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## The Reading Difficulty of Parent Education Materials

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THE READING DIFFICULTY OF PARENT EDUCATION MATERIALS <sup>1</sup>

R. H. OJEMANN

It is not necessary to emphasize the fact that reading plays an important part in the education of parents. A more significant problem is that of discovering the characteristics of materials that fall at different levels of difficulty. A solution of this problem would make possible a more effective selection and preparation of materials suitable to the widely differing reading abilities that one finds among adults. The purpose of this investigation is to determine the factors that are associated with difficulty and to learn what the characteristics of materials are at the various levels. To carry out this study the reading difficulty of a series of sixteen selections was determined experimentally and the variation of numerous factors with difficulty was analyzed.

In previous work in the reading comprehension of parents a test was constructed and employed which consists of three selections taken from parent education materials and which requires thirty-nine minutes for administration. Each part consists of approximately 500 words. One selection was taken from each of the three books, Thom, *EVERYDAY PROBLEMS OF THE EVERYDAY CHILD*, Blanton and Blanton, *CHILD GUIDANCE*, and Blatz and Bott, *PARENTS AND THE PRE-SCHOOL CHILD*. The nature of this test may be learned from an examination of the sample for practice as it appears on the first page of the four-page folder :

<p>The diet of the nursing mother must be generous. It should contain each day at least one quart of milk and an abundance of vegetables — at least two, besides potatoes. One of these should be preferably some form of greens — spinach, cabbage, chard, lettuce, etc. The daily diet should also include at least one egg; one serving of meat or fish; some cereals; some butter; and three servings of fruit, one of</p>	<p>---9---1. How many eggs should be included in the diet of the nursing mother?</p> <p>---7---2. What examples of greens are given?</p> <p>-----3. How much milk should be included in the daily diet?</p>
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<sup>1</sup> Presented at the meeting of Iowa Academy of Science, April, 1932, Cedar Falls, Ia.

which should be a   serving   of   uncooked   -----4. How many vegetables  
  fruit.     12   should the nursing  
mother's diet contain?

For the purposes of this study it was desirable if possible to shorten the test. The reliability of the first two parts for a group of 209 parents as measured by the correlation of even and odd scores is  $.87 \pm .01$  which with the application of the Spearman-Brown formula becomes  $.93$ . This reliability is sufficiently high to warrant the abridgment of the test to the first two selections which require a total time of only twenty-six minutes.

In order to give added meaning to the data presented in this paper the distribution of the scores on the short reading test among parents who have had eight years or less of work in school, those who have had nine to twelve years inclusive, and those who have had more than thirteen years will be considered. Data are available from 209 parents to whom the entire test was administered and 156 parents who served as subjects in this experiment. The average score for eighty-eight parents having a partial or complete elementary school education is  $14.50 \pm .48$ ; for 159 subjects having nine to twelve years of schooling it is  $21.36 \pm .26$ . The average of the 118 parents having thirteen or more years of schooling,  $25.10 \pm .36$ , is slightly too low since the test is not sufficiently complex to take care of the highest levels of reading ability. This is shown by the fourteen perfect scores made in the college group. Since the reading problem is mainly one for parents whose comprehension falls below the college level, no attempt was made to increase the difficulty of the test.

The sixteen selections whose difficulty in terms of the short reading test scores was determined experimentally consist of approximately 500 words each and were taken from fifteen different books written primarily for parents. Each selection was prepared in reading test form. Fifteen questions and fifty brackets were used in each case. Considerable care was exercised in the preparation of the questions. An attempt was made to use short, simple sentences with a vocabulary about as difficult as or somewhat easier than that of the respective selections. Five judges examined the questions and took the tests to remove difficulties and ambiguities.

Fifteen minutes were allowed for each test. The purpose of the ample time limit was to obtain a measure of comprehension rather than of speed.

The selections were administered to parents whose scores on the short reading test were obtained at the same time. The subjects of the experiment were parents in a residential city in Iowa of

18,000 population, and mothers in the maternity ward<sup>2</sup> of the University of Iowa Hospital. The tests were administered by a trained examiner to individuals or to small groups where the conditions could be carefully controlled. The materials were given in random order and each parent took approximately six tests. Each selection was included in the series until fifteen to twenty cases were secured whose scores fell between nine and twelve inclusive. This range of scores was assumed to indicate satisfactory comprehension and at the same time to be sufficiently wide to avoid making the gathering of the data an unduly long process.

In the following table the number of subjects making a score between nine and twelve, the average score of these subjects on the experimental selections, and the average score on the short reading test are presented.

*Table I. Average Score on Reading Test Required for Satisfactory Comprehension*

SELECTION No.	No. OF SUBJECTS	AV. SCORE ON EXPERIMENTAL SELECTION	AV. SCORE ON READING TEST
3	17	11.09	12.35
4	17	10.92	12.94
5	16	11.00	14.50
6	15	11.13	18.47
7	15	10.80	18.58
8	19	11.31	23.37
9	18	10.94	21.56
10	19	10.95	21.16
11	15	11.11	17.20
12	31	10.90	24.13
13	19	10.89	22.00
14	16	11.05	18.56
15	19	11.09	23.16
16	18	11.05	22.83
17	18	10.94	27.94
18	16	10.56	27.13

From column three it will be seen that the average score on the experimental selections varies about three-fourths of a point. The range in difficulty is indicated by the figures in the last column. Three of the selections are at or below the average score made by parents who have had a partial or complete elementary school education; four fall in the neighborhood of seventeen to eighteen; four, around twenty-one and twenty-two; three, in the interval twenty-three to twenty-five; and the two most difficult selections fall at twenty-seven. With the order of difficulty established by these data the next step is to determine what factors are most closely associated with difficulty.

<sup>2</sup> The writer wishes to express his appreciation to Dr. E. D. Plass for permission to use the subjects in the maternity ward of the State University of Iowa Hospital.

In the quantitative analysis<sup>3</sup> of the experimental materials fifteen factors were studied. These include nine factors of composition and sentence structure such as: number of simple sentences, number of complex sentences, number of compound sentences, number of dependent clauses, average length of dependent clauses, number of words in dependent clauses, ratio of total words in dependent clauses to total words in selection, number of prepositions, and number of prepositions plus infinitive signs. Six factors of vocabulary difficulty were studied. These are: the percent of words in Thorndike's first 1000 using the new Thorndike word list published in 1931, the percent of words in Thorndike's first 2000, and four factors of word difficulty which require some explanation.

It was realized that the frequency of use of a word may not be very closely related to its difficulty, and that the same word may have different degrees of difficulty depending upon whether the more concrete or the more abstract meaning of the word is used. It was desired, therefore, to obtain a measure of word difficulty. The most feasible plan that presented itself was to obtain the relative difficulty in terms of some standard group such as pupils in the sixth grade. Through the courtesy of Dr. Edgar Dale of the Bureau of Educational Research at Ohio State University a tentative list of the familiarity of 8000 common words to pupils in the fourth, sixth, and eighth grades was obtained. In the preparation of this list, it was assumed that approximately 2000 words appearing in the Thorndike list of 10,000 and in several vocabularies of kindergarten and primary children were known by at least ninety percent of the children in grade four and beyond and were, therefore, not tested. Many words with two or more distinct meanings were tested in phrase or sentence context.

From this list the average difficulty per word in terms of the percent of sixth grade pupils familiar with a given meaning, the average difficulty per different word, the percent of words known by ninety percent of sixth grade pupils, and the percent known by seventy percent of the pupils were calculated. In carrying out this procedure, it was found that there were 168 words in the sixteen selections that are not found in Thorndike's 10,000. Judgments of twenty-one carefully selected sixth grade teachers were averaged to obtain an estimate of the proportion of sixth grade pupils familiar with these words. This procedure was adopted because it was assumed that if this list of, for the most part, unusual words, was presented to sixth grade pupils, the results

<sup>3</sup> The quantitative analyses of the experimental selections were made by two independent observers.

would not be as reliable as those obtained by presenting a list containing only a small proportion of unusual words.

The correlations of the fifteen factors with difficulty are presented in Table II. Inspection of the table shows that there are three sets of factors that correlate closer than .60; number of simple sentences, number of prepositions including and excluding infinitive signs, and all of the six vocabulary factors. The correlation of number of simple sentences with difficulty is  $-.61$ .

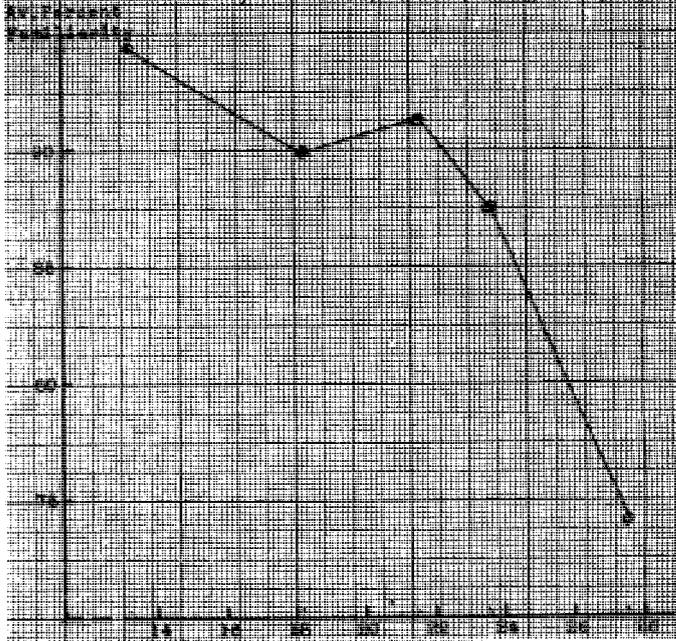
*Table II. Correlation of Factors With Difficulty*

FACTOR	r.
1. No. of simple sentences	$-.61$
2. No. of complex sentences	.13
3. No. of compound sentences	small range
4. No. of dependent clauses	.02
5. No. of words in dependent clauses	.48
6. Av. length of dependent clauses	.40
7. Ratio of total words in dependent clauses to total words in selection	.50
8. Av. difficulty per different word	$-.74$
9. Av. difficulty per word	$-.72$
10. Percent of words known by 70% of pupils	$-.73$
11. Percent of words known by 90% of pupils	$-.73$
12. Percent of words in Thorndike's 1000	$-.64$
13. Percent of words in Thorndike's first 2000	$-.73$
14. No. of prepositions plus infinitive signs	.66
15. No. of prepositions	.67

The correlation of the four vocabulary factors, percent of words in Thorndike's first 2000, percent of words known by seventy percent and by ninety percent of pupils, average difficulty per word, and average difficulty per different word are all closer than .70. The factor showing the closest relationship is average difficulty per different word where the figure is  $-.74$ . The two factors, number of prepositions plus infinitive signs and number of prepositions correlate .66 and .67 respectively. The next highest factor dealing with sentence structure is ratio of total words in dependent clauses to total words in the selection where the correlation is .50.

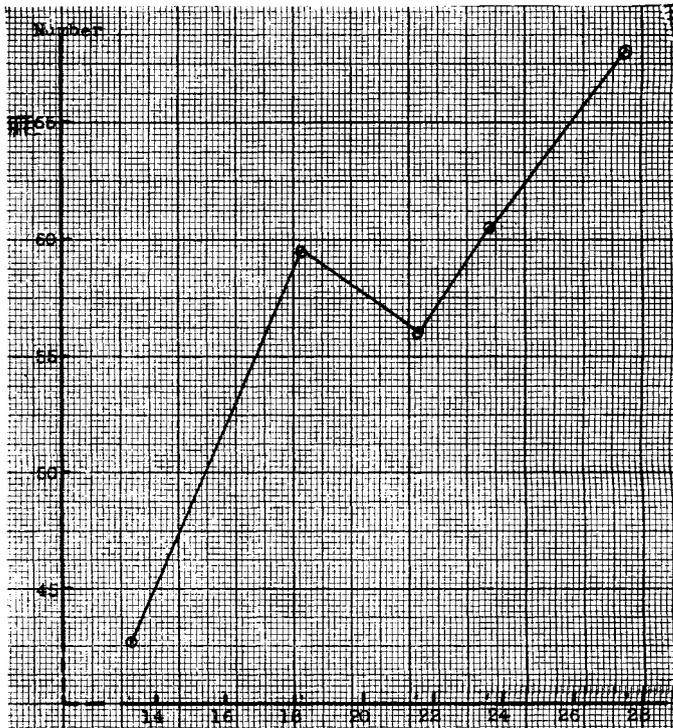
An inspection of the correlation tables upon which the data presented in Table II are based shows that the relation is not linear in all cases. A better analysis of the variation of a given factor with difficulty can therefore be obtained by studying the graphs directly.

The curves showing the relation to difficulty of the four factors: number of simple sentences, number of prepositions, average difficulty per different word, and ratio of total words in dependent clauses to total words are presented in Figures 1, 2, 3, and 4. In preparing the figures the sixteen selections were divided into five groups. Group one comprises the three selections whose difficulty



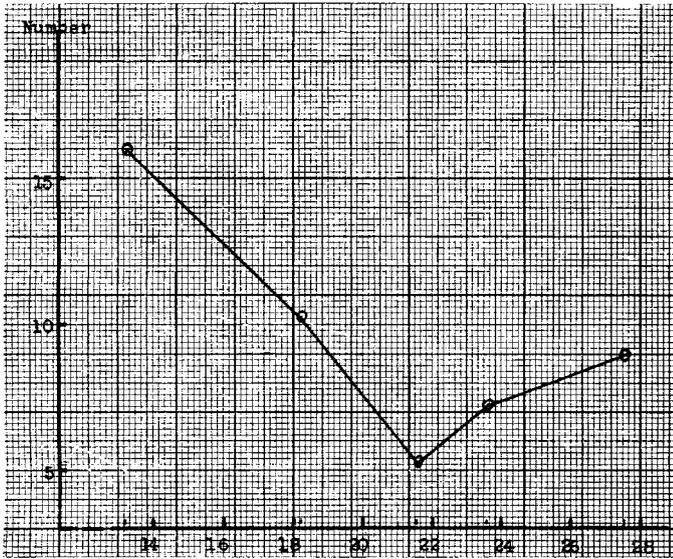
READING DIFFICULTY

Fig. 1. Relation of Word Difficulty to Reading Difficulty



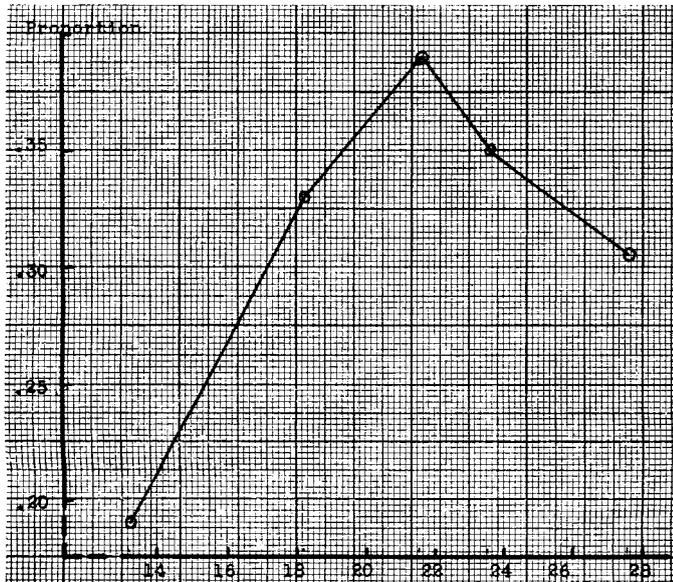
READING DIFFICULTY

Fig. 2. Relation of Number of Prepositions to Reading Difficulty



READING DIFFICULTY

Fig. 3. Relation of Number of Simple Sentences to Difficulty



READING DIFFICULTY

Fig. 4. Relation of Proportion of Total Words in Dependent Clauses to Difficulty

in terms of the score on the reading test is 12.35, 12.94, and 14.50 with an average of 13.36. Group two is composed of the four selections ranging in scores from 17.20 to 18.58 and averaging 18.20. In group three there are three selections ranging from 21.16 to 22.00 and averaging 21.57. The four selections that make up group four range in scores from 23.16 to 24.13 and average 23.63. In group five are found the two hardest selections for which the difficulty scores are 27.13 and 27.94, or an average of 27.53.

Figure 1 shows the variation of the factor, average difficulty per different word, with reading difficulty. Except for group three which is on the whole slightly easier in vocabulary than group two, each group shows a greater vocabulary difficulty than the immediately preceding one.

Figure 2 shows the variation of number of prepositions. The trend is distinctly upward and only one group deviates but slightly from this trend.

The variation of the number of simple sentences with difficulty is shown in figure 3. In the very simple selections the number of simple sentences tends to be high. But the curve soon approaches a region where the changes are not very great.

The curve for the ratio of total words in dependent clauses to total words in selection shows just the inverse behavior as an examination of chart 4 will show. A decrease in the number of simple sentences is, on the average, accompanied by an increase in the proportion of words used in dependent clauses.

Thus far the analysis has concerned itself with vocabulary and sentence structure. It must be remembered that in addition to these such factors as the concreteness or abstractness of the *relations* discussed as distinguished from the individual words used, obscurity in expression, and incoherence in expression are involved in reading comprehension. Some indication of the potency of these factors in the experimental selections can be obtained by comparing the difficulty score which would be expected from the combination of sentence structure and vocabulary difficulty with the experimental score.

A predicted score obtained by using a combination of the three factors, average difficulty for different word, number of prepositions, and number of simple sentences was calculated by reading the corresponding values directly from the curves presented in figures 1, 2, and 3 and averaging the values. Since none of the graphs are straight lines there are points on the ordinate which have more than one abscissa value. In such cases the average of

the possible abscissae values was used. For example on the graph showing the relation of average difficulty per different word to reading difficulty the ordinate value of ninety crosses the curve at 17.90, 18.80, and 22.20. These values were read to the nearest quarter unit and averaged. In this case the values become 18.00, 17.75, 22.25 and average 19.33.

The differences between the predicted values and the obtained values are presented in the last column of Table III. The predicted

*Table III. Comparison of Observed and Predicted Values*

SELECTION No.	OBSERVED DIFFICULTY SCORE	PREDICTED DIFFICULTY SCORE	DIFFERENCE (PREDICTED-OBSERVED)
3	12.35	10.75	-1.60
4	12.94	12.75	-.19
5	14.50	16.50	+2.00
6	18.47	18.41	-.06
7	18.58	20.25	+1.67
8	23.37	21.58	-1.79
9	21.56	22.33	+.77
10	21.16	20.50	-.66
11	17.20	19.92	+2.72
12	24.13	24.92	+.79
13	22.00	16.67	-5.33
14	18.56	21.82	+3.26
15	23.16	17.17	-5.99
16	23.83	23.92	+.09
17	27.94	26.17	-1.77
18	27.13	26.17	-.96

values are not seriously in error except in two cases where the differences are -5.33 in the case of selection thirteen and -5.99 points in the case of selection fifteen. In each of these the predicted value is lower than the observed value. An examination of selection thirteen gives a possible reason for the departure from the observed value. The material deals with children's fears, their relation to ignorance and curiosity, and the differences between fear and caution. Although the vocabulary is relatively simple, the relations expressed are quite abstract and therefore somewhat difficult to comprehend. The case for selection fifteen is not so clear except that the number of principles expressed is relatively large and that an improvement in the paragraphing would make for greater clearness. In the writer's judgment, these two factors and an experimental error in the observed value which has not yet been uncovered account for the deviation of selection fifteen.

An examination of the remaining selections does not reveal any outstanding cases of lack of clearness or coherence in expression or of abstractness in relationships other than that accounted for by the use of a more abstract vocabulary which in turn would raise the average difficulty per different word.

An opportunity to test the method of predicting reading difficulty implied in the above analysis with a selection which was not used in constructing the curves is available in the third part of the original reading test. The reader will recall that the original test from which the short form was prepared contained three selections and that this test was administered in an earlier study to a group of 209 parents. There were seventy-nine papers in this group which scored between nine and twelve (av. 10.98) on the third part of the reading test.

An analysis of this selection yields the following data:

Number of simple sentences	11
Proportion of words in dependent clauses	.21
Average difficulty per different word	86.7
Number of prepositions	71

Using the data for average difficulty per different word, the number of prepositions, and the number of simple sentences, and the corresponding curves presented in figures 1, 2, and 3 we obtain the following:

Average word difficulty	86.7	Corresponding difficulty value	24.00
No. of prepositions	71	Corresponding difficulty value	29.00
No. of simple sentences	11	Corresponding difficulty value	17.50
		Average predicted value	23.50

An examination of the material shows that the number of different groups of ideas expressed is rather large but that the discussion is straightforward. In its quantitative analysis it compares favorably with selection twelve which has nine simple sentences, .29 of the total words in dependent clauses, 69 prepositions, and a word difficulty of 84.6. Selection twelve has a reading difficulty score of 24.13. A qualitative comparison does not show any outstanding differences in clearness of expression or abstractness of relations other than those accounted for by the differences in word difficulty. We would expect, therefore, the predicted value to be near the true value. This is found to be the case, for the experimentally observed value is 22.99.

Writers of parent education materials are interested in the characteristics of materials that can be read by parents of limited ability. About one-half of the adult population have only a partial or complete elementary school education. What types of materials can be read by this group? An analysis of the three easiest selections which the data show are at or below the average score made by parents having from five to eight years of schooling will supply some data to answer our question.

The least difficult of the three selections is characterized by a large number of simple sentences, twenty-three per 500 word sample; low proportion of total words in dependent clauses, .11; a small number of prepositions, thirty-two per 500 word sample; and a very simple vocabulary, average difficulty per different word equaling 94.9.

The next selection in order of difficulty is number four which stands approximately .6 of a point above number three. As compared with number three, it has approximately the same number of simple sentences, twenty as against twenty-three; approximately the same ratio of total words in dependent clauses to total words in selection, .16 as against .11, approximately the same vocabulary difficulty, 94.4 as compared to 94.9; but a larger number of prepositions, forty-nine as against thirty-two.

Selection five is one and one-half points higher in difficulty than number four. As compared with selection four it has approximately the same vocabulary difficulty, 93.9 as against 94.4; approximately the same number of prepositions, forty-seven as compared with forty-nine; but a very small number of simple sentences, five instead of twenty; and a significant increase in the ratio of total words in dependent clauses, .31 as compared with .16.

An analysis of the content of the three selections shows that they deal with relatively concrete ideas, feeding and bathing the baby, providing play space and play equipment, and supplying fresh air and exercise.

Simple materials then are characterized by easy vocabulary and simplified sentence structure as evidenced either by a relatively large proportion of simple sentences, by a small proportion of words in dependent clauses, and by a small number of prepositional phrases. An increase in the number of complex sentences or in the number of prepositional phrases increases difficulty even when vocabulary is held constant.

In the simplified materials used in this study, few abstract ideas were involved. The way of preparing simplified materials for the concrete phases of child development is thus fairly clear. A more difficult problem is presented in the preparation of materials discussing the more abstract phases such as the principles of discipline or control. An analysis of one of the selections which ranks only a few points above the mean of the elementary school group in difficulty gives an indication of how this problem may be solved. Selection six discusses the principles of guiding the child in learning to put away his toys. Following a general discussion

of the factors complicating the situation, three principles are set forth and are explained in relatively concrete terms. For example, the second principle, that the picking up of toys should be treated as a learning situation, is made clear by enumerating several concrete acts which are involved in carrying out the principle, such as providing accessible places for putting toys, showing the child where to put them, helping the child to put them away, and being patient with the early fumbling efforts. This selection is a few points beyond the average ability of the elementary school group but by simplifying the sentence structure through the use of more simple sentences and fewer complex sentences, by simplifying the vocabulary somewhat more, and by supplementing the other abstract principles with concrete materials it appears that this discussion can be brought within the desired comprehension range. The data in this paper tend to indicate that an application of these suggestions to other discussions of abstract phases of child development will prove helpful in preparing simplified materials.

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