor environment - poor in educational material at least - was just enough to fix in the child a pattern of dullness. The experiences of these children had been so limited for so long, they seemed to just be unable to learn as well as the younger children.

These have been only speculations. There are many avenues of exploration, but it is far beyond the scope of this study to try to answer these questions.

The subjects in this study were Negro children in one locality, and to draw broad general conclusions about the results would not be appropriate. However, it does suggest the need for more experimentation in this area.
The purpose of this study was to determine whether or not children entering school at different ages would differ significantly in reading achievement at the end of two years in school.

Four groups of Negro children who had been in school for the same length of time (two years) but had been of different ages when they began school, (either 6, 7, 8, or 9 years old) were tested. These children were given the Gates Primary Reading Tests, Primary Word Recognition, Primary Sentence Reading, and Primary Paragraph Reading; and the Otis Tests of Mental Ability, Alpha Short Form. Using these two measures, a two factor analysis of covariance with repeated measures on the Reading Achievement factor was done. The results showed that the main effects of the age at which the subjects entered school, on the reading achievement scores, after having been adjusted for differences in ability, was significant at the .05 level. A Duncan Procedure showed that the group of children who entered school at six years of age scored significantly higher on reading achievement than did the group of children who had not entered school until they were nine years old. This upheld the original hypothesis that the four groups of children would differ significantly in reading achievement, and that of
these groups, the children who were oldest entering school, would fare the poorest in reading.

The unusual distribution of the IQs of the four groups was noted, and a parallel was made between this study and studies made on the Southern highlanders of Tennessee and Kentucky.

The question of a "critical period" for beginning reading instruction was discussed, and from the results of the study, it would appear that the upper boundary of such a "critical period" lies between eight and nine years of age. Several possibilities for the poor reading achievement of the older group were mentioned, however no attempt was made to explain what determined this upper boundary of the "critical period". The implications of this study suggest much in the way of future work.
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