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A Readability Survey of the Science Textbooks used in University Place Elementary School, District No. 83

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A READABILITY SURVEY OF THE SCIENCE TEXTBOOKS USED IN UNIVERSITY PLACE ELEMENTARY SCHOOL, DISTRICT # 83

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APPROVED FOR THE GRADUATE FACULTY

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CHAPTER I

THE PROBLEM AND DEFINITIONS OF TERMS USED

Because of the increasing amount of scientific knowledge being accumulated, grade school science textbooks are becoming more technical in subject matter and vocabulary. With the new technical language, the question arises as to whether average grade school children can read and understand their textbooks. Textbooks are at present the primary source of knowledge in the area of science for children; therefore, the textbook must be readable (16:429; 42:40; 45:442; 46:368-69). Determining the readability level of science textbooks is important. Kerr stated that many concepts, remote in both space and time, are presented in science texts; therefore, reading difficulties should not be present, thus adding further complications (34:412).

I. THE PROBLEM

Statement of the problem. The purpose of this study was to determine: 1) the readability of an intermediate series of science textbooks, Concepts in Science, published by Harcourt, Brace and World; 2) if the text was readable for the students at University Place Elementary School near Tacoma, Washington; 3) whether the gradation or slope of difficulty rises progressively from the beginning of the book to the ending of the book.

Importance of the study. Many concepts found in science textbooks are difficult for elementary school children to grasp. Since many elementary teachers, according to Ottley, are weak in a knowledge of science, there is a heavy reliance upon the textbook for information and explanation of the material (43:363). Due to this, both Kerr and Ottley believe textbooks should be chosen with extreme care in order to prevent further complications from arising (34:412; 43:363).

Reading abilities in any grade span a rather wide range. Gerald A. Yoakum has stated that the range may be five grades or more (14:13). Chall states seventy-five percent of the children in a grade should be able to read the text that is being used (18:10). Mallinson, Sturm and Patton state that a science book for fourth grade students should be on a readability level below that of the average fourth-grader within the class (40:462). Many textbooks used within a grade are too difficult for that grade. Yoakum feels books labeled fourth grade are often actually sixth grade in difficulty (13:48).

Children reading science textbooks within their grasp will not be thwarted, or become discouraged with the material. However, children must be able to make sense out of their reading in order to profit from the reading experience (11:18; 14:11). Therefore, a series of science textbooks must be chosen with extreme care; a series must be on a readability level within the reading range of the majority of the class.

Methods of study. Five readability formulas, Dale-Chall, Flesch, Fry, Lorge and SRA were used in conjunction with the cloze readability procedure, to determine the readability of the Concepts in Science textbooks. The three formulas devised by Dale-Chall, Flesch and Lorge provide helpful information regarding the relative reading difficulty of textbooks, stated Kerr in 1949 (34:414). The Fry formula was chosen because it ranks, in Fry's words, "... about as well as Dale-Chall and Flesch and SRA formulas" 28:516). The cloze readability procedure is a method producing "valid indices," states Taylor, "of the comprehensibility of English prose - for the readers concerned" (51:25). The five formulas gave a comprehensive overview of readability.

A random selection containing a minimum of one hundred words was taken every tenth page. If a page contained no reading material, the next page that did contain reading material was used as the sample.

All formulas, except Fry's formula, were applied to the same sample for a control and a measure of validity. The cloze readability procedure was given to children in the three grades, four, five, six, at University Place Elementary School near Tacoma, Washington to determine if the texts were readable for them.

The Dale-Chall Formula for Predicting Readability calculates readability by following these steps.

1. List the total number of words in the sample.

2. List the total number of sentences in the sample.

3. List the total number of words which were not on the Dale list.

4. List the average sentence length which is determined by dividing number one by number two.

5. List the Dale score which is found by dividing number three by number one and then multiplying the answer by one hundred.

6. List the average sentence length which is found by multiplying the average sentence length (number four) by .0496.

7. List the product of the Dale score which is found by multiplying number five by .1579.

8. List the constant of 3.6365.

9. Add the total of numbers six, seven and eight to achieve the formula raw score.

10. Convert this score to the corrected grade level (Appendix C, pages 110-122).

The Flesch formula determines Reading Ease by:

1. List the number of syllables in a one hundred word sample.

2. List the average sentence length, determined by dividing the number of words in the sample by the number of sentences in the sample.

3. List the product which is found by multiplying number one by .846.

4. List the product which is found by multiplying number two by 1.015.

5. List the sum of numbers three and four.

6. Subtract number five from 206.835 (Appendix C, page 123).

Three one-hundred word passages, deleting proper nouns, are selected from near the beginning, middle and the end of the book to determine readability using the Fry method. Total the number of sentences and the number of syllables, averaging both. These averages are then plotted on a graph (Appendix C, pages 124-125).

The Lorge formula predicts Readability Index by:

1. List the total number of words in the sample.

2. List the total number of sentences in the sample.

3. List the total number of prepositional phrases in the sample.

4. List the total number of words not on the Dale list of 769 words.

5. List the average sentence length which is determined by dividing number one by number two.

6. List the ratio of prepositional phrases in the sample which is determined by dividing the number of prepositional phrases in the sample by the number of words in the sample.

7. List the ratio of hard words in the sample which is determined by dividing the number of words not on the Dale list by the number of words in the sample.

8. List the product of number five multiplied by .06.

9. List the product of number six multiplied by 9.55.

10. List the product of number seven multiplied by 10.43.

11. List the constant 1.9892.

12. Add the numbers listed under eight, nine, ten and eleven to arrive at a Readability Index (Appendix C, pages 126-130).

Readability is determined with the aid of a calculator using the SRA Reading-Ease method. Set the dial to the number of sentences in the first one-hundred words in the sample. Count the number of syllables in the same one-hundred words. The color opposite the number of syllables on the dial of the calculator indicates the reading-ease of that sample.

The cloze readability procedure was the last method used. How well a person is able to read a particular selection of material can be determined by using the cloze readability procedure (51:25). Eight passages, each containing from 250 to 300 words, were selected at random from each book. Beginning with the second sentence, every fifth word was replaced with an underlined blank of a standard length until a total of fifty words had been deleted. The deletion of every fifth word is best for both convenience and reliability. The cloze procedure was then given, without a time limit, to students who had not previously read the material. Responses are correct when they exactly match the words deleted, disregarding minor misspellings.

The five readability formulas and one readability procedure used in this study have produced an accurate survey of the readability of the textbooks.

Limitations of the study. This study was limited in that: only five readability formulas were used in the study, Dale-Chall, Flesch, Fry, Lorge and SRA; only one readability procedure was used in the study, the cloze readability procedure; only three textbooks were used in the study, the intermediate series entitled Concepts in Science, grades four, five and six; only ten percent of each text was sampled with four formulas, three passages from each text were sampled with another formula, and eight passages from each text were sampled with the readability procedure; and only seven intermediate classes in one school, University Place Elementary School, took the cloze readability procedure test.

II. DEFINITIONS OF TERMS USED

Comprehension level. Based on the material used for this study, comprehension level will be taken to mean the point at which a person can grasp the concept involved in the material being read.

Gradation. Gradation of material, as applied here, means a change in readability level taking place by degrees; that is, gradation is an upward slope of readable passages, each more difficult than the passage preceeding.

Publisher's designated grade level. According to tradition, publisher's designated grade level is taken to mean the numerical grade level found on textbooks which corresponds to the grade level or year of schooling for which the publishers indicate the book is best suited.

Readability formula. Throughout this investigation, readability formula is interpreted to mean a mathematical formula which either numerically or by graph estimates how readable a piece of written material is. The formula can take any of several forms, according to the originators of the formula, but is generally applied in an orderly, specific form with reliably significant correlations as a result.

Readability level. Readability level is a level of reading which can be read by a specific group of children within the same year of school or grade. This study limits level to mean grades four, five and six of the intermediate school system, unless otherwise indicated.

Readable. Readable is a style of writing which is comprehensible to the reader. Reading material which can be read, assimilated and understood is readable.

Unit-type textbooks. Unit-type textbooks are texts which deal with only one specific area of science, such as books dealing only with heat, another dealing only with rocks, or the like. They are smaller than standard textbook size and each is rather limited in use.

III. ORGANIZATION OF REMAINDER OF THE THESIS

The remainder of this thesis covers the following topics. The first section of Chapter II is applied to readability studies and formulas in general. Readability studies on science textbooks during the last twenty years are covered in the second section of Chapter II. Chapter III states the results of the study. Chapter IV deals with conclusions and recommendations.

CHAPTER II

REVIEW OF THE LITERATURE

The amount of existing literature concerning readability is large. In the area of science textbooks for elementary schools, a lesser amount of literature exists. This chapter deals generally with differing readability studies and specifically with studies upon elementary science textbooks.

I. READABILITY STUDIES

The first readability formula study was performed in 1923. Bertha A. Lively and S. L. Pressey desired to determine the vocabulary difficulty of science textbooks (3:17-18; 15-442; 18:3; 29:492; 35:389-98). Junior high school teachers had reported an unusual number of technical terms in science textbooks. Vocabulary burden was determined by assigning the Thorndike frequency number to each different word and averaging the numbers. The lower the number, the more difficult the book was considered to be.

The frequency of the word was found rather than actually measuring the difficulty of the word. A 1,000 word sample was examined using the following methods: the range or number of different words, the number of different words which are not found in Thorndike's list of the 10,000 most common, and weighting the words according to their Thorndike index number (35:398).

Four other studies took place in the late twenties. The next study occurred in 1927. F. D. Keboch surveyed five history textbooks to determine vocabulary difficulty. After selecting the passages, Keboch checked the words in the sample against the words found in Thorndike's list of most common English words and Thorndike's The Teacher's Word Book. The remaining words were judged as to general and specific usefulness and of doubtful service in the seventh grade. The study showed no marked variability of word-difficulty (33:22-26).

Mabel Vogel and Carleton W. Washburne, in 1928, determined what books were read and liked by children in certain grades in the Winnetka study (3:19-21; 15:443; 18: 3; 29:492; 54:373-81). Books from grades three to nine were analyzed as to differences of style. This formula used number of sentences, number of different words, number of prepositional phrases and number of words not on Thorndike's 10,000 word list, in order to determine why the books were popular with children in different grades. This study was revised in 1938. The study was extended to include textbooks in the first two years of school.

A formula was developed so that when each of the above factors were counted in a book, then given certain weights, the readability or grade-level of the book could be predicted. A difficulty score was assigned each book on the basis of the average reading-grade score on the Stanford Achievement Test of those children who had read and liked each book (18:4). Correct grade placement can be determined by judging structural difficulty (54:380).

In 1928, Dolch measured the vocabulary difficulty of three series of basal readers. The vocabulary was measured by using the combined frequency rating from several word counts (18:3). He then compiled a vocabulary word list. Using this list, it was possible to determine the grade-level of any textbook (23:173).

Alfred S. Lewerenz studied vocabulary in order to determine average reading ability of children. He found that words beginning with the letters b, h and w are easy words. Words beginning with the letters c and i are considered difficult (15:443-44; 29:492-93).

The thirties marked the peak years of readability study. The first study was that of George R. Johnson, occurring in 1930. He determined that the percentage of polysyllabic words in a passage is the method used to measure difficulty of reading material for children (29:493; 32:284).

W. W. Patty and W. I. Painter, in 1931, studied readability using weighted vocabulary sampling. They modified the formula used by Lively and Pressey. Patty and

Painter multiplied the Thorndike index number given the word by the frequency of use of the respective words. In their study of high school texts, the books used in the sophomore year had the greatest vocabulary burden (44:31).

The peak year of the thirties was 1934 with four studies. Ralph Ojemann devised a method for judging the difficulty of parent-teacher educational materials (3:21-22; 29:494). He determined characteristics of readable passages. The characteristics were simple sentence structure, low vocabulary difficulty, and a small number of prepositional phrases.

Edgar Dale and Ralph Tyler predicted the difficulty of materials for adults using three variables (3:22-23; 18:5; 21:384-412; 29:494). They found that the elements of reading material that correlated with ease of comprehension were the number of monosyllabic words and of second person pronouns plus the percentage of easy words. The method for predicting difficulty is to count the number of different technical and non-technical words in the selection and the number of indeterminate clauses (21:401).

Edward Thorndike also conducted a study on vocabulary difficulty in 1934 (3:43; 53:229-30). From his study, Thorndike concluded that three essentials be included in reading material to improve readability. These three essentials were that a detailed statement of vocabulary load must be contained in any graded book, words unknown to the reader occur infrequently (one in every two hundred words) and that sections be rewritten in order to make the book more comprehendable.

Howard McClusky studied the characteristics of reading materials representing different content fields and found that the easier materials contained short simple sentences and an easy, familiar vocabulary (39:282).

The year 1935 produced two studies. One by William Gray and Bernice Leary, who summarized and critically appraised previous readability work, was made earlier in the year (3:23-24; 15:444; 18:6; 29:495). They made a statistical analysis and were able to predict the difficulty of reading materials for adults. Irving Lorge started with the Gray-Leary formula and devised a formula of his own (3-27-28; 15:446; 18:6; 29:495). Lorge made revisions on has formula in 1939, 1944 and 1948. Lorge's formula is a valid method of determining readability (2:34).

Clarence Stone, in 1938, measured vocabulary in order to compare beginning reading books as to simplicity. Vocabulary burden was measured in terms of ratio of new words to the total words, average new words per page, and the percentage of sentences complete in one line. Stone found that the index of difficulty cannot be determined by the average number of words per page (48:447).

In 1939 Elizabeth Morriss and Dorothy Holversen conducted a readability study to estimate the difficulty of passages. This study was in the direction of a semantic analysis approach rather than a structural approach. Words were classified into two categories, content and non-content (3:25; 15:445; 18:6-7; 29:497). This technique was never published or put into a usable form (3:27).

Gerald Yoakum's technique for grading books was based on an index figure derived from identifying all words above the 4,000 level on Thorndike's Teacher's Word Book of 20,000 Words. The grade placement of a book is determined by checking the average page index number against a reading difficulty scale (3:28-29; 15:445; 29:493).

The forties produced three readability formulas. Rudolf Flesch created his formula in 1943. He revised the formula in 1948 and again in 1950 (3:29-33; 15:446; 18:7; 29:495). The Dale-Chall readability formula was devised in 1948 by Edgar Dale and Jeanne Chall (3:33-34; 4:194-213).

In 1948 L. R. Wheeler and V. D. Wheeler produced a method of checking readability. The Wheeler-Wheeler method deals with a tabulation of vocabulary. Each word is given the grade placement rating found in the Thorndike Wordbook of Twenty Thousand Words. After counting the number of words on each grade level, table the results and determine the percentage of words at each grade level. The reading difficulty of the book is then interpreted (57:485).

The SRA Reading-Ease Calculator was developed in 1950. The calculator is a device for measuring the readability level of almost any type of written material (58: 1).

George Spache's readability formula was devised in 1953 (47:410-413). This formula predicted the readability level of primary grade materials. The cloze procedure was also introduced in 1953 (50:415-33). Wilson Taylor found that by using this method, it is possible to determine that instructional materials are understandable to the children in a specific class.

Edward Fry, in 1963, produced a readability formula which could be used on materials from the primary grades through the college level (28:513-16). This formula was revised in 1968.

The formulas chosen for this study were the Dale-Chall, Flesch, Fry, Lorge and SRA formulas and the cloze readability procedure. Using six different types of readability check in the study allowed for error which might be found by using similar formulas.

II. READABILITY STUDIES ON SCIENCE TEXTBOOKS

In the last twenty years, there have been six published studies done on science materials. Chall remarks that the studies on science materials (textbooks) have shown that the vocabulary is difficult. Too many technical words, a lack of defined important words and too many non-technical terms were found in the textbooks (3:168; 6:3).

Mallinson, Sturm and Patton conducted a study on readability of science textbooks in 1950 (40:460-63). Reading difficulty of five series of textbooks for the fourth, fifth and sixth grades was plotted. The Flesch formula was applied to five one-hundred word samples from each book. The average was found for each five samples and this score was the reading difficulty score for each book.

Reading levels of books designed for fourth grade science should be below that of the average fourth-grader (40:462). Only two books on the fourth grade level met this criterion. The average score for the fourth grade textbooks in this study was 1.08. A reading-difficulty score of 1-2 is the grade level of difficulty for a person who has completed the fifth grade (40:463) Therefore, the books were too difficult to be used on the fourth grade level according to Flesch.

After the completion of their study, Mallinson, Sturm and Patton arrived at the following conclusion:

> In general, it may be stated that many of the books in elementary science for Grade IV are far too difficult for the fourth-grader of average reading ability. The fifth-grade textbooks in science are rather difficult for the average fifth-grader

> and the sixth-grade books are slightly difficult for the average sixth-grader. At any rate, none of them could be construed as being easy reading material (40:463).

Passages taken from the earlier portions of the books were more difficult than the passages taken from the later portions in nine of the fifteen books used in the study (40:463). No steady upward gradation of reading material was found.

A study conducted in 1951 on books used for math, science, history, English and literature in the Washington, D. C. area brought forth some interesting information concerning science textbooks. The 1948 Flesch formula was used in the study performed by Edmund Faison. Books of two city school systems were used. These books were from grades five through eight. A total of thirty-eight texts were sampled, one for each school subject from each grade. From each text thirty one-hundred word samples were selected. One school system did not study science in the intermediate grades; geography was taught instead of science. The other system's science textbooks for both fifth and sixth grades were within the eighth-ninth grade level (25:47). The average Reading Ease score on the Flesch formula was 68 in the fifth grade and 63 in the sixth grade. Scores ranging from 60 to 70 encompass reading material estimated at the eighth and ninth grade level (6:43).

Unit-type elementary science textbooks, if used at designated publisher's grade level, would prove to be difficult for children (41:409). This study by Mallinson, Sturm and Mallinson was conducted in 1955 over thirty-four textbooks with and without publisher's indication of grade level. Eighteen textbooks had a publisher's designated numerical grade level, twelve had been designated as intermediate and four had no indication of grade level. Three of the eighteen had a computed score at the grade level the publisher had designated while one was estimated at one grade below. Seven of the intermediate textbooks produced a grade level of fifth grade. Five were on sixth grade level. All four of the books having no publisher's indicated level were estimated at sixth grade level (41:409).

The 1946 Flesch formula was used in this study. A one-hundred word sample passage was selected for each one hundred pages. A minimum of five passages was selected from each text (41:407).

Leroy Ottley applied the revised Lorge formula to twelve intermediate science books published between 1959 and 1962. His findings were similar to those of Mallinson, Sturm and Patton. The four fourth grade texts had a Lorge readability grade level ranging from 4.2 to 5.0 with an average of 4.6 Four fifth grade books were also surveyed. These texts ranged from 4.8 to 5.4, averaging 5.1. The four sixth grade texts ranged from 5.0 to 5.4 with an average of 5.2. Ottley found that sixth grade science books were more suitable for sixth grade children than the texts at grades four and five (43:366).

Another readability study was reported by John F. Newport in 1965. The purpose of the study was to determine the readability level of nine continuous series of science texts using the Spache and Yoakum formulas (42:40). Spache's formulas was used on books from grades one, two and three and Yoakum's formula was used on the books for the intermediate grades. Ten samples were taken from each textbook. Each sample contained two hundred words. Twenty-seven intermediate texts were sampled. Fifteen books were estimated from one to five years above the publisher's grade level. Eight books were on the publisher's grade level and four were one year below (42:41).

The latest study was undertaken in 1969. Cramer and Dorsey performed a study on the readability of thirty-six science textbooks used in the six elementary grades (20:28). The Dale-Chall formula was used on the intermediate texts. Twelve samples were taken from each book. None of the books in the six series for intermediate grade level had readability levels the same as the publisher's designated level (20:31).

Five of the six fourth grade texts had readability estimates three to six grades above the publisher's designated level. The sixth text had an estimate one grade level above the designated level. The readability estimates were four to five grades higher on five of the six series for fifth grade. The sixth text exceeded the publisher's classification by six to seven grades (20:31). All of the sixth grade texts exceeded the designated grade level by three to six grades (20:32). In eight of the thirty-six textbooks, the most difficult passages were found in the first sections of the book. The gradation of the other twenty-eight books was not stated.

III. CONCLUSION

Published readability studies on science textbooks have been extremely limited in the past. The first study on science materials was conducted in 1923. The second study was performed in 1950. A total of seven studies have been conducted over the past forty-seven years, six of which have been executed in the last twenty years. More work must be accomplished in the area of readability of science materials in order to provide the child with the right book.

CHAPTER III

ANALYSIS OF DATA

I. INTRODUCTION

Five readability formulas were used to estimate the readability level of the intermediate series of science textbooks, Concepts in Science. The Dale-Chall, Flesch, Lorge and SRA readability formulas were applied to the same passages within each textbook. A ten percent sampling from each book was used in these samples (Appendix A, pages 44-55). A random sample was selected by choosing every tenth page. If the page did not contain reading material, the sample was selected from the next page that did contain reading material (31:386). The Fry formula was applied to three randomly chosen samples, one from the beginning, middle and ending portions of each book (28:514).

II. RESULTS OF STUDY

The book designated fourth grade by the publisher was rated one to two grades higher by the four formulas, Dale-Chall, Flesch, Fry and Lorge, as shown in Table I. The fifth grade book was rated from two to three grades higher by three of the four formulas. The fourth formula, the Lorge, rated it according to the designated level. The sixth grade text was ranked from one to three grades higher than the designated level. One formula, the Lorge, ranked it one level below the publisher's designated level.

Reading-Ease is estimated by the SRA Calculator by setting the dial so the arrow points to the number of sentences in the one-hundred word sample on the Reading-Ease Calculator. The number of syllables in the sample is found on the vertical scale of the Calculator. The color opposite this number indicates the reading ease of the passage (58: 9-10).

The SRA Reading-Ease Calculator rated the book designated for grade four rather similar to the Dale-Chall and Flesch rankings. From twenty-nine samples, twenty-one fell in the "Very Easy" range. The score of "Very Easy" encompasses those who have completed the fourth-fifth grade (58:13). Eight samples fell within the "Easy" score which encompasses those who have completed the sixth-eighth grade (58:13). Using the figures cited above (Table II), SRA would place the grade four text two grades above, at sixth grade level.

The grade five textbook with thirty-three samples taken from it had nineteen in the "Very Easy" score, twelve in the "Easy" score, and two in the "Hard" score (Table II). The "Hard" Reading-Ease Calculator Score estimates the material to be on a high school graduate's reading level. This textbook's estimated readability level is the sixth grade, only one grade above the publisher's designation. However, twelve samples are in the "Easy" range, implying that the textbook might be more difficult than the estimated sixth grade level.

The Calculator estimated that the forty passages taken from the sixth grade text were also on three levels (Table II). Twenty-three fell in the "Easy" range, ten fell in the "Hard" category and seven were termed "Very Easy". The readability estimate of the sixth grade text was three grades higher than that designated by the publishers.

In addition to the five readability formulas, the cloze readability procedure was also used. Eight passages were chosen at random from each textbook, by drawing page numbers from a hat. The number eight was selected from a list of random numbers from six to twelve (16:433). The passages contained from a minimum of two hundred and fifty words to a maximum of three hundred words.

Leaving the first sentence intact, every fifth word was deleted and replaced with underlined blanks all of a standard length until fifty words had been deleted (16: 429). The children were given the deleted selection, with no time limit, and were told to write in the word they believe was deleted. Responses were correct only when they exactly matched the deleted words. Minor misspellings were disregarded.

TABLE I

RANKINGS OF THREE TEXTBOOKS, IN A SERIES, BY PUBLISHER DESIGNATION AND FOUR READABILITY FORMULAS

Textbooks	Dale-Chall	Flesch	Fry	Lorge
Grade Four	5-6	6	5	5
Grade Five	7-8	7	7	5
Grade Six	7-8	8-9	8	5

TABLE II

RANKING OF READABILITY ESTIMATES AS DERIVED FROM THE SRA READING EASE CALCULATOR, CONCEPTS IN SCIENCE, GRADES FOUR, FIVE, SIX

Textbooks	Range	Grades Completed	Number of Passages
Grade Four	VE	4-5	21
	E	6-8	8
Grade Five	VE	4-5	19
	E	6-8	12
	H	9-12	2
Grade Six	VE	4-5	7
	E	6-8	23
	H	9-12	10

The cloze procedure is helpful in the problem of readability in that it tests the reader's ability to understand the concept or concepts involved (56:571). To some extent, the cloze procedure measures vocabulary. The child in the fourth grade, for example, would not be expected to derive from context words which are from a more difficult vocabulary.

A score between forty-four and fifty-seven percent correct means that the material is at a level of difficulty thought to be suitable for use in supervised instruction. (Forty-four to fifty-seven percent represents a score of twenty-two to twenty-eight items out of a total of fifty). The material on which a student scores above fifty-seven percent (twenty-nine to fifty items correct out of a total of fifty) is suitable for use in his independent study and that below forty-four percent (zero to twenty-one items correct out of a total of fifty) is considered too difficult for the average student in that grade (16:434).

Arrangements were made for seven teachers at University Place Elementary School to administer the cloze procedure to the children in their classes. Three fourth grade, two fifth grade and two sixth grade teachers comprised the group of seven. The teachers were given instruction in the proper method of administering the cloze procedure.

Each grade took a total of eight tests from the text designated by the publisher for that grade. After correction, all eight tests from a textbook were ranked in one graph. In the fourth grade, three hundred fifteen tests were taken. Slightly under seventy-five percent of the fourth grade children found the reading material too difficult (Table III).

The fifth grade textbook was found too difficult by slightly over sixty-six and two-thirds percent. A total of 191 tests were given and 131 children scored under forty-four percent (Table III). The same percentage of children found the sixth grade text rather difficult. The number of children scoring under forty-four percent was 129 out of a total of 194 (Table III). The material in all three textbooks appears to be too difficult for the student's reading ability.

All of the methods of readability, with the exception of the Lorge formula on the texts for grades five and six, estimate that the materials are more difficult than the publisher's designation. The Lorge formula rated all the textbooks on a fifth grade level of readability. The fourth and fifth grade texts were estimated at 5.1 and the sixth grade text at 5.7. However, in Lorge's words, the formula tends "... to underestimate the difficulty of passages to be read primarily for specific details or for

TABLE III

RANKING OF SCORES OF CLOZE READABILITY TEXTS
TAKEN BY FOURTH, FIFTH AND SIXTH GRADE
STUDENTS AT UNIVERSITY PLACE
ELEMENTARY SCHOOL

Textbook	Reading Level	Number of Tests
Grade Four	Independent	20
	Instructional	60
	Frustrational	235
Grade Five	Independent	10
	Instructional	49
	Frustrational	132
Grade Six	Independent	10
	Instructional	55
	Frustration	129

following directions" (9:187; 37:407). This may be the reason for the readability estimates of the Lorge formula rating the material easier than the other formulas.

Vocabulary is a factor in readability. A method of checking vocabulary is used by both the Dale-Chall and the Lorge readability formulas. The words in the passage to be sampled are checked against word lists. The Dale list, which is used in the Dale-Chall formula, contains 3,000 words. This list was comprised by testing fourth graders on their knowledge of a list of approximately 10,000 words. When eighty percent of the fourth graders checked a word as known, that word was placed on the Dale list (4:197). The Lorge formula also uses a Dale list, but this list contains only 769 words. The two lists comprised by Dale present a fairly accurate number of familiar and simple words.

In the Dale-Chall formula, an unfamiliar word is counted each time it appears in the sample. The Lorge formula counts an unfamiliar word only once, the first time that it appears in the sample. This difference in counting might account for the discrepancy of readability estimates of the two formulas.

Vocabulary is an important factor which can account for difficulty in readability. A textbook having a vocabulary that cannot be comprehended by the grade for which it is intended will be too difficult for the students in that grade. Judging from the results of the formulas, the vocabulary seems to be too difficult in this series of textbooks.

Further evidence concerning vocabulary and comprehension of the material is displayed by the Flesch formula in its count of syllables. Instead of relying on word lists to judge difficulty, Flesch has instead used polysyllabic words to indicate the degree of difficulty. The more polysyllabic words in a particular passage, the more difficult the passage reads in vocabulary and the lower the comprehension level. The SRA readability calculator also takes vocabulary and comprehension level into account but to a lesser degree. Instead of the number of polysyllabic words working into the formula, as with the Flesch formula, the SRA Calculator takes the number of syllables in a one-hundred word passage in conjunction with the number of sentences to determine difficulty. The more polysyllabic words, the more difficult vocabulary a passage has.

As shown quite clearly by the findings of the cloze readability procedure, the material was not readable or comprehensible to the majority of those tested (Table III). With seventy-five percent of the tests from the fourth grade and sixty-six percent of the tests from the fifth and sixth grades falling below the instructional reading level into the frustration level, it is safe to assume that the text is not readable for the intermediate students at University Place Elementary School.

The third problem concerning readability is gradation. No upward readability gradation was found in any samples checked (Appendix A, pages 44-55). The readability gradation of a fifth grade textbook should begin at a grade level of 4.5 in the beginning chapters and increase steadily to approximately 5.5 in the last chapters (34: 414). The textbook designated fourth grade had no correlation as to gradation, as did those designated fifth or sixth grade.

III. CONCLUSIONS

The results of the formulas and the cloze readability procedure prove that the publisher's designated reading level is not accurate, at least not accurate for the students at University Place Elementary School. The formula scores tended, consistently, to estimate the readability level of the textbooks higher than the publisher's had indicated with the exception of the Lorge formula. The scores of the cloze procedure validate the readability formulas' estimates in the study.

CHAPTER IV

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Several conclusions and recommendations can be made from the findings reported in the previous chapter. The readability checks proved very enlightening concerning the science textbooks studied.

I. SUMMARY

All the readability checks with the exception of one rated the texts higher than the publisher. The Lorge Readability formula estimated all three texts to be on the fifth grade level.

The Fry and Lorge formulas ranked the grade four book on the fifth grade level. The Flesch Reading-Ease formula rated the text on the sixth grade level. The Dale-Chall formula estimated the textbook on the fifth-sixth grade level. The SRA Calculator ranked the majority of samples on the sixth grade level. Of the cloze readability procedures taken by the fourth grade students, seventy-five percent of the scores were grouped below forty-four percent correct, that is, in the frustration level.

All formulas and the cloze procedure estimated that the passages sampled were on a readability level above the fourth grade.

The text designated fifth grade was rated by the Lorge formula on a fifth grade level. The Flesch and Fry formulas estimated the book to be on the seventh grade reading level. Of the thirty-three samples, nineteen were rated on the sixth grade level using the SRA Reading-Ease Calculator. Twelve other samples were rated on the ninth grade level. Slightly more than two-thirds of the cloze readability procedures taken by the fifth grade students scored in the frustration level.

The text designated sixth grade was estimated by the Lorge formula to be on the fifth grade level. Seventh-eighth grade level was where the Dale-Chall formula placed the same book. Fry's readability formula ranked the textbook on the eighth grade level and the Flesch formula estimated it to be on the eighth-ninth grade level. The majority of the samples taken from the sixth grade text were ranked on the ninth grade level by the SRA Calculator. Slightly less than two-thirds of the cloze readability procedures were grouped in the frustration level.

All three of the Concepts in Science series for the intermediate grades were rated too low by the publisher. The estimations by the formulas were substantiated by the scores of the students who took the cloze readability procedure.

II. CONCLUSIONS

1. All readability formulas with the exception of one consistently rated the texts higher than the publisher indicated as the reading level.

2. The intermediate grade textbooks, Concepts in Science, were rated on a lower level by the publisher than the readability formulas estimated.

3. The readability formula estimates indicated that no general slope of reading difficulty was present.

4. The cloze readability procedures indicated the material was too difficult for the students at University Place Elementary School since out of the 700 tests given, 496 were grouped on the frustration level.

5. The intermediate grade students at University Place Elementary School found the cloze passages too difficult to read.

III. RECOMMENDATIONS

1. The texts should be re-evaluated by the publisher as to readability level. Either a different vocabulary could be substituted or the publisher's designated level could be raised.

2. Children should not be asked to read the texts independently in a classroom situation unless another means

of presenting the material can be adopted. Supplementary material is recommended to be used to help children overcome reading difficulties.

3. Readability formulas should be used more frequently by publishers and teachers in order to provide students with textbooks on their reading level.

4. Further readability studies should be done on the suitability of textbooks to the grade for which they are being used.

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APPENDIX A

RESULTS OF READABILITY RESEARCH ON SAMPLES FROM THE TEXTS

DALE-CHALL READABILITY FORMULA SAMPLING

GRADE FOUR

Page 3	(Think-way)	5.0611
Page 13	(Tie-wave)	5.2865
Page 23	(Let-batter)	5.0460
Page 33	(You-way)	5.7453
Page 43	(Look-made)	5.3957
Page 55	(Look-like)	4.2658
Page 66	(Go-them)	5.7335
Page 76	(What-vapor)	6.6282
Page 86	(Then-apple)	5.5030
Page 99	(What-about)	4.8409
Page 109	(An-iron)	8.0732
Page 119	(Think-water)	6.6436
Page 131	(How-substance)	5.9929
Page 141	(In-soil)	4.9956
Page 152	(Suppose-is)	4.1871
Page 162	(These-food)	5.8247
Page 176	(The-sac)	5.4275
Page 186	(The-sea)	5.1101
Page 196	(Salmon-environment)	5.4609
Page 206	(In-spring)	6.9747
Page 216	(At-this)	6.2289
Page 226	(When-crack)	5.8531
Page 236	(Why-sediment)	5.1218
Page 246	(Scientists-happens)	5.6668
Page 256	(Everyone-cycle)	4.9767
Page 266	(The-stopped)	4.6688
Page 276	(Gravitation-child)	5.8079
Page 286	(Fill-hours)	4.4392
Page 296	(The-jar)	6.9169
	Total:	161.8764
	Divided by 29 samples	
	Average raw score	5.5819

LORGE READABILITY FORMULA SAMPLING

GRADE FOUR

Page 3	(Think-way)	6.4370
Page 13	(Tie-wave)	5.6219
Page 23	(Let-batter)	5.6831
Page 33	(You-way)	5.2944
Page 43	(Look-made)	5.1087
Page 55	(Look-like)	4.3352
Page 66	(Go-them)	5.5927
Page 76	(What-vapor)	5.6270
Page 86	(Then-apple)	4.5795
Page 99	(What-about)	4.1282
Page 109	(An-iron)	4.9857
Page 119	(Think-water)	5.4852
Page 131	(How-substance)	4.9457
Page 141	(In-soil)	4.2372
Page 152	(Suppose-is)	4.8582
Page 162	(These-food)	4.7955
Page 176	(The-sac)	5.7816
Page 186	(The-sea)	4.8991
Page 196	(Salmon-environment)	4.9326
Page 206	(In-spring)	5.3776
Page 216	(At-this)	5.2762
Page 226	(When-crack)	5.2944
Page 236	(Why-sediment)	4.3305
Page 246	(Scientists-happens)	5.0167
Page 256	(Everyone-cycle)	4.9313
Page 266	(The-stopped)	4.8485
Page 276	(Gravitation-child)	4.7687
Page 286	(Fill-hours)	5.0625
Page 296	(The-jar)	5.5663
	Total:	147.7912
	Divided by 29 samples	
	Average raw score	5.0962

FLESCH READABILITY FORMULA SAMPLING

GRADE FOUR

Page 3	(Think-matter)	100.9840
Page 13	(Tie-as)	98.0755
Page 23	(Let-batter)	95.1655
Page 33	(You-the)	76.6540
Page 43	(Look-made)	88.3970
Page 55	(Look-idea)	82.7810
Page 66	(Go-catch)	77.0945
Page 76	(What-in)	63.3710
Page 86	(Then-plant)	85.5550
Page 99	(What-is)	95.2810
Page 109	(An-put)	64.6430
Page 119	(Think-with)	70.1915
Page 131	(How-made)	82.7620
Page 141	(In-soil)	85.9720
Page 152	(Suppose-is)	94.0485
Page 162	(These-no)	76.4520
Page 176	(The-on)	82.5100
Page 186	(The-of)	91.5445
Page 196	(Salmon-its)	93.4390
Page 206	(In-spring)	79.0910
Page 216	(At-does)	83.7950
Page 226	(When-a)	83.9305
Page 236	(Why-a)	82.2385
Page 246	(Scientists-what)	91.6800
Page 256	(Everyone-cycle)	82.0015
Page 266	(The-the)	91.5445
Page 276	(Gravitation-as)	82.0695
Page 286	(Fill-them)	94.6580
Page 296	(The-from)	68.3625
	Total:	2,444.2920
	Divided by 29 samples	
	Average raw score	84.2859

SRA READING EASE CALCULATOR SAMPLING

GRADE FOUR

Page 3	(Think-matter)	VE 4-5
Page 13	(Tie-as)	VE 4-5
Page 23	(Let-batter)	VE 4-5
Page 33	(You-the)	E 6-8
Page 43	(Look-made)	VE 4-5
Page 55	(Look-idea)	VE 4-5
Page 66	(Go-catch)	E 6-8
Page 76	(What-in)	E 6-8
Page 86	(Then-plant)	VE 4-5
Page 99	(What-is)	VE 4-5
Page 109	(An-put)	E 6-8
Page 119	(Think-with)	E 6-8
Page 131	(How-made)	VE 4-5
Page 141	(In-soil)	VE 4-5
Page 152	(Suppose-is)	VE 4-5
Page 162	(These-no)	VE 4-5
Page 176	(The-on)	VE 4-5
Page 186	(The-of)	VE 4-5
Page 196	(Salmon-its)	VE 4-5
Page 206	(In-spring)	E 6-8
Page 216	(At-does)	VE 4-5
Page 226	(When-a)	VE 4-5
Page 236	(Why-a)	VE 4-5
Page 246	(Scientists-what)	VE 4-5
Page 256	(Everyone-cycle)	E 6-8
Page 266	(The-the)	VE 4-5
Page 276	(Gravitation-as)	VE 4-5
Page 286	(Fill-them)	VE 4-5
Page 296	(The-from)	E 6-8

Total: 29 samples
21 VE 4-5
8 E 6-8

DALE-CHALL READABILITY FORMULA SAMPLING

GRADE FIVE

Page 3	(One-scientists)	5.3923
Page 13	(Sometimes-on)	6.7914
Page 23	(Toothpaste-open)	7.4881
Page 33	(There-waves)	7.8922
Page 44	(Billions-cooled)	5.7115
Page 54	(What-atoms)	8.5813
Page 65	(We-paper)	6.8722
Page 77	(You-tests)	7.1497
Page 92	(Toss-down)	4.2436
Page 102	(With-carton)	6.1298
Page 112	(While-began)	6.8226
Page 122	(What-revolution)	5.5913
Page 132	(Suppose-force)	7.5087
Page 142	(However-sun)	6.6814
Page 152	(Of-cells)	6.2402
Page 162	(Place-stiffness)	5.9948
Page 172	(Spallanzani-microscope)	4.9789
Page 182	(Inside-protoplasm)	7.4416
Page 192	(By-breathe)	5.8153
Page 202	(Here-brain)	6.8109
Page 212	(Put-works)	5.4914
Page 227	(Have-it)	5.0784
Page 237	(There-elements)	6.3725
Page 247	(You-formed)	6.3963
Page 257	(Green-silkworm)	5.1932
Page 267	(Green-things)	6.4662
Page 277	(With-light)	5.5475
Page 288	(To-of)	5.1357
Page 298	(We-person)	5.9844
Page 308	(Look-lived)	6.9479
Page 318	(Somehow-trilobites)	7.0965
Page 328	(No-like)	5.4223
Page 338	(From-cover)	6.3670
	Total:	207.8351
	Divided by 33 samples	
	Average raw score	6.2980

LORGE READABILITY FORMULA SAMPLING

GRADE FIVE

Page 3	(One-scientist)	5.0828
Page 13	(Sometimes-on)	5.3803
Page 23	(Toothpaste-open)	5.7410
Page 33	(There-waves)	5.3589
Page 44	(Billions-cooled)	5.5854
Page 54	(What-atoms)	4.6830
Page 65	(We-paper)	5.5305
Page 77	(You-tests)	5.2835
Page 92	(Toss-down)	4.0105
Page 102	(With-carton)	5.5489
Page 112	(While-began)	5.2688
Page 122	(What-revolution)	5.2695
Page 132	(Suppose-force)	5.8502
Page 142	(However-sun)	5.1378
Page 152	(Of-cells)	4.2703
Page 162	(Place-stiffness)	5.6230
Page 172	(Spallanzani-microscope)	4.6063
Page 182	(Inside-protoplasm)	5.6426
Page 192	(By-breathe)	4.5393
Page 202	(Here-brain)	4.3966
Page 212	(Put-works)	5.2517
Page 227	(Have-it)	4.9626
Page 237	(There-elements)	5.4743
Page 247	(You-formed)	5.2660
Page 257	(Green-silkworm)	5.1320
Page 267	(Green-things)	4.9605
Page 277	(With-light)	4.9929
Page 288	(To-of)	5.3378
Page 298	(We-person)	5.2013
Page 308	(Look-lived)	5.5778
Page 318	(Some-trilobites)	5.0077
Page 328	(No-like)	4.0465
Page 338	(From-cover)	4.9115
	Total:	168.8820
	Divided by 33 samples	
	Average raw score	5.1176

FLESCH READABILITY FORMULA SAMPLING

GRADE FIVE

Page 3	(One-would)	66.4020
Page 13	(Sometimes-is)	74.5910
Page 23	(Toothpaste-the)	84.2685
Page 33	(There-so)	68.1240
Page 44	(Billions-the)	87.6525
Page 54	(What-made)	66.9085
Page 65	(We-paper)	81.4595
Page 77	(You-many)	77.8060
Page 92	(Toss-come)	104.4370
Page 102	(With-ice)	93.0415
Page 112	(While-with)	78.3810
Page 122	(What-days)	61.5795
Page 132	(Suppose-by)	75.4370
Page 142	(However-in)	92.9660
Page 152	(Of-the)	80.9520
Page 162	(Place-it)	87.8220
Page 172	(Spallanzani-carefully)	70.3600
Page 182	(Inside-of)	68.9730
Page 192	(By-this)	84.9455
Page 202	(Here-heart)	86.0620
Page 212	(Put-how)	87.9235
Page 227	(Have-not)	82.0695
Page 237	(There-have)	83.6595
Page 247	(You-a)	74.1835
Page 257	(Green-silkworm)	90.1565
Page 267	(Green-to)	84.7085
Page 277	(With-there)	70.2405
Page 288	(To-out)	93.8125
Page 298	(We-identify)	87.6190
Page 308	(Look-the)	55.9450
Page 318	(Look-the)	59.7670
Page 328	(No-in)	82.0010
Page 338	(From-life)	80.4590
	Total:	2.624.7135
	Divided by 33 samples	
	Average raw score	79.5368

SRA READING EASE CALCULATOR SAMPLING

GRADE FIVE

Page 3	(One-would)	E 6-8
Page 13	(Sometimes-is)	E 6-8
Page 23	(Toothpaste-the)	VE 4-5
Page 33	(There-so)	E 6-8
Page 44	(Billions-the)	VE 4-5
Page 54	(What-made)	E 6-8
Page 65	(We-paper)	VE 4-5
Page 77	(You-many)	E 6-8
Page 92	(Toss-come)	VE 4-5
Page 102	(With-ice)	VE 4-5
Page 112	(While-with)	E 6-8
Page 122	(What-days)	E 6-8
Page 132	(Suppose-by)	E 6-8
Page 142	(However-in)	VE 4-5
Page 152	(Of-the)	VE 4-5
Page 162	(Place-it)	VE 4-5
Page 172	(Spallanzani-carefully)	E 6-8
Page 182	(Inside-of)	E 6-8
Page 192	(By-this)	VE 4-5
Page 202	(Here-Both)	VE 4-5
Page 212	(Put-how)	VE 4-5
Page 227	(Have-not)	VE 4-5
Page 237	(There-have)	VE 4-5
Page 247	(You-A)	E 6-8
Page 257	(Green-silkworm)	VE 4-5
Page 267	(Green-to)	VE 4-5
Page 277	(With-there)	VE 4-5
Page 288	(To-out)	VE 4-5
Page 298	(We-identify)	VE 4-5
Page 308	(Look-the)	H 9-12
Page 318	(Somehow-are)	H 9-12
Page 328	(No-in)	VE 4-5
Page 338	(From-life)	E 6-8

Total: 33 samples
19 VE 4-5
12 E 6-8
2 H 9-12

DALE-CHALL READABILITY FORMULA SAMPLING

GRADE SIX

Page 3	(You-achievements)	5.8344
Page 13	(First-eyes)	4.5261
Page 23	(People-act)	5.1326
Page 33	(Ask-better)	4.7349
Page 47	(To-aluminum)	6.6387
Page 57	(In-heat)	8.1768
Page 67	(You-Celsius)	8.0709
Page 77	(Look-furnace)	6.1400
Page 87	(Still-liquid)	7.8565
Page 99	(In-begins)	7.9536
Page 110	(How-germproof)	5.4511
Page 120	(This-bacteria)	7.6721
Page 131	(You-drink)	6.5709
Page 141	(Scientists-can)	7.4027
Page 151	(This-out)	6.5601
Page 161	(Today-one)	5.9919
Page 172	(Do-hill)	6.1850
Page 182	(One-road)	6.8694
Page 195	(On-action)	7.0083
Page 205	(According-increases)	6.1363
Page 215	(The-works)	5.0426
Page 225	(The-work)	7.3806
Page 235	(Recall-it)	6.9827
Page 245	(An-bolt)	6.7840
Page 257	(At-second)	6.0419
Page 268	(High-code)	6.6866
Page 279	(From-generator)	6.8421
Page 290	(Complete-charges)	7.8327
Page 300	(The-dangerous)	6.6430
Page 310	(At-neutrons)	7.4707
Page 320	(A-miles)	7.8932
Page 330	(Certain-flower)	6.5564
Page 340	(What-w)	6.0438
Page 350	(Scientists-page)	6.4045
Page 360	(The-chromosomes)	7.1469
Page 370	(The-energy)	7.3535
Page 380	(How-Palomar)	5.4570
Page 390	(Imagine-Nebula)	8.3173
Page 403	(People-sun)	5.8789
Page 413	(It-done)	6.4655
	Total:	266.1362
	Divided by 40 samples	
	Average raw score	6.6534

LORGE READABILITY FORMULA SAMPLING

GRADE SIX

Page 3	(You-achievements)	5.0413
Page 13	(First-eyes)	4.9292
Page 23	(People-act)	5.4440
Page 33	(Ask-better)	5.4277
Page 47	(To-aluminum)	6.9060
Page 57	(In-heat)	7.3119
Page 67	(You-Celsius)	6.3789
Page 77	(Look-furnace)	5.4518
Page 87	(Still-liquid)	6.6360
Page 99	(In-beings)	5.5489
Page 110	(How-germproof)	6.2432
Page 120	(This-bacteria)	6.2187
Page 131	(You-drink)	5.4203
Page 141	(Scientists-can)	5.1787
Page 151	(This-out)	5.7203
Page 161	(Today-one)	5.2711
Page 172	(Do-hill)	6.2397
Page 182	(One-road)	4.9529
Page 195	(On-action)	6.5365
Page 205	(According-increases)	6.5202
Page 215	(The-works)	5.4974
Page 225	(The-work)	6.3386
Page 235	(Recall-it)	5.9132
Page 245	(An-bolt)	5.3158
Page 257	(At-second)	5.7215
Page 268	(High-code)	6.2812
Page 279	(From-generator)	5.4439
Page 290	(Complete-charges)	6.3210
Page 300	(The-dangerous)	6.1795
Page 310	(At-neutrons)	6.8032
Page 320	(A-miles)	5.3578
Page 330	(Certain-flower)	5.8530
Page 340	(What-w)	4.2605
Page 350	(Scientists-page)	5.0492
Page 360	(The-chromosomes)	5.6681
Page 370	(The-energy)	6.3706
Page 380	(How-Palomar)	4.0867
Page 390	(Imagine-Nebula)	6.3520
Page 403	(People-sun)	5.1245
Page 413	(It-done)	4.7322
	Total:	229.9681
	Divided by 40 samples	
	Average raw score	5.7267

FLESCH READABILITY FORMULA SAMPLING

GRADE SIX

Page 3	(You-the)	65.6160
Page 13	(First-on)	99.7670
Page 23	(People-act)	75.7080
Page 33	(Ask-for)	83.9640
Page 47	(To-no)	50.2100
Page 57	(In-the)	55.9460
Page 67	(You-Fahrenheit)	59.3290
Page 77	(Look-the)	73.3725
Page 87	(Still-then)	55.5825
Page 99	(In-bad)	57.1110
Page 110	(How-germproof)	73.8805
Page 120	(This-their)	35.8780
Page 131	(You-does)	65.0110
Page 141	(Scientists-and)	61.9345
Page 151	(This-go)	58.8215
Page 161	(Today-and)	81.8000
Page 172	(Do-of)	84.0330
Page 182	(One-wheels)	80.4445
Page 195	(On-see)	73.1370
Page 205	(According-or)	73.7455
Page 215	(The-men's)	68.6350
Page 225	(The-can)	69.8825
Page 235	(Recall-conduct)	66.4350
Page 245	(An-you)	70.9025
Page 257	(At-about)	71.5130
Page 268	(High-a)	61.0640
Page 279	(From-falling)	71.0375
Page 290	(Complete-numbers)	62.3835
Page 300	(The-amount)	67.0785
Page 310	(At-neutrons)	48.6370
Page 320	(A-you)	73.0000
Page 330	(Certain-flower)	83.4755
Page 340	(What-w)	71.4445
Page 350	(Scientists-in)	63.7610
Page 360	(The-height)	64.2460
Page 370	(The-forms)	58.3480
Page 380	(How-before)	85.7885
Page 390	(Imagine-photographs)	46.1650
Page 403	(People-around)	81.3250
Page 413	(It-of)	63.7975
	Total:	2,713.2110
	Divided by 40 samples	
	Average raw score	67.8303

SRA READING EASE CALCULATOR SAMPLING

GRADE SIX

Page 3	(You-the)	E 6-8
Page 13	(First-on)	VE 4-5
Page 23	(People-act)	E 6-8
Page 33	(Ask-four)	E 6-8
Page 47	(To-no)	H 9-12
Page 57	(In-the)	H 9-12
Page 67	(You-Fahrenheit)	H 9-12
Page 77	(Look-the)	E 6-8
Page 87	(Still-then)	H 9-12
Page 99	(In-bad)	H 9-12
Page 110	(How-germproof)	E 6-8
Page 120	(This-their)	H 9-12
Page 131	(You-does)	E 6-8
Page 141	(Scientists-and)	E 6-8
Page 151	(This-go)	H 9-12
Page 161	(Today-and)	VE 4-5
Page 172	(Do-of)	VE 4-5
Page 182	(One-wheels)	VE 4-5
Page 195	(On-see)	E 6-8
Page 205	(According-or)	E 6-8
Page 215	(The-men's)	E 6-8
Page 225	(The-can)	E 6-8
Page 235	(Recall-conduct)	E 6-8
Page 245	(An-you)	E 6-8
Page 257	(At-about)	E 6-8
Page 268	(High-a)	E 6-8
Page 279	(From-falling)	E 6-8
Page 290	(Complete-numbers)	E 6-8
Page 300	(The-amount)	E 6-8
Page 310	(At-neutrons)	H 9-12
Page 320	(A-you)	E 6-8
Page 330	(Certain-flower)	VE 4-5
Page 340	(What-w)	E 6-8
Page 350	(Scientists-in)	VE 4-5
Page 360	(The-height)	E 6-8
Page 370	(The-forms)	H 9-12
Page 380	(How-before)	VE 4-5
Page 390	(Imagine-photograph)	H 9-12
Page 403	(People-around)	E 6-8
Page 413	(It-of)	E 6-8

Total: 40 samples
7 VE 4-5
23 E 6-8
10 H 9-12

FRY READABILITY FORMULA

Concepts in Science, Grade Four

	Sentences Per 100 Words	Syllables Per 100 Words
Page 62, 100 word sample	12.7	142
Page 140-141, 100 word sample	12.5	141
Page 208, 100 word sample	9.0	148
	34.2	431
Sample average	11.4	143.7

Concepts in Science, Grade Five

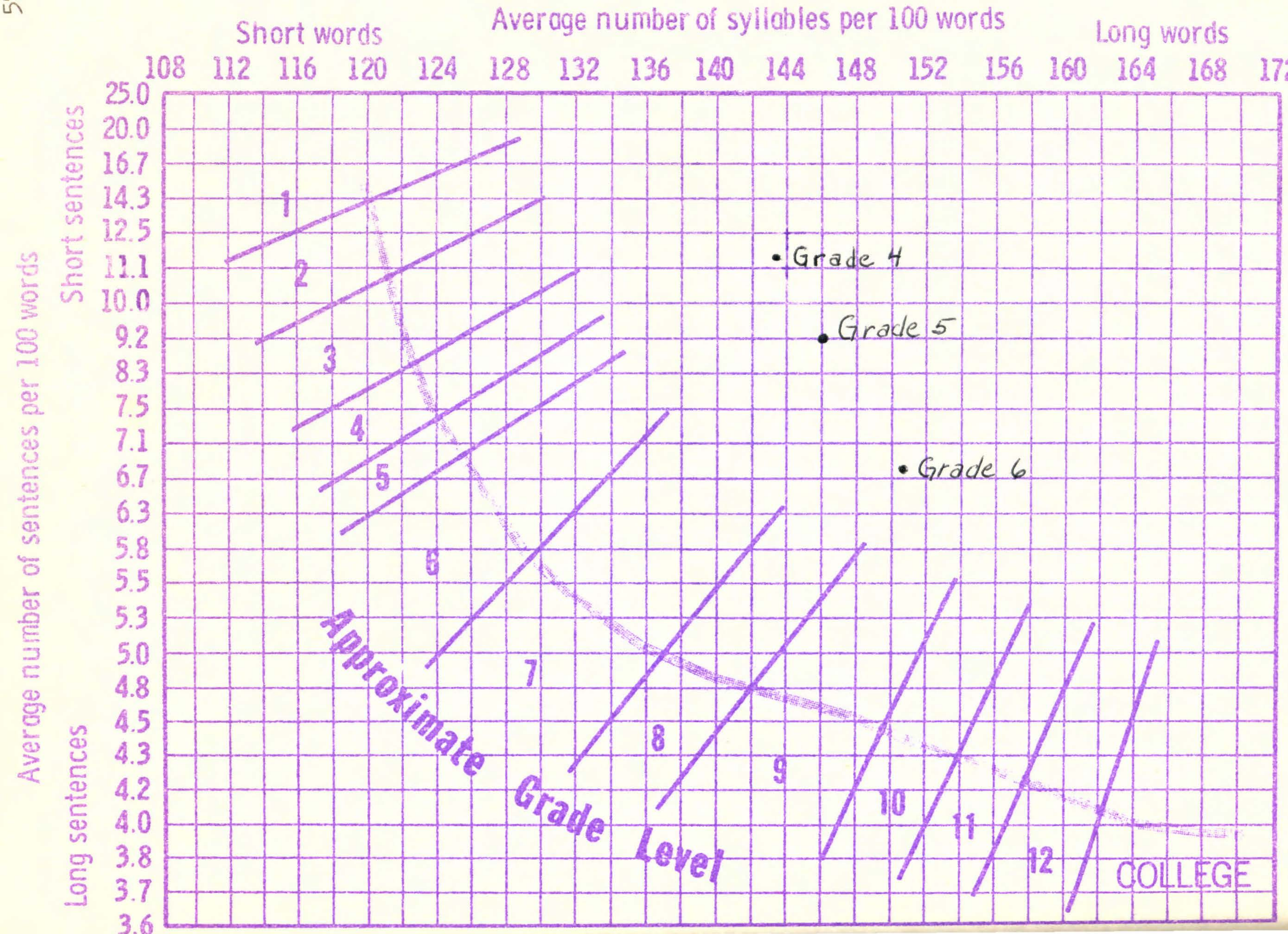
	Sentences Per 100 Words	Syllables Per 100 Words
Page 28, 100 word sample	9.1	155
Page 139, 100 word sample	8.2	145
Page 266-267, 100 word sample	10.3	139
	27.6	439
Sample average	9.2	146

Concepts in Science, Grade Six

	Sentences Per 100 Words	Syllables Per 100 Words
Page 53, 100 word sample	7.1	145
Page 275, 100 word sample	6.4	152
Page 294, 100 word sample	6.8	155
	20.3	452
Sample Average	6.8	150.7

GRAPH FOR ESTIMATING READABILITY

By Edward Fry,
Rutgers University Reading Center



APPENDIX B

CLOZE READABILITY TESTS WHICH WERE GIVEN TO THE STUDENTS OF UNIVERSITY PLACE ELEMENTARY SCHOOL

4.1 A fish is fitted to live in its environment of water in many ways. The fish can move __________ in order to hunt __________ to hide. It can __________. It can get food __________ eat it. When a __________ thing is fitted to __________ environment, we say it __________ adapted to the environment. __________ oak tree is adapted __________ its environment. The goldfish __________ adapted to its environment. __________ salmon is adapted to __________ environment. There is a __________ between the environment of __________ goldfish and a salmon. __________ goldfish would die in __________. The special environment, the __________, of a goldfish is __________ pond, not the sea. __________ grown salmon would die __________ a pond. Its special __________, or habitat, is the __________. Even if the environment __________ all fish is water, __________ fish has a special __________.

4.2 In that habitat it __________ its special food. An __________ cannot live on grass. __________ cow cannot live on __________. Each kind of living __________ has its own habitat, __________ its own food. Each __________ thing is adapted to __________ habitat. How is a __________ fitted to its habitat? __________ can investigate this problem __________ the help of a __________, as shown on the __________ page. Look at the __________ adaptations for moving about. __________ at the salmon's muscles.

__________ how they make a __________ of zigzag pattern. Almost __________ whole body of a __________ is made of muscle. (__________ you eat salmon, you __________ muscle, mainly.) It is __________ powerful muscles that make __________ salmon fit for fast __________, turning quickly, and leaping __________ out of the water.

4.3 The egg of the mallard duck is much like a hen's egg. Its shell is not __________, but porous. There is __________ membrane just under the __________, a thin, white skin. __________ is an egg white, __________ a yellow yolk inside __________. The young duck uses __________ and yolk for food __________ it is growing in __________ shell. And there is __________ speck on the yolk __________ is the beginning of __________ embryo. Inside the egg __________ young, growing duck looks __________ this. Inside the egg __________ is still an embryo. __________ the beginnings of wings, __________, and eyes. Just hatched, __________ duckling can soon walk __________ feed itself. Is it __________ different from the adult __________? In a year it __________ begin to get the __________ and the feathers of __________ adult duck.

4.4 The young __________ some birds, such as __________ and eagles, must be __________ by the parents at __________. The young of dogs __________ cats and horses must __________ fed. So must the __________ of human beings. But __________ ducklings! Notice the difference __________ a salmon and a __________. When a salmon egg __________, the young salmon carries __________ yolk sac for almost __________ weeks. Its food is __________ the sac. But when __________ young duck hatches, it __________ used up all the __________ stored in its egg. __________ young duck is ready __________ look for its own __________. To grow from a __________ duckling to a handsome __________, the mallard must eat, __________ course. Like other ducks, __________ like to eat grain, __________ as wild rice. However, __________ will eat small frogs, toads, lizards, small fish, snails, earthworms, and even mice.

4.5 A drop of water makes many different journeys. It flows down a river __________ a lake. There it __________ the ground and rises __________ the air, as water __________. Up rise its molecules. __________ make a cloud. Presently __________ water droplets in the __________ form drops. Down comes __________ raindrop. It falls on __________ ground, sinks into the __________, and meets the roots __________ a tree. It is __________ into the tree, carried __________ the trunk, into a __________, and then into a __________. It is given off __________ the air by the __________, as water vapor. Again, __________ water vapor rises in __________ air. Again it forms __________ droplets. This time the __________ freeze and fall as __________. The snowflakes land on __________ cold mountaintop and slide __________ into a river of __________, a glacier.

4.6 An iceberg __________ off the glacier, floats __________ to sea, and melts. __________ drop rises again to __________ another could. This story __________ no end, has it? __________ of water just go __________ traveling, on more different __________ than we can imagine. __________ no matter how different __________ journeys that water molecules __________, we know how they __________ them. Water evaporates. It __________ to water vapor. The __________ vapor condenses and turns __________ water. Then the water __________. It turns to water __________. Again the water vapor __________ and turns to water. __________ has no end either. __________ us make a diagram __________ has no end, like __________. No matter where you __________, one happening leads to __________ next and the next __________ the next.

4.7 What is happening in the glass chamber in the investigation? Something is happening, certainly. __________ the beginning of the __________, the upper glass is __________. Little by little, a __________ of moisture collects on __________ clear glass. Water is __________ on the glass. Water __________ traveling from the bottom __________ the chamber to the __________ of the chamber, somehow. __________ does water get from __________ bottom to the top __________ the glass chamber? At __________ bottom of the chamber, __________ water is evaporating. Water __________ are flying off the __________. They are becoming water __________, Very soon the air __________ the chamber is full __________ water vapor. At the __________ of the chamber, though, __________ vapor is condensing. The __________ vapor is turning into __________ droplets of water on __________ sides of the glass __________ is making the glass __________.

4.8 The air at the __________ of the glass is __________ than the air at __________ bottom. So the water __________ at the top condenses. __________ forms tiny droplets. Isn't __________ how a cloud is __________? In a cloud, the __________ becomes cooler as it __________. In the glass chamber, __________ air cools as it __________ the top because it __________ heat to the cooler __________ of the glass. In __________ the cloud and the __________ chamber, the same things __________. Air with water vapor __________ it rises and cools. __________ water vapor condenses into __________. In the could, the __________ float in the air. __________ the glass chamber, the __________ gather on the glass __________ form larger drops. Something __________ happens in the glass chamber.

4.9 In the spring, salmon start swimming to the sea. __________ early spring, mallards start __________ to the northwest. How __________ a fish or a __________ know when to migrate? __________ have investigated this question. __________ example, scientists did some __________ with the birds pictured __________, called juncos. Juncos migrate. __________ begin to fly north __________ the spring. Scientists wondered __________ they could make some __________ migrate earlier than usual. __________ they could, they might __________ a clue to what __________ juncos migrate at a __________ time. You know that __________ days get longer as __________ go from winter to __________. Some scientists suspected that __________ length of the days __________ have something to do __________ when juncos migrated. So __________ juncos were kept in __________.

4.10 Lights in the barns __________ turned on and off __________ control the length of __________ in the barns. When __________ days became about 8 __________ long, the juncos began __________ get ready to migrate. __________ the days became about __________ hours long, the juncos __________ to migrate. It was __________ number of hours of __________ that set off the __________ migration. The amount of __________ seemed to be the __________ for migration. A stimulus __________ anything that produces a

__________, or answer. A bright __________ is a stimulus which __________ moths. The flight of __________ moths toward the light __________ their response. When you __________ to hearing your name __________, you are responding to __________ stimulus. You may respond __________ doing something when your __________ is called. When the __________ of the day reaches a certain number of hours, it is a stimulus for juncos.

4.11 To make sound, there must be movement. What kind of motion __________ it be? Could you __________ how the ruler moved __________ it made a sound? __________ moved up and down. __________ swung one way and __________ the other way, to __________ fro. Could you observe __________ the rubber band moved __________ it made a sound? __________ swung back and forth, __________ and fro. If you __________, you can see this __________ in slow motion. Make __________ chain of rubber bands __________ 2 feet long. Fasten __________ end to a doorknob __________ table leg. Stretch the __________ just a little and __________ it. It will move __________ and fro, slowly enough __________ you to see. It __________ this to-and-fro __________ that makes sound. Scientists __________ a name for this __________ of movement.

4.12 It is __________ vibration. The rubber band __________ as it moves to __________ fro and makes a __________. The ruler vibrates as __________ makes a sound. A __________ string and a guitar __________ vibrate as they make __________. The trumpet player's lips __________. The bass drum vibrates. __________ your throat something must __________ in order for you __________ speak or sing. Whenever __________ hear a sound, something __________ vibrating. Something is moving __________ and forth. Does this __________ that whenever something is __________, you hear a sound? __________ it and see. Vibrate __________ hand, like a fan. __________ the chain of rubber __________ in slow motion. No __________ is heard. Things can __________ without making a sound. __________ you hear a sound, __________, something is vibrating.

4.13 The Earth is changing, changing all the time. Often __________ do not notice it, __________ many of the changes __________ so slowly. Yet they __________ happening. Rocks are breaking __________. Water seeps into cracks __________ the top of mountains. __________ weather gets cold and __________ water changes to ice. __________ it does so, it __________ against the sides of __________ cracks. The rock splits __________ breaks up. In summer, __________ of plants work into __________ tiny cracks in the __________ and widen them still __________. Then, in winter, ice __________ again to widen the __________. Melting snows and spring __________ move rocks and soil (__________ bits of dead plants __________ animals) down the mountain __________ the valley. These bits __________ rock and parts of __________ and animals make more __________.

4.14 More plants can grow __________ this soil. As they __________, they add substances to __________ soil. So more soil __________ always being made. As __________ and animals grow and __________, the soil is being __________, too. The dead animals __________ plants are putting useful __________ back into the soil. __________ are making the soil __________ for more plants to __________ in, providing food for __________. Running water is picking __________ soil in one place __________ dropping it in another __________. Plains and valleys are __________ built up with soil

__________ which plants can grow. __________ are useful in saving __________. too. If water runs __________ fast, the good soil __________ carried away and only __________ soil is left. Plants __________ not grow well in __________ soil.

4.15 People used to be afraid of comets. __________ comet, you see. was __________ that did not seem __________ belong in the sky. __________ stars seemed to be __________ in their places, fixed __________ unmoving. The planets and __________ Moon all moved, to __________ sure. Yet they moved __________ regular ways and in __________ same orbits all the __________. You could count on __________ regular behavior. Then suddenly __________ comet might appear. A __________ looked like nothing else __________ the sky. Sometimes it __________ strangely bright. It moved __________ the sky and in __________ few weeks disappeared. Where __________ a comet come from? __________ did it go? No __________ knew. It frightened people. __________ felt that a comet __________ a sign that something __________ was going to happen: __________, disease, floods, or who __________ what?

4.16 Comets used to __________ feared. A man named __________ changed that. Edmund Halley __________ an English scientist who __________ over 200 years ago. __________ was interested in many __________, but he was especially __________ in comets. Where did __________ come from, and where __________ they do? Halley wanted __________ know. He studied the __________ of comets, which other __________ had made. The orbit __________ a comet was a __________ difficult problem in mathematics. __________

could not figure it __________. Neither could other scientists __________ tackled the problem. However, __________ had a friend named __________ Newton, who was a __________ mathematician. Could Newton possibly __________ out what the orbit __________ a comet would be __________? Yes, he could. In __________, he had already worked out that problem, Newton thought.

5.1 What did the first mammals look like? We don't know exactly. __________, we do have an __________, based on fossil evidence.__________ in the rocks. The __________ mammals had coats of __________ or hair, as all __________ do. The evidence suggests __________ they were small animals. __________ were not very different __________ the shrews we have __________. Some early mammals may __________ laid their eggs, like __________ duckbilled platypus. The duckbill __________ in Australia. It lays __________ that have shells around __________. When duckbill eggs were __________ discovered, people thought they __________ be the eggs of __________ reptile. They look much __________ the eggs of a __________. After the young of __________ duckbill hatch out of __________ eggs, they are fed __________ a strange milk made __________ the mother. Most people __________ not recognize it as __________.

5.2 It is more like __________ thin white of egg. __________ the duckbill part reptile? __________ would be better to __________ that it is a __________ which hasn't changed much __________ millions of years. The __________ of the reptiles of __________ ago hatched outside the __________ body, as do the __________ of reptiles living now. __________ the eggs were eaten __________ other animals. Sometimes the __________ dried up in the __________ of froze in the __________. One way or another, __________ eggs of reptiles were __________ to many dangers. But __________ eggs of mammals were __________ inside the mother's body. __________ is one reason why __________ came to rule the __________. The young of mammals __________ carried inside the mother, __________ they are well protected.

5.3 Look at these layers of sedimentary rock. Can you tell one __________ from another? Yes, for __________ sedimentary layer does differ __________ another. Some layers contain __________ which are colored red, __________ yellow, or brown. Different __________ elements and compounds color __________ sediment. Iron compounds, for __________, may color sediment red. __________ has color. There are __________ soils, black soils, brown __________. There are sands of __________ colors, as well. So __________ rock layers may be __________ differently. The structure of __________ layers may be different, __________. To know which layer __________ oldest, you must know __________ was laid down first. __________ the layers are in __________ order in which they __________ down, then the bottom __________ is the oldest. Still, __________ can scientists find out __________ old a rock is? __________ is an interesting answer.

5.4 __________ have discovered a kind __________ clock in the Earth. __________ you learned in Unit __________, the element uranium in __________ Earth is slowly turning __________ lead. How fast uranium __________ into lead has been __________ out too. So the __________ uranium is a kind __________ clock, keeping time in __________ rocks. The uranium clock __________ tell time in hours, __________, like an ordinary clock. __________ tells time in millions

__________ years. Suppose a fossil-hunting __________ finds a piece of __________ with both uranium and __________ in it. He knows __________ lead in the rock __________ from uranium. He can __________ out how long it __________ for uranium to change __________ that much lead. Since __________ uranium began changing when __________ rock was formed, he knows about how old the rock is.

5.5 Your ear doesn't hang down, does it? Why not? Your ear __________ still and erect. Yet __________ has no bones in __________. What holds it up? __________ in the ear make __________ kind of material that __________ the ear. This material __________ called cartilage. Cells of __________ ear are surrounded by __________ cartilage they make. Cartilage __________ the ear stiffness. Cartilage __________ your nose its shape, __________. Another kind of supporting __________ allows you to stand __________. You can stand because __________ have bones, which support __________ body. The bones are __________ by bone cells, another __________ of supporting cell. Bone __________ might better be called __________ cells. The cells make __________ hard bones that surrounds __________. There are other cells __________ provide support. Feel your __________ just below the kneecap.

5.6 __________ is a tough band __________ called a ligament. A __________ is built of strong __________ cells. It joins one __________ to another. Now feel __________ inside of your elbow __________ you bend your arm. __________ is another tough connecting __________ here. This one is __________ tendon, a band of __________ that joins bone to __________. Look back over the __________ of cells on these __________ pages you have just __________. These cells look different __________ each other. These different __________ of cells have different __________ to do. Yet these __________ cells are alike, in __________ ways. Each one of __________ cells has a nucleus, __________ example. Each one of __________ cells, no matter how __________ it appears from other __________, can make more cells __________ itself -- can reproduce itself.

5.7 Schleiden and Schwann went further. Like biologists before them, they observed that cells did certain things. Cells in the body __________ special jobs. In other __________ cells have special functions, __________ you know. For instance, __________ know that nerve cells __________ the function of carrying __________. Red blood cells have __________ function of carrying oxygen. __________ cells have the function __________ protecting the tissues under __________. Green plant cells have __________ very special function: they __________ sugar. Green cells are __________ cells that can capture __________ Sun's energy. They can __________ this energy to make __________. Because sugar is the __________ food substance from which __________ foods are made, all __________ us depend on the __________ plant cell. In other __________, we depend on the __________ of the plant cell. __________ depend on its chloroplasts, __________ contain the green substance __________.

5.8 We depend on its __________. The green plant cell __________ the food upon which __________ world depends. So Schleiden __________ Schwann were able to __________ as well: The cell __________ the unit of structure __________ function in living things. __________ cells of the organisms __________ not scattered about. They __________ organized into tissues, such __________ nerve tissue, and muscle

__________. The tissues are organized __________ organs, such as kidneys, __________, lungs, brain. The organs __________ organized into organ systems, __________ as the digestive system, __________ system, circulatory system. Finally __________ systems, all of them, __________ beautifully organized into the __________. You are an organism, __________ organized. The smallest part __________ this beautiful organization is __________ cell. The cell is __________ unit of structure and __________ in you, as it is in all living things.

5.9 Think of a mouse and a paramecium. A mouse is a complete __________ thing, an organism. It __________ an organism made up __________ millions of cells: muscle __________, nerve cells, blood cells, __________ many other kinds of __________. A mouse is a __________ organism. A paramecium is __________ complete living thing, too. __________ paramecium is an organism. __________ it is made up __________ just one cell. A __________ is a single-celled organism. __________ a paramecium, one cell __________ enough. Just as the __________ is a single-celled plant, __________ cell is enough for __________ paramecium, an animal. What __________ the difference between a __________ animal like a paramecium, __________ a single animal cell, __________ as a muscle cell __________ the mouse? The paramecium __________ get its own food. __________ muscle cell in the __________ depends on blood to __________ it food.

5.10 The single __________ of the paramecium can __________ about on its own. __________ a single muscle cell __________ the mouse can move __________ along with millions of __________ muscle cells. Single-celled animals __________ the paramecium carry on __________ life activities in one __________. A single-celled animal is __________ complete organism. But a __________ cell is only one __________ of cell in a __________ animal like the mouse.

__________ single animal cell is __________ part of an organism. __________ animals belong to a __________ known as Protozoa. The __________ is a protozoan; it __________ to the Protozoa. The __________ and the vorticella, and __________ one-celled animals are protozoans. __________ fact there are more __________ 15,000 different kinds of __________, or single-celled animals.

5.11 As the red powder of mercuric oxide is heated, it turns black. Drops of mercury __________ to appear. Oxygen is __________ given off too, but __________ into the air. It __________ a colorless gas, without __________ odor, so you don't __________ it, or smell it. __________ mercury is left. The __________ powder is made of __________ silvery liquid and an __________ gas, mercury and oxygen. __________ is an element. It __________ made up only of __________ of mercury. Oxygen is __________ element made up of __________ of oxygen. The elements __________ and oxygen can combine __________ form a new substance, __________ oxide. Chemists call this __________ substance a compound. A __________ is formed when two (__________ more) elements are combined. __________ oxide is a compound __________ the elements mercury and __________. No other atoms are __________ of this compound.

5.12 Look __________ this compound another way. __________ oxide is made up __________ molecules. Each molecule of __________ oxide is made up __________ two different kinds of __________, atoms of mercury and __________ of oxygen. Heating mercuric __________ makes the molecule break __________. The mercuric oxide molecule __________ apart into atoms of __________ and molecules of oxygen, __________ these models show. A __________ can write about the __________ down of red mercuric __________ powder in this way: __________ oxide = mercury + oxygen. This __________ called a word equation. __________ use the arrow to __________ "becomes" or "yields." Say "__________ oxide becomes mercury and __________." You may wonder why __________ is not mentioned in __________ equation. After all, heat __________ used to break down __________ compound. However, chemists take it for granted that heat is used, and usually don't write it.

5.13 To find out what a cake is made of, you take a bit of it and test it - usually by putting it in your mouth. To find out what __________ Earth is made of, __________ take bits of its __________ and minerals and test __________ in various ways. Unfortunately, __________ can't get bits of __________ stars to test. Of __________ our Sun is a __________, and much nearer to __________ than any of the __________ stars. Even so, it __________ too far away. We __________ get bits of the __________ to test, either. Yet __________ have managed to find __________ much about what the __________ and other stars are __________ of. How? By studying __________ light that comes to __________ from the Sun and __________ the stars. Think of __________ happens when light from __________ Sun is sent through __________ prism. A spectrum is __________, a pattern of colors.

5.14 __________ spectrum shows that white __________ from the Sun is __________ made up of light __________ many different colors. You __________ the Sun's spectrum. Scientists __________ an instrument that allows __________ to study a spectrum __________ closely and exactly. This __________ for studying a spectrum __________ called a spectroscope. Astronomers __________ found out much of __________ they know about the __________ with the spectroscope. You __________ get an idea of __________ this is done by __________ the investigation on the __________ page. When the sodium __________ sodium chloride is heated __________ the blue flame of __________ burner, it produces a __________ flame. This yellow flame __________ one way of recognizing __________ element sodium. What happens __________ this yellow light is __________ through a glass prism? __________ result is a spectrum of one band only, yellow light.

5.15 Joan suspected that the test tube would fill with oxygen more quickly if the plants had more sunlight. She tried the investigation __________. This time there was __________ whole week of sunny __________, and at the end __________ the week the test __________ was full of gas. __________ this time the test __________ oxygen did not work. __________ the glowing sliver of __________ was slipped into the __________ tube, it glowed more __________, but didn't burst into __________. What was wrong? Joan __________ to the library and __________ more. She found that __________ way of collecting oxygen __________ not a sure way. __________ one thing, there was __________ dioxide gas in the __________ water. Sometimes some carbon __________ collected in the test __________. Ordinary air, which is __________ nitrogen, sometimes collected in __________ tube. So the oxygen __________ the tube was not __________ pure as it should __________ been.

5.16 As a result, __________ sliver did not burst __________ flame. Joan found that __________ she threw away the __________ inch of gas that __________ and started over again, __________ investigation usually worked. She __________ oxygen from the water __________. And she showed that __________ green water plants gave __________ oxygen gas. It is __________ fact that all green __________ plants give off gas __________ in oxygen. All green __________ plants give off a __________ deal of oxygen if . . . __________, there is an if. __________ do green water plants __________ off oxygen? Joan guessed __________ the answer was. Can __________? Joan's guess was really __________ scientists call a hypothesis. __________ is, her guess was __________ possible answer, or explanation, __________ be tested. Let's see what Joan did to test her hypothesis.

6.1 Do you live in a part of the country where you can ice-skate? If so, you may __________ sometimes wished that the __________ were not so smooth, __________ that you could glide __________ slowly. Why do you __________ so smoothly on ice? __________ sharp edges of the __________ blade are really wedges, __________ machines. This kind of __________ bites into the ice __________ helps to keep you __________ skidding sideways, yet a __________ sends you forward. If __________ were to spread sand __________ the ice, what would __________ the action of the __________? The investigation on the __________ page will give you __________ clues. Why is it __________ to pull the block __________ the rough edge of __________ sandpaper? Each time you __________ the piece of wood __________ the table, your work __________ made harder by friction. __________ is a force that __________ motion.

6.2 It is caused __________ two surfaces rubbing against __________ other. The amount of __________ depends on the types __________ surfaces that are rubbing __________ each other. Since the __________ of the sandpaper is __________ than the surface of __________ tabletop, it causes more __________. It is harder to __________ the piece of wood __________ the sandpaper because the __________ of friction is greater. __________ is it harder to __________ two blocks across the __________ of the table than __________ pull just one? It __________ more force because the __________ weight makes the bottom __________ of wood press harder __________ the surface of the __________. The force of friction __________ greater. Why does the __________ move farther when it __________ rolling than when it is sliding?

6.3 This is exactly the result Sir Alexander Fleming found in some of the rows. He repeated the __________ in many different ways __________ at many different times. __________ kept careful written records __________ photographed his results. Other __________ repeated his experiment. He __________ was able to show __________ that Penicillium does __________ substance which destroys certain __________ of dangerous bacteria. He __________ performed other experiments that __________ that penicillin (the substance __________ from Penicillium) was not __________ to higher animals. Other __________, before Sir Alexander, has __________ that molds produced such __________. Some had even written __________ their ideas; but Sir __________ designed the experiment which __________ that these substances secreted __________ molds would destroy certain __________. When Sir Alexander Fleming __________ that Penicillium produces a __________ that kills some kinds __________ bacteria, he called it __________.

6.4 He also found, by __________ it into animals that __________ is generally harmless to __________ animals; but it took __________ years and the help __________ many scientists to find __________ way to produce large __________ at a reasonable cost. __________ kills many kinds of __________ bacteria. Should your body, __________ its natural defenses, be __________ to throw off any __________ these kinds of bacteria, __________ doctor may give you __________ to help control them. __________ other scientists, Dr. Howard __________ and Dr. Earnst Chain __________ Dr. Fleming; they found __________ way to purify penicillin __________ make it safe for __________ to use. For their __________ contribution, the three scientists __________ awarded the Nobel prize. __________ Nobel prize is perhaps __________ greatest prize that scientists __________ receive for their work - except, perhaps, the personal satisfaction which they get from doing the work.

6.5 The origin of cotton has never been definitely determined; but it has been indicated that cotton cloth was being produced as early as 1500 B.C. Man learned very early __________ use the fibers of __________ cotton plants. He picked __________ cotton boll and for __________ of years removed the __________ by hand. This was __________ expensive labor. Removal of __________ seeds by hand was __________ difficult that it required __________ day for one person __________ clean a pound of __________. Eli Whitney went to __________ and in ten days __________ the cotton gin, a __________ which separated the fibers __________ the seeds very easily. __________ patented the machine in __________. Cotton is one of __________ most valuable of all __________. The uses for its __________ are so varied that __________ is by far the __________ important of all textile __________. Today, however, many synthetic __________ are being used in __________ textile industry.

6.6 Still, in __________, the concept of the __________ of matter was just __________ developed. The way atoms __________ molecules combined to form __________ compounds was not yet __________ understood. It wasn't really __________ the 1850's that the __________ of chemistry began to __________ rapidly. As chemists learned __________ about ways of combining __________ it was natural that __________ should turn to a __________ of substances like silk __________ cotton. They found that __________ could change cotton into __________ thread that had some __________ the properties of silk. __________ way the chemists found __________ to dissolve cotton in __________ hydroxide. Then, as in __________ picture, the dissolved cotton __________ pressed out through tiny __________ into a liquid. It __________ into a fiber which __________ called rayon.

6.7 When an atomic nucleus breaks up, its particles shoot out in all directions and a great deal of heat is produced. Suppose an engineer had __________ problem of obtaining heat __________ an element like uranium. __________ would need to find __________ way to break up __________ nuclei of many atoms __________ uranium - without an explosion. __________ a way has been __________. It makes use of __________ invention known as an __________ pile. In an atomic __________ many nuclei split, that __________, undergo fission, by a __________ known as a chain __________. To get an idea __________ how a chain reaction __________ in an atomic pile, __________ can use our model __________ made of marbles and __________ spring marble launcher. When __________ shoot a single marble (__________ bullet) at the bunch __________ marbles (target nucleus), the __________ from the marble nucleus __________ in many directions.

6.8 Suppose __________ as the marbles from __________ marble nucleus scatter, some __________ them hit other bunches __________ marbles, or nuclei. Then __________ nuclei would also be __________. Their particles would scatter __________ would, in their turn, __________ still more nuclei. In __________ atomic pile, the atomic __________ are neutrons. A speeding __________ hits a uranium nucleus. __________ uranium nucleus splits up __________ sends out other neutrons. __________ neutrons also hit uranium __________ and cause them to __________ out neutrons. In a __________ short time, much less __________ a second, fission after __________ of uranium nuclei takes __________. On and on this __________, very steadily - neutrons hitting __________ and freeing other neutrons __________ hit more nuclei. This __________ is the chain reaction. __________ the chain reaction were __________ happen too quickly, there would be an explosion.

6.9 All living things depend on their environment for food, water, and shelter. Without the sun's energy, __________ plants do not make __________ and cannot live; without __________ plants, animals cannot live. __________ depend on green plants __________ only for food but __________ for oxygen. We depend __________ our environment; but the __________ is not always friendly. __________ tiger feeds on the __________. Some snakes feed on __________. Animals feed on each __________, as well as on __________. Some animals and plants __________ dangerous to humans, too. __________ bacteria would kill us __________ we let them; others __________ make us sick. Over __________ years there have been __________ diseases which were caused __________ microorganisms. Such diseases have __________ many men and there __________ many other diseases that __________ do. Before the microscope __________ invented, man did not __________ about microorganisms.

6.10 A tool __________ to be invented before __________ could discover the cause __________ many diseases. Without the __________ we could not have __________ about microorganisms, the invisible __________ against which we must __________ be on guard. These __________ enemies killed many people __________ made many others very __________. For example, the Black __________, a disease caused by __________, killed one-fourth of all __________ people in

Europe about __________ years ago. The diesase __________ caused by a specific __________ of bacterium, but the __________ that bacteria and other __________ cause disease was not __________ 600 years ago. Tuberculosis __________ many and still does. __________ 1900, smallpox caused many __________. Today, it still causes __________ in many countries but __________ almost unknown in the __________ States due to vaccination programs.

6.11 As you stand on the dam and look back, you see water trapped in a huge lake. Then as you look __________ on the front of __________ dam, you see the __________ flowing from openings near __________ base of the dam. __________ the river below. Inside, __________ are standing beside a __________ generator; you cannot miss __________ loud and steady hum. __________ us find out what __________ causing the hum. The __________ of the lake rushes __________ the dam in large __________. This falling water is __________ wheels, or turbines, in __________ way much like that __________ on page 242. As __________ turbine turns, strong magnets __________ are inside huge coils __________ wire turn also. The __________ energy, or potential energy, __________ the water behind the __________ is turned into energy __________ motion - or kinetic energy.

6.12 __________ energy turns the turbines __________ turn the generators and __________ electrons to flow through __________ wires (cables) for hundreds __________ miles. The magnets in __________ generator do not look __________ the metal magnets you __________ seen. Look at those __________ the picture. They are __________ shaped like a common __________ magnet. They have coils __________ wire wrapped tightly around __________. They are, as you __________ have guessed, electromagnets. Look __________ the simple electromagnet shown __________ opposite page. Notice

__________ the wire is connected __________ a circuit going from __________ terminal of the dry __________ to the other. Between __________ two terminals, the wire __________ wound into a coil __________ a soft iron bolt, __________ shown in the picture. __________ bolt is the core __________ the electromagnet. The magnetic __________ around the coil of wire, through which a current is flowing, makes the soft iron core act as a magnet.

6.13 The story of television is not so simple as that given here, however. For instance, the way __________ picture tube reproduces the __________ is quite complicated. Of __________, the transmission of color __________ is even more complicated __________ the transmission of a __________ picture. You will learn __________ about this amazing story __________ future science classes. For __________ clue now, however, adjust __________ television picture to get __________ slightly out of focus. __________ it really one solid __________ or is it made __________ of many small lines, __________ shown? The picture is __________ into these fine lines __________ it is trans- mitted and __________ reproduced as a __________ picture on your screen. __________ you seen movies of __________ pony express in the __________ days of the West? __________ you know that the __________ had stations where they __________ fresh horses.

6.14 At some __________ of the stations, called __________ stations, new riders would __________ over the job of __________ the mail. Today we __________ relay stations in space __________ expand the efficiency of __________ commun- ications. The relay stations __________ it possible to transmit __________ types of electromagnet waves __________ a much greater distance. __________, many of these relay __________ will be permanently placed __________ space. Echo I was __________ first of the communications __________ to be sent out __________ space. Then came Telstar, __________ could relay live television __________ across the Atlantic. These __________ been followed by several __________. Echo and Telstar are __________ relay stations; they were __________ first to be used __________ bounce messages back to __________. Since television waves travel __________ in straight lines, they cannot go around the curve of the earth.

6.15 It is now known that the growth of all living things is affected by their chromosomes. Furthermore, by determining the __________ in the chromosomes scientists __________ predict the kind of __________ that will be born, __________ to some extent, how __________ will develop. It is __________ DNA molecule in the __________ which carries the hereditary __________ of the organism. The __________ of the garden pea __________ the code (in the __________ of genes) that causes __________ plant to reproduce garden __________ and not geraniums or __________. The DNA also determines __________ of the garden peas, __________ as color and height. __________ DNA code determines the __________ of cattle, and dogs, __________ oak trees, each having __________ own particular code, which __________ it different from other __________. We can cross garden __________ to get certain flowers __________ and not others.

6.16 In __________ words, by controlling the __________ of garden peas, we __________ determine the genetic code __________ some extent. By radiation, __________ can perhaps alter and __________ the code. It has __________ possible to improve our __________ supply by selective breeding __________ desirable traits. We have __________ that the molecule DNA, __________ the genes, can change.

__________ other words, when the __________ molecule changes, the code __________ changed. New traits appear. __________ millions upon millions of __________, genes mutate and produce __________ in organisms. Unless we __________ the orgamisms with the __________ environment in which to __________, the traits will not __________ to their fullest. The __________ shows how a poor __________ can hamper the development __________ good traits. In order __________ understand what environment has __________ do with development, an important concept must be kept in mind.

CLOZE READABILITY SAMPLES

<u>Concepts in Science</u>, Grade Four

Page 189, 4.1-4.2
Page 199, 4.3-4.4
Page 93, 4.5-4.6
Page 76, 4.7-4.8
Page 206, 4.9-4.10
Page 6, 4.11-4.12
Page 249, 4.13-4.14
Page 260, 4.15-4.16

<u>Concepts in Science</u>, Grade Five

Page 330, 5.1-5.2
Page 314, 5.3-5.4
Page 202, 5.5-5.6
Page 266, 5.7-5.8
Page 171, 5.9-5.10
Page 56, 5.11-5.12
Page 288, 5.13-5.14
Page 230, 5.15-5.16

<u>Concepts in Science</u>, Grade Six

Page 180, 6.1-6.2
Page 120, 6.3-6.4
Page 86, 6.5-6.6
Page 302, 6.7-6.8
Page 139, 6.9-6.10
Page 244, 6.11-6.12
Page 275, 6.13-6.14
Page 405, 6.14-6.16

APPENDIX C

READABILITY FORMULAS

CLOZE READABILITY PROCEDURE

1. Select from six to twelve passages randomly from the text.
2. Each passage should begin at a normal beginning and contain at least 250 words.
3. Beginning with the second sentence, delete every fifth word. Delete fifty items for both convenience and test reliability.
4. Replace the deleted item with an underlined blank of a standard length (ten spaces).
5. The tests are given without time limit to students who have not previously read the material.
6. The students write in the blank the word they believe was deleted.
7. The responses are correct when they exactly match the words deleted (disregarding minor misspellings). (45: 429-433).

A FORMULA FOR PREDICTING READABILITY

By Edgar Dale and Jeanne S. Chall

(Reasearch in the Three R's)
(C. W. Hunnicutt and William J. Iberson)

The directions to guide the various steps in filling out the work sheet follow.

I. Selecting samples. Take approximately 100 words about every tenth page for books. For articles, select about four 100-word samples per 2000 words. Space these samples evenly. For passages of abour 200 to 300 words analyze the entire passage. Never begin or end a sample in the middle of the sentence.

II. Labeling work sheet. Enter such information as title, author, publisher, date of publication, etc., regarding the sample to be appraised.

III. Counting the number of words:
   A. Count the total number of words in the sample.
   B. Count hyphenated words and contractions as one word.
   C. Count numbers as words: 10 is one word; 1947 is one word.
   D. Count compound names of persons and places as one word; St. John, Van Buren, and so on, are each counted as one word.
   E. Do not count initials which are part of a name as separate words; John F. W. St. John is counted as two words--John and F. W. St. John.
   F. Record the number of words under 1 of the work sheet.

IV. Counting the number of sentences.
   A. Count the number of complete sentences in the sample.
   B. Record this under 2 of the work sheet.

V. Counting the number of unfamiliar words. Words which do not appear on the Dale list are considered unfamiliar. Underline all unfamiliar words, even if they appear more than once. In making this count, special rules are necessary for common and proper nouns, verbs, and other parts of speech. These are given in the section which follows.
   A. Common nouns
      1. Consider familiar all regular plurals and possessives of words on the list; "boy's" is familiar bacause "boy" is on the list (possessive); "girls" is familiar because "girl" is on the list (plural by adding "s"); "churches" is familiar because "church" is on the list (plural by adding "es"); armies is familiar because "army" is on the list (plural by changing "y" to "ies").
      2. Count irregular plurals as unfamiliar, even if the singular form appears on the list; "oxen" is unfamiliar, although "ox" is on the list. Several irregular plurals, however, are listed in the word list. When the plural appears as a separate word or is indicated by the ending in parentheses next to the word, it is considered familiar; "goose" and "geese" appear on the list and both are considered familiar.
      3. Count as unfamiliar a noun that is formed by adding "er" or "r" to a noun or verb appearing on the word list (unless this "er" or "r" form is indicated on the list); "burner" is counted as unfamiliar, although "burn" is on the list. "Owner" is considered familiar because it appears on the list as follows: own ("er").

B. Proper nouns:

1. Names of persons and places are considered familiar. "Japan, Smith," and so on, are familiar even though they do not appear on the word list.
2. Names of organizations, laws, documents, titles of books, movies, and so on generally comprise several words.
   a. When determining the number of words in a sample, count all the words in the name of an organization and the like. "Chicago Building Association" should be counted three words. SPECIAL RULE: When the title of an organization, law, and so on is used several times within a sample of 100 words, all the words in the title are counted, no matter how many times they are repeated.

   b. For the unfamiliar word count, consider unfamiliar only words which do not appear on the Dale list, except names of persons or places. "Chicago Building Association" is counted one unfamiliar word--"Association." "Building" and "Chicago" are familiar. "Declaration of Independence" is counted as two unfamiliar words--as "of" is on the list. SPECIAL RULE: When the name of an organization, law, document, and so on is used several times within a sample of 100 words, count it only twice when making the unfamiliar word count. "Security Council," if repeated more than twice within a 100-word sample, is counted as four unfamiliar words.

3. Abbreviations:
   a. In counting the words in a sample, an abbreviation is counted as one word. "Y.M.C.A." is counted one word. "Nov." is counted one word. "A.M." and "P.M." are each counted as one word.
   b. In making the unfamiliar word count, an abbreviation is counted as one unfamiliar word only. "Y.M.C.A." is considered one unfamilar word. "Nov." is considered familiar because the names of the months are on the word list. "U.S." is considered familiar. "A.M." and "P.M." are each considered familiar. SPECIAL RULE: An abbreviation which is used several times within a 100-word sample is counted as two unfamiliar words only. "C.I.O." is counted two unfamiliar words if repeated five times in a 100-word sample.

C. Verbs:

1. Consider familiar the third-person, singular forms ("s" or "ies" from "y"), present-participle forms ("ing"), past-participle forms ("n"), and past-tense forms ("ed" or "ied" from "y"), when these are added to verbs appearing on the list. The same rule applies when a consonant is doubled before adding "ing" or "ed." E.G., "ask, asking, asked" are considered familiar, although only the word "ask" appears on the word list; "dropped" and "dropping" are familiar because "drop" is on the list.

D. Adjectives:

1. Comparatives and superlatives of adjectives appearing on the list are considered familiar. The same rule applies if the consonant is doubled before adding "er" or "est." E.G., "longer, prettier," and "bravest" are familiar because "long, pretty," and "brave" are on the list; "red, redder," and "reddest" are all familiar.
2. Adjectives formed by adding "n" to a proper noun are familiar. For example, "American, Austrian."

3. Count as unfamiliar an adjective that is formed by adding "y" to a word that appears on the list. But consider the word familiar if "y" appears in parentheses following the word. E.G., "wooly" is unfamiliar although wool is on the list; "sandy" is familiar because it appears on the list as "sand(y)."

E. Adverbs:

1. Consider adverbs familiar which are formed by adding "ly" to a word on the list. In most cases "ly" will be indicated following the word. E.g., "soundly" is familiar because "sound" is on the list
2. Count as unfamiliar words which add more than "ly," like "easily."

F. Hyphenated words:

1. Count the hyphenated words as unfamiliar if either the word in the compound does not appear on the word list. When both appear on the list, the word is familiar.

G. Miscellaneous special cases:

1. Words formed by adding "en" to a word on the list (unless the "en" is listed in parentheses or the word itself appears on the list) are considered unfamiliar; "sharpen" is considered unfamiliar although "sharp" is on the list; "golden" is considered familiar because it appears on the list "gold(en)."
2. Count a word unfamiliar if two or more endings are added to a word on the list; "clippings" is considered unfamiliar, although "clip" is on the list.
3. Words on the list to which "tion, ation, ment," and other suffices not previously mentioned are added are considered unfamiliar, unless the word with the ending is included on the list; "treatment" is unfamiliar although "treat" is on the list; "protection" is unfamiliar although "protect" is on the list; "preparation" is unfamiliar although "prepare" is on the list.
4. Numbers: Numerals like 1947, 18 and so on, are considered familiar.

H. Record the total number of unfamiliar words under 3 of the work sheet.

The number of words in the sample (1 on the work sheet) have now been recorded, as well as the number of sentences in the sample (2) and the number of words not on the Dale list (3). The next steps can be followed easily on the work sheet.

VI. Completing the work sheet.

1. The average sentence length (4) is computed by dividing the number of words in the sample by the number of sentences in the sample.
2. The Dale score or percentage of words outside the Dale list is computed by dividing the number of words not on the Dale list by the number of words in the sample and multiplying by 100.
3. Follow through Steps 6 and 7 on the work sheet.
4. Add 6, 7, and 8 to get the formula raw score.
5. If you have more than one sample to analyze, get an average of the formula raw scores by adding all of these and dividing by the number of samples.
6. Convert the average formula raw score to a corrected grade level according to the Correction Table given on the work sheet page.

The corrected grade level indicates the grade at which a book or article can be read with understanding. For example, a book with a corrected grade level of 7-8 is one which should be within the reading ability of average children in Grades 7-8. For adults, the 7-8 grade level can be compared to the last grade reached. If materials are being selected for persons who have had an average of eight grades of schooling, passages with a corrected grade level of 7-8 should be within their ability. The corrected grade levels corresponding to the raw scores obtained from the formula are given on the work sheet page.

Dale-Chall Work Sheet

Article: ________	Page No. ________	Page No. ________	Page No. ________
Author: ________	From ________	From ________	From ________
Publisher: ________	To ________	To ________	To ________
1. Number of words in the sample	________	________	________
2. Number of sentences in the sample	________	________	________
3. Number of words not on Dale list	________	________	________
4. Average sentence length (divide 1 by 2)	________	________	________
5. Dale score (divide 3 by 1, multiply by 100)	________	________	________
6. Multiply average sentence length (4) by .0496	________	________	________
7. Multiply Dale score (5) by .1579	________	________	________
8. Constant	________	________	________
9. Formula raw score (add 6, 7, 8)	________	________	________

Average raw score of 3 samples ________ Analyzed by ________ Date ________

Average corrected grade level ________ Checked by ________ Date ________

Formula Score	Corrected Grade Levels
4.9 and below	Grade 4 and below
5.0 to 5.9	Grades 5-6
6.0 to 6.9	Grades 7-8
7.0 yo 7.9	Grades 9-10
8.0 to 8.9	Grades 11-12
9.0 to 9.9	Grades 13-15 (college)
10.0 and above	Grades 16- (college graduate)

Dale List of 3000 Familiar Words

a
able
aboard
about
above
absent
accept
accident
account
ache (ing)
acorn
acre
across
act(s)
add
address
admire
adventure
afar
afraid
after
afternoon
afterward(s)
again
against
age
aged
ago
agree
ah
ahead
aid
aim
air
airfield
airplane
airport
airship
airy
alarm
alike
alive
all
alley
alligator
allow
almost
alone
along
aloud
already
also
always
am

America
American
among
amount
an
and
angel
anger
angry
animal
another
answer
ant
any
anybody
anyhow
anyone
anything
anyway
anywhere
apart
apartment
ape
apiece
appear
apple
April
apron
are
aren't
arise
arithmetic
arm
armful
army
arose
around
arrange
arrive(d)
arrow
art
artist
as
ash(es)
aside
ask
asleep
at
ate
attack
attend
attention
August
aunt
author

auto
automobile
autumn
avenue
awake(n)
away
awful(ly)
awhile
ax

baa
babe
baby(ies)
back
background
backward(s)
bacon
bad(ly)
badge
bag
bake(r)
bakery
baking
ball
balloon
banana
band
ban age
bang
banjo
bank(er)
bar
barber
bare(ly)
barefoot
bark
barn
barrel
base
baseball
basement
basket
bat
batch
bath
bathe
bathroom
bathrub
battle
battleship
bay
be(ing)
beach

bead
beam
bean
bear
beard
beast
beat(ing)
beautiful
beautify
beauty
became
because
become
becoming
bed
bedbug
bedroom
bedspread
bedtime
bee
beech
beef
beefsteak
beehive
been
beer
beet
before
beg
began
beggar
begged
begin
beginning
begun
behave
behind
believe
bell
belong
below
belt
bench
bend
beneath
bent
berry(ies)
beside(s)
best
bet
better
between
bib
bible

bicycle
bid
big(ger)
bill
billboard
bin
bind
bird
birth
birthday
biscuit
bit
bite
biting
bitter
black
blackberry
blackbird
blackboard
blackness
blacksmith
blame
blank
blanket
blast
blaze
bleed
bless
blessing
blew
blind(s)
blindfold
block
blood
bloom
blossom
blot
blow
blue
blueberry
bluebird
bluejay
blush
board
boast
boat
bob
bobwhite
body (ies)
boil(er)
bold
bone
bonnet
boo

book
bookcase
bookkeeper
boom
boot
born
borrow
boss
both
bother
bottle
bottom
bought
bounce
bow
bowl
bow-wow
box(es)
boxcar
boxer
boy
boyhood
bracelet
brain
brake
bran
branch
brass
brave
bread
break
breakfast
breast
breath
breathe
breeze
brick
bride
bridge
bright
brightness
bring
broad
broadcast
broke(n)
brook
broom
brother
brought
brown
brush
bubble
bucket
buckle

bud
buffalo
bug
buggy
build
building
built
bulb
bull
bullet
bum
bumblebee
bump
bun
bunch
bundle
bunny
burn
burst
bury
bus
bush
bushel
business
busy
but
butcher
butt
butter
buttercup
butterfly
buttermilk
butterscotch
button
buttonhole
buy
buzz
by
bye

cab
cabbage
cabin
cabinet
cackle
cage
cake
calendar
calf
call(er)(ing)
came
camel
camp
campfire
can
canal
canary
candle
candlestick
candy
cane
cannon
cannot
canoe
can't
canyon
cap
cape
capital
captain
car
card
cardboard
care
careful
careless
carelessness
carload
carpenter
carpet
carriage
carrot
carry
cart
carve
case
cash
cashier
castle
cat
catbird
catch
catcher
caterpillar
catfish
catsup
cattle
caught
cause
cave
ceiling
cell
cellar
cent
center
cereal
certain(ly)
chain
chair
chalk
champion
chance
change
chap
charge
charm
chart
chase
chatter
cheap
cheat
check
checkers
cheek
cheer
cheese
cherry
chest
chew
chick
chicken
chief
child
childhood
children
chil)y)
chimney
chin
china
chip
chipmunk
chocolate
choice
choose
chop
chorus
chose(n)
christen
Christmas
church
churn
cigarette
circle
circus
citizen
city
clang
clap
class
classmate
classroom
claw
clay
clean(er)
clear
clerk
clever
click
cliff
climb
clip
cloak
clock
close
closet
cloth
clothes
clothing
cloud(y)
clover
clown
club
cluck
clump
coach
coal
coast
coat
cob
cobbler
cocoa
coconut
cocoon
cod
codfish
coffee
coffeepot
coin
cold
collar
college
color(ed)
colt
column
comb
come
comfort
comic
coming
company
compare
conductor
cone
connect
coo
cook(ed)
cook(ing)
cooky(ie)(s)
cool(er)
coop
copper
copy
cord
cork
corn
corner
correct
cost
cot
cottage
cotton
couch
cough
could
couldn't
count
counter
country
county
course
court
cousin
cover
cow
coward(ly)
cowboy
cozy
crab
crack
cracker
cradle
cramps
cranberry
crank(y)
crash
crawl
crazy
cream(y)
creek
creep
crept
cried
croak
crook(ed)
crop
cross(ing)
cross-eyed
crow
crowd(ed)
crown
cruel
crumb
crumble
crush
crust
cry(ies)
cub
cuff
cup
cupboard
cupful
cure
curl(y)
curtain
curve
cushion
custard
customer
cut
cute
cutting

dab
dad
daddy
daily
dairy
daisy
dam
damage
dame
damp
dance(r)
dancing
dandy
danger(ous)
dare
dark(ness)
darling
darn
dart
dash
date
daughter
dawn
day
daybreak
daytime
dead
deaf
deal
dear
death
December
decide
deck
deed
deep
deer
defeat
defend
defense
delight
den
dentist
depend
deposit
describe
desert
deserve
desire
desk

destroy
devil
dew
diamond
did
didn't
die(d)(s)
difference
different
dig
dim
dime
dine
ding-dong
dinner
dip
direct
direction
dirt(y)
discover
dish
dislike
dismiss
ditch
dive
diver
divide
do
dock
doctor
does
doesn't
dog
doll
dollar
dolly
done
donkey
don't
door
doorbell
doorknob
doorstep
dope
dot
double
dough
dove
down
downstairs
downtown
dozen
drag
drain
drank
draw(er)
draw(ing)

dream
dress
dresser
dressmaker
drew
dried
drift
drill
drink
drip
drive(n)
driver
drop
drove
drown
drowsy
drug
drum
drunk
dry
duck
due
dug
dull
dumb
dump
during
dust(y)
duty
dwarf
dwell
dwelt
dying

each
eager
eagle
ear
early
earn
earth
east(ern)
easy
eat(en)
edge
egg
eh
eight
eighteen
eighth
eighty
either
elbow
elder
eldest
electric
electricity

elephant
eleven
elf
elm
else
elsewhere
empty
end(ing)
enemy
engine
engineer
English
enjoy
enough
enter
envelope
equal
erase(r)
errand
escape
eve
even
evening
ever
every
everybody
everyday
everyone
everything
everywhere
evil
exact
except
exchange
excited
exciting
excuse
exit
expect
explain
extra
eye
eyebrow

fable
face
facing
fact
factory
fail
faint
fair
fairy
faith
fake
fall
false

family
fan
fancy
far
faraway
fare
farmer
farm(ing)
far-off
farther
fashion
fast
fasten
fat
father
fault
favor
favorite
fear
feast
feather
February
fed
feed
feel
feet
fell
fellow
felt
fence
fever
few
fib
fiddle
field
fife
fifteen
fifth
fifty
fig
fight
figure
file
fill
film
finally
find
fine
finger
finish
fire
firearm
firecracker
fireplace
fireworks
firing
first

fish
fisherman
fist
fit(s)
five
fix
flag
flake
flame
flap
flash
flashlight
flat
flea
flesh
flew
flies
flight
flip
flip-flop
float
flock
flood
floor
flop
flour
flow
flower(y)
flutter
fly
foam
fog
foggy
fold
folks
follow(ing)
fond
food
fool
foolish
foot
football
footprint
for
forehead
forest
forget
forgive
forgot(ten)
fork
form
fort
forth
fortune
forty
forward
fought

found
fountain
four
fourteen
fourth
fox
frame
free
freedom
freeze
freight
French
fresh
fret
Friday
fried
friend(ly)
friendship
frighten
frog
from
front
frost
frown
froze
fruit
fry
fudge
fuel
full(y)
fun
funny
fur
furniture
further
fuzzy

gain
gallon
gallop
game
gang
garage
garbage
garden
gas
gasoline
gate
gather
gave
gay
gear
geese
general
gentle
gentleman
gentlemen

geography
get
getting
giant
gift
gingerbread
girl
give(n)
giving
glad(ly)
glance
glass(es)
gleam
glide
glory
glove
glow
glue
go(ing)
goes
goal
goat
gobble
God(g)
godmother
gold(en)
goldfish
golf
gone
good(s)
good-by(bye)
good-looking
goodness
goody
goose
gooseberry
got
govern
government
gown
grab
gracious
grade
grain
grand
grandchild
grandchildren
granddaughter
grandfather
grandma
grandmother
grandpa
grandson
grandstand
grape(s)
grapefruit
grass

grasshopper
grateful
grave
gravel
graveyard
gravy
gray
graze
grease
great
green
greet
grew
grind
groan
grocery
ground
group
grove
grow
guard
guess
guest
guide
gulf
gum
gun
gunpowder
guy

ha
habit
had
hadn't
hail
hair
haircut
hairpin
half
hall
halt
ham
hammer
hand
handful
handkerchief
handle
handwriting
hang
happen
happily
happiness
happy
harbor
hard
hardly
hardship

hardware
hare
hark
harm
harness
harp
harvest
has
hasn't
haste(n)
hasty
hat
hatch
hatchet
hate
haul
have
haven't
having
hawk
hay
hayfield
haystack
he
head
headache
heal
health(y)
heap
hear(ing)
heard
heart
heat(er)
heaven
heavy
he'd
heel
height
held
hell
he'll
hello
helmet
help(er)
helpful
hem
hen
henhouse
her(s)
herd
here
here's
hero
herself
he's
hey
hickory

hid
hidden
hide
high
highway
hill
hillside
hilltop
hilly
him
himself
hind
hint
hip
hire
his
hiss
history
hit
hitch
hive
ho
hoe
hog
hold(er)
hole
holiday
hollow
holy
home
homely
homesick
honest
honey
honeybee
honeymoon
honk
honor
hood
hoof
hook
hoop
hop
hope(ful)
hopeless
horn
horse
horseback
horseshoe
hose
hospital
host
hot
hotel
hound
hour
house

housetop
housewife
housework
how
however
howl
hug
huge
hum
humble
hump
hundred
hung
hunger
hungry
hunk
hunt(er)
hurrah
hurried
hurry
hurt
husband
hush
hut
hymn

I
ice
icy
I'd
idea
ideal
if
ill
I'll
I'm
important
impossible
improve
in
inch(es)
income
indeed
Indian
indoors
ink
inn
insect
inside
instant
instead
insult
intend
interested
interesting
into
invite

iron
is
island
isn't
it
its
it's
itself
I've
ivory
ivy

jacket
jacks
jail
jam
January
jar
jaw
jay
jelly
jellyfish
jerk
jig
job
jockey
join
joke
joking
jolly
journey
joy(ful)
joyous
judge
jug
juice
juicy
July
jump
June
junior
junk
just

keen
keep
kept
kettle
key
kick
kid
kill(ed)
kind(ly)
kindness
king
kingdom
kiss

kitchen	lemon	lord	mayor	morning	next
kite	lemonade	lose(r)	maypole	morrow	nibble
kitten	lend	loss	me	moss	nice
kitty	length	lost	meadow	most(ly)	nickel
knee	less	lot	meal	mother	night
kneel	lesson	loud	mean(s)	motor	nightgown
knew	let	love	meant	mount	nine
knife	let's	lovely	measure	mountain	nineteen
knit	letter	lover	meat	mouse	ninety
knives	letting	low	medicine	mouth	no
knob	lettuce	luck(y)	meet(ing)	move	nobody
knock	level	lumber	melt	movie	nod
knot	liberty	lump	member	movies	noise
know	library	lunch	men	moving	noisy
known	lice	lying	mend	mow	none
	lick		meow	Mr., Mrs.	noon
lace	lid	ma	merry	much	nor
lad	lie	machine	mess	mud	north(ern)
ladder	life	machinery	message	muddy	nose
ladies	lift	mad	met	mug	not
lady	light(nes.)	made	metal	mule	note
laid	lightning	magizine	mew	multiply	nothing
lake	like	magic	mice	murder	notice
lamb	likely	maid	middle	music	November
lame	liking	mail	midnight	must	now
lamp	lily	mailbox	might(y)	my	nowhere
land	limb	mailman	mile	myself	number
lane	lime	major	milk		nurse
language	limp	make	milkman	nail	nut
lantern	line	making	mill	name	
lap	liner	male	miller	nap	oak
lard	lion	mama	million	napkin	oar
large	lip	mamma	mind	narrow	oatmeal
lash	list	man	mine	nasty	oats
lass	listen	manager	miner	naughty	obey
last	lit	mane	mint	navy	ocean
late	little	manger	minute	near	o'clock
laugh	live(s)	many	mirror	nearby	October
laundry	lively	map	mischief	nearly	odd
law	liver	maple	miss(M)	neat	of
lawn	living	marble	misspell	neck	off
lawyer	lizard	march(M)	mistake	necktie	offer
lay	load	mare	misty	need	office
lazy	loaf	mark	mitt	needle	officer
lead	loan	market	mitten	needn't	often
leader	loaves	marriage	mix	Negro	oh
leaf	lock	married	moment	neighbor	oil
leak	locomotive	marry	Monday	neighborhood	old
lean	log	mask	money	neither	oldfashioned
leap	lone	mast	monkey	nerve	on
learn(ed)	lonely	master	month	nest	once
least	lonesome	mat	moo	net	one
leather	long	match	moon	never	onion
leave(ing)	look	matter	moonlight	nevermore	only
led	looked	mattress	moose	new	onward
left	loop	may(M)	mop	news	open
leg	loose	maybe	more	newspaper	or

orange
orchard
order
ore
organ
other
otherwise
ouch
ought
our(s)
ourselves
out
outdoors
outfit
outlaw
outline
outside
outward
oven
over
overalls
overcoat
overeat
overhead
overhear
overnight
overturn
owe
owing
owl
own(er)
ox

pa
pace
pack
package
pad
page
paid
pail
pain(ful)
paint(er)
painting
pair
pal
palace
pale
pan
pancake
pane
pansy
pants
papa
paper
parade
pardon

parent
park
part(ly)
partner
party
pass
passenger
past
paste
pasture
pat
patch
path
patter
pave
pavement
paw
pay
payment
pea(s)
peace(ful)
peach(es)
peak
peanut
pear
pearl
peck
peek
peel
peep
peg
pen
pencil
penny
people
pepper
peppermint
perfume
perhaps
person
pet
phone
piano
pick
pickle
picnic
picture
pie
piece
pig
pigeon
piggy
pile
pill
pillow
pin
pine

pineapple
pink
pint
pipe
pistol
pit
pitch
pitcher
pity
place
plain
plan
plane
plant
plate
platform
platter
play(er)
playground
playhouse
playmate
plaything
pleasant
please
pleasure
plenty
plow
plug
plum
pocket
pocketbook
poem
point
poison
poke
pole
police
policeman
polish
polite
pond
ponies
pony
pool
poor
pop
popcorn
popped
porch
pork
possible
post
postage
postman
pot
potato(es)
pound

pour
powder
power(ful)
praise
pray
prayer
prepare
present
pretty
price
prick
prince
princess
print
prison
prize
promise
proper
protect
proud
prove
prune
public
puddle
puff
pull
pump
pumpkin
punch
punish
pup
pupil
puppy
pure
purple
purse
push
puss
pussy
pussycat
put
putting
puzzle

quack
quart
quarter
queen
queer
question
quick(ly)
quiet
quilt
quit
quite

rabbit

race
rack
radio
radish
rag
rail
railroad
railway
rain(y)
rainbow
raise
raisin
rake
ram
ran
ranch
rang
rap
rapidly
rat
rate
rather
rattle
raw
ray
reach
read
reader
reading
ready
real
really
reap
rear
reason
rebuild
receive
recess
record
red
redbird
redbreast
refuse
reindeer
rejoice
remain
remember
remind
remove
rent
repair
repay
repeat
report
rest
return
review

reward
rib
ribbon
rice
rich
rid
riddle
ride(r)
riding
right
rim
ring
rip
ripe
rise
rising
river
road
roadside
roar
roast
rob
robber
robe
robin
rock(y)
rocket
rode
roll
roller
roof
room
rooster
root
rope
rose
rosebud
rot
rotten
rough
round
route
row
rowboat
royal
rub
rubbed
rubber
rubbish
rug
rule(r)
rumble
run
rung
runner
running
rush

rust(y)
rye

sack
sad
saddle
sadness
safe
safety
said
sail
sailboat
sailor
saint
salad
sale
salt
same
sand(y)
sandwich
sang
sank
sap
sash
sat
satin
satisf ctory
Saturday
sausage
savage
save
savings
saw
say
scab
scales
scare
scarf
school
schoolboy
schoolhouse
schoolmaster
schoolroom
scorch
score
scrap
scrape
scratch
scream
screen
screw
scrub
sea
seal
seam
search
season

seat
second
secret
see(ing)
seed
seek
seem
seen
seesaw
select
self
selfish
sell
send
sense
sent
sentence
separate
September
servant
serve
service
set
setting
settle
settlement
seven
seventeen
seventh
seventy
several
sew
shade
shadow
shady
shake(r)
shaking
shall
shame
shan't
shape
share
sharp
shave
she
she'd
she'll
she's
shear(s)
shed
sheep
sheet
shelf
shell
shepherd
shine
shining

shiny
ship
shirt
shock
shoe
shoemaker
shone
shook
shoot
shop
shopping
shore
short
shot
should
shoulder
shouldn't
shout
shovel
show
shower
shut
shy
sick(ness)
side
sidewalk
sideways
sigh
sight
sign
silence
silent
silk
sill
silly
silver
simple
sin
since
sing
singer
single
sink
sip
sir
sis
sissy
sister
sit
sitting
six
sixteen
sixth
sixty
size
skate
skater

ski
skin
skip
skirt
sky
slam
slap
slate
slave
sled
sleep(y)
sleeve
sleigh
slept
slice
slid
slide
sling
slip
slipped
slipper
slippery
slit
slow(ly)
sly
smack
small
smart
smell
smile
smoke
smooth
snail
snake
snap
snapping
sneeze
snow(y)
snowball
snowflake
snuff
snug
so
soak
soap
sob
socks
sod
soda
sofa
soft
soil
sold
soldier
sole
some
somebody

somehow
someone
something
sometime(s)
somewhere
son
song
soon
sore
sorrow
sorry
sort
soul
sound
soup
sour
south(ern)
space
spade
spank
sparrow
speak(er)
spear
speech
speed
spell(ing)
spend
spent
spider
spike
spill
spin
spinach
spirit
spit
splash
spoil
spoke
spook
spoon
sport
spot
spread
spring
sprinkle
square
squash
squeak
squeeze
squirrel
stable
stack
stage
stair
stall
stamp
springtime

stand
star
stare
start
starve
state
station
stay
steak
steal
steam
steamboat
steamer
stell
steep
steeple
steer
stem
step
stepping
stick(y)
stiff
still(ness)
sting
stir
stitch
stock
stocking
stole
stone
stood
stool
stoop
stop
stopped
stopping
store
stories
stork
storm(y)
story
stove
straight
strange(r)
strap
straw
strawberry
stream
street
stretch
string
strip
stripes
strong
stuck
study
stuff

study	tale	thirteen	tooth	uncle	walnut
stung	talk(er)	thirty	toothbrush	under	want
subject	tall	this	toothpick	understand	war
such	tame	tho	top	underwear	warm
suck	tan	thorn	tore	undress	warn
sudden	tank	those	torn	unfair	was
suffer	tap	though	toss	unfinished	wash(er)
sugar	tape	thought	touch	unfold	washtub
suit	tar	thousand	tow	unfriendly	wasn't
sum	tardy	thread	toward(s)	unhappy	waste
summer	task	three	towel	unhurt	watch
sun	taste	threw	tower	uniform	watchman
Sunday	taught	throat	town	United States	water
sunflower	tax	throne	toy	unkind	watermelon
sung	tea	through	trace	unknown	waterproof
sunk	teach(er)	throw(n)	track	unless	wave
sunlight	team	thumb	trade	unpleasant	wax
sunny	tear	thunder	train	until	way
sunrise	tease	Thursday	tramp	unwilling	wayside
sunset	teaspoon	thy	trap	up	we
sunshine	teeth	tick	tray	upon	weak(ness)
supper	telephone	ticket	treasure	upper	weaken
suppose	tell	tickle	treat	upset	wealth weapon
sure(ly)	temper	tie	tree	upside	wear
surface	ten	tiger	trick	upstairs	weary
surprise	tennis	tight	tricycle	uptown	weather
swallow	tent	till	tried	upward	weave
swam	term	time	trim	us	web
swamp	terrible	tin	trip	use(d)	we'd
swan	test	tinkle	trolley	useful	wedding
swat	than	tiny	trouble		Wednesday
swear	thank(s)	tip	truck	valentine	wee
sweat	thankful	tiptoe	true	valley	weed
sweater	Thanksgiving	tire	truly	valuable	week
sweep	that	tired	trunk	value	weep
sweet(ness)	that's	'tis	trust	vase	weigh
sweetheart	the	title	truth	vegetable	welcome
swell	theater	to	try	velvet	well
swept	then	toad	tub	very	we'll
swift	their	toadstool	Tuesday	vessel	went
swim	them	toast	tug	victory	were
swimming	then	tobacco	tulip	view	we're
swing	there	today	tumble	village	west(ern)
switch	these	toe	tune	vine	wet
sword	they	together	tunnel	violet	we've
swore	they'd	toilet	turkey	visit	whale
	they'll	told	turn	visitor	what
table	they're	tomato	turtle	voice	what's
tablecloth	they've	tomorrow	twelve	vote	wheat
tablespoon	thick	ton	twenty		wheel
tablet	thief	tone	twice	wag	when
tack	thimble	tongue	twig	wagon	whenever
tag	thin	tonight	twin	waist	where
tail	thing	too	two	wait	which
tailor	think	took		wake(n)	while
take(n)	third	tool	ugly	walk	whip
taking	thirsty	toot	umbrella	wall	

whipped	wiggle	wise	wool	wrap	yes
whirl	wild	wish	woolen	wrapped	yesterday
whisky	wildcat	wit	word	wreck	yet
whisper	will	witch	wore	wren	yolk
whistle	willing	with	work(er)	wring	yonder
white	willow	without	workman	write	you
who	win	woke	world	writing	you'd
who'd	wind(y)	wolf	worm	written	you'll
whole	windmill	woman	worn	wrong	young
who'll	window	women	worry	wrote	youngster
whom	wine	won	worse	wrung	your(s)
who's	wing	wonder	worst		you're
whose	wink	wonderful	worth	yard	yourself
why	winner	won't	would	yarn	yourselves
wicked	winter	wood(en)	wouldn't	year	youth
wide	wipe	woodpecker	wound	yell	you've
wife	wire	woods	wove	yellow	

Dale-Chall Formula Multiplication Table of Weights

Average Sentence Length

.0496 X	1-	.0496	26-	1.2896
	2-	.0992	27-	1.3392
	3-	.1488	28-	1.3888
	4-	.1984	29-	1.4384
	5-	.2480	30-	1.4880
	6-	.2976	31-	1.5376
	7-	.3472	32-	1.5872
	8-	.3968	33-	1.6368
	9-	.4464	34-	1.6864
	10-	.4960	35-	1.7360
	11-	.5456	36-	1.7856
	12-	.5952	37-	1.8352
	13-	.6448	38-	1.8848
	14-	.6944	39-	1.9344
	15-	.7440	40-	1.9840
	16-	.7936	41-	2.0336
	17-	.8432	42-	2.0832
	18-	.8928	43-	2.1328
	19-	.9424	44-	2.1824
	20-	.9920	45-	2.2320
	21-	1.0416	46-	2.2816
	22-	1.0912	47-	2.3312
	23-	1.1408	48-	2.3808
	24-	1.1904	49-	2.4304
	25-	1.2400	50-	2.4800

Dale Score

.1579 X	1-	.1579	26-	4.1054
	2-	.3158	27-	4.2633
	3-	.4737	28-	4.4212
	4-	.6316	29-	4.5791
	5-	.7895	30-	4.7370
	6-	.9474	31-	4.8949
	7-	1.1053	32-	5.0528
	8-	1.2632	33-	5.2107
	9-	1.4211	34-	5.3686
	10-	1.5790	35-	5.5265
	11-	1.7369	36-	5.6844
	12-	1.8948	37-	5.8423
	13-	2.0527	38-	6.0002
	14-	2.2106	39-	6.1581
	15-	2.3685	40-	6.3160
	16-	2.5264	41-	6.4739
	17-	2.6843	42-	6.6318
	18-	2.8422	43-	6.7897
	19-	3.0001	44-	6.9476
	20-	3.1580	45-	7.1055
	21-	3.3159	46-	7.2634
	22-	3.4738	47-	7.4213
	23-	3.6317	48-	7.5792
	24-	3.7896	49-	7.7371
	25-	3.9475	50-	7.8950

FLESCH READABILITY FORMULA

1. Count the words in your piece of writing or, if you are using samples, take each sample and count each word in it up to 100. Count contractions and hyphenated words as one word. Count as words numbers or letters separated by space.

2. Count the syllables in your 100-word samples or, if you are testing a whole piece of writing, compute the number of syllables per 100 words. If in doubt about syllabication rules, use any good dictionary. Count the number of syllables in symbols and figures according to the way they are normally read aloud, e.g. two for $ ("dollars") and four for 1918 ("nineteen-eighteen"). If a passage contains several or lengthy figures, your estimate will be more accurate if you don't include these figures in your syllable count. In a 100-word sample, be sure to add instead a corresponding number of words in your syllable count. To save time, count all syllables except the first in all words of more than one syllable and add the total to the number of words tested. It is also helpful to "read silently aloud" while counting.

3. Figure the average sentence length in words for your piece of writing or, if you are using samples, for all your samples combined. In a 100-word sample, find the sentence that ends nearest to the 100-word mark - that might be the 94th word or the 109th word. Count the sentences up to that point and divide the number of words in those sentences by the number of sentences. In counting sentences, follow the units of thought rather than the punctuation: usually sentences are marked off by periods; but sometimes they are marked off by colons or semicolons - like these. But don't break up sentences that are joined by conjunctions like <u>and</u> or <u>but</u>.

4. Find your "reading ease" score by inserting the number of syllables per 100 words (word length, <u>wl</u>) and the average sentence length (sl) in the following formula:

   R.E. ("reading ease") = 206.835-.846wl-1.015 sl.

   The reading ease score will put your piece of writing on a scale between 0 (practically unreadable) and 100 (easy for any literate person).

FRY READABILITY FORMULA

1. Select three one-hundred-word passages from near the beginning, middle and end of the book. Skip all proper nouns.

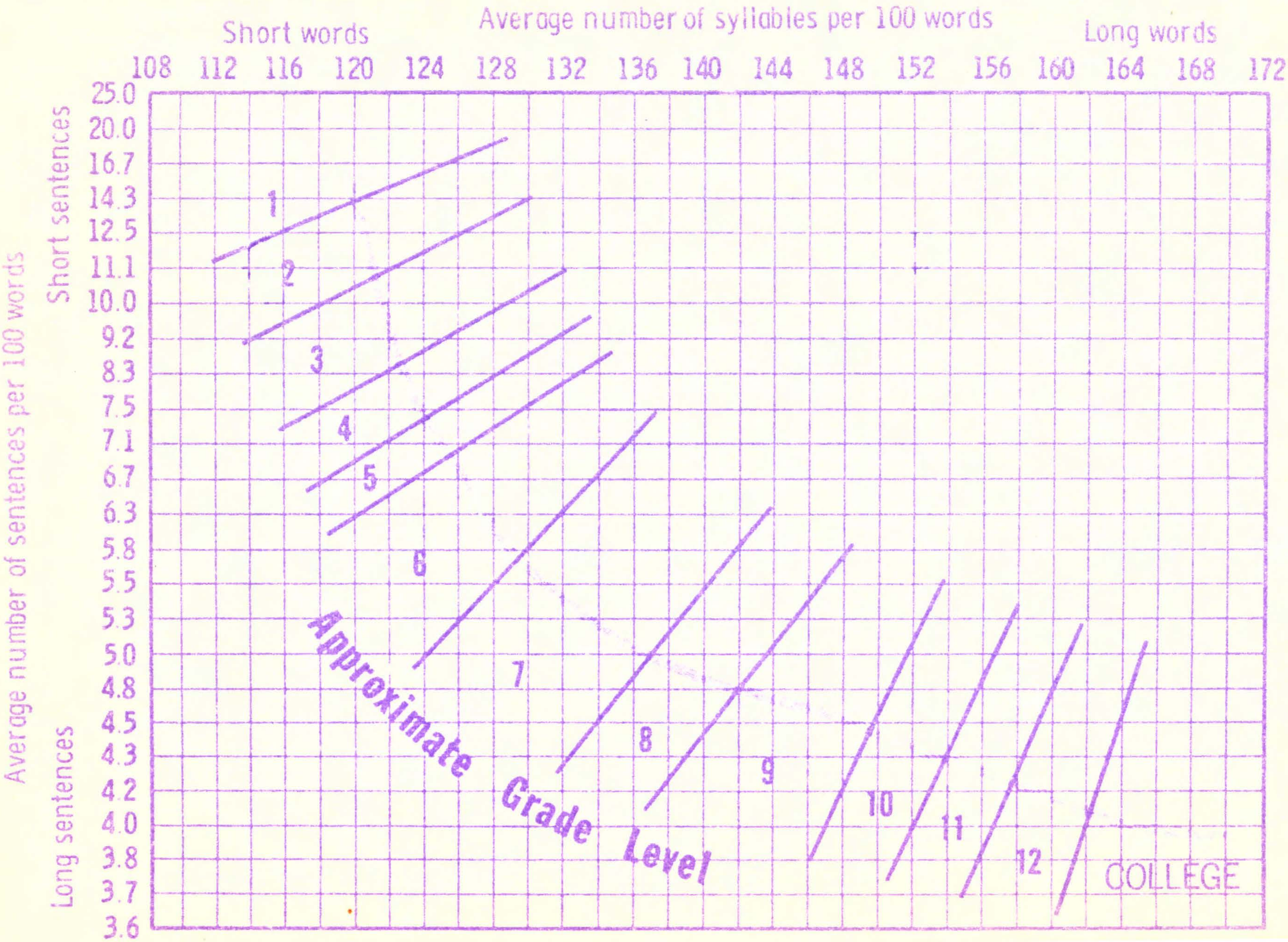
2. Count the total number of sentences in each hundred-word passage (estimating to nearest tenth of a sentence). Average these three numbers.

3. Count the total number of syllables in each hundred-word sample. There is a syllable for each vowel sound; don't be fooled by word size. Endings such as -y, -ed, -el, or -le usually make a syllable. I find it convenient to count every syllable over one in each word and add 100. Average the total number of syllables for the three samples.

4. Plot on the graph the average number of sentences per hundred words and the average number of syllables per hundred words. Most plot points fall near the heavy curved line. Perpendicular lines mark off approximate grade level areas. Plotting these averages on the graph will give an indication of grade level. (28: 514).

GRAPH FOR ESTIMATING READABILITY

By Edward Fry,
Rutgers University Reading Center



THE LORGE FORMULA

The Lorge Formula is used to judge the relative difficulty of written passages. Comprehension is judged by responses to questions based on the passages read by school children. Since the purpose for which the passage is read tends to influence the estimate of the reading difficulty, the formula cannot give an exact prediction for every occasion. The Lorge Formula, according to the authors, tends to over-estimate the difficulty of passages read primarily for appreciation or for a general impression. It tends to underestimate the difficulty of passages read for specific details or for following directions. The authors stress that the formula should not be used blindly.

The reading index of the Lorge Formula is an estimate of the reading grade at which the average school child will be able to answer approximately 50 percent of the questions correctly. A readibility index of 5.2 for a passage of written material indicates that the passage is within the reading comprehension of the average beginning fifth-grader.

Directions for Computing the Lorge Readibility Index

1. Selecting the Sample:
   a. If the passage is short (300 words or less) it is advisable to analyze the entire passage.
   b. If the passage is long, it is advisable to analyze samples...one sample near the beginning, one near the middle and one near the end of the passage. The samples should be approximately 100 words in length. Each sample should begin at the beginning of a sentence and end at the end of a sentence. Some random method should be adopted in selecting the samples so that subjective factors do not influence the selection.
   c. Books: Sample from 5 to 10 percent of the book (never less than 5 samples). Selection of samples should be evenly spaced through the book and some rule determined for dealing with pages where analysis would not be possible. (Example - page containing a picture - possible rule might be to use page immediately following).

2. Rules for Analysis:
   a. Count the number of words in the sample
      1. Hyphenated words are counted as one word. A word is considered to be hyphenated if listed as such in Webster's Unabridged Dictionary (2nd edition).
      2. Numbers are counted as one word. Example: "January 3, 1940"... "January" is one word...."three" is one word..."nineteen-forty" is one word.
      3. Compound words formed by names of places or persons are counted as one word...."New York; United States; Van Loon; Santa Claus; St. Nicholas."
   b. Counting the number of sentences.
      1. Follow regular punctuation for determination of sentences.

c. Count the prepositional phrases .

1. For use in this formula, a phrase is considered to be made up of a preposition and a noun, a pronoun or gerund. Infinitive phrases (phrases composed of a preposition and a verb) and prepositions followed by clauses, are not counted.
2. A list of prepositions:

about	behind	despite	notwithstanding	until
above	below	during	of	up
across	beneath	except	on	upon
after	beside	for	onto	with
along	between	in	till	without
among	beyond	inside	to	
at	by	into	under	
before	concerning			

d. Count the number of hard words.

1. "The Dale Check List for Gray-Leary" is used as a list of easy words. Hard words are those which do not appear on this list.
2. Each hard word is counted only once.
   a. Nouns - plurals formed by adding "s," "es", or "ies" in place of "y" are considered easy words. Other plurals are counted as hard words unless they appear on Dale list separately... "goose" and "geese" are considered different words. If addition of an "s" to the root word forms an entirely different word it is considered a different word...."Robert" and "Roberts" are different...and the same applies to proper nouns formed from root words...."wheel" and the name "Wheeling" are different words. The same is true of nouns formed by adding "r" or "er" to the root...."own" and "owner" are different.
   b. Adverbs - Separate count is not made of adverbs formed by adding "y" to the adjective ...."sad" and "sadly" are the same. Adverbs formed from an adjective in "e" are counted as different words...."true" and "truly" are different words.
   c. Adjectives - Adjectives formed by adding "n" to a proper noun are not counted separately..." Australia" and "Australian" are not counted separately. Adjectives formed by adding "ly" to the noun are counted separately...."home" and homely" are different words. Comparatives and superlatives of adjectives and adverbs are not counted separately, nor are "brave, braver, bravest" counted separately. The same rule applies if the final consonant is doubled..."red, redder, reddest," are not counted separately.
   d. Verbs - Verb forms ending in "ing, s, d, ed," or those changing "y" to "ies" and to "ied", and past participles formed by adding "n" are not counted separately...Thus, "play, plays, playing, played," are not counted separately. The same rule applies to verbs which drop the final "e" and add "ing" and those which double the final consonant and add "ing" or "ed" are not counted separately. Thus, "pace and pacing" are counted as one word, and "drip, dripped, dripping," are counted as one word. Past participles formed by adding "en" are counted as different from the root word..."eat, eaten" are different words.

e. Hyphenated words - Follow Webster's Dictionary. If the word is not shown as hyphenated in that source it is then considered as two words.

f. Compound names - Compound names of persons or places are counted as single words...."Santa Claus, New York."

g. Contractions - Contractions should be counted as different words from those from which they are derived...."he"s" is different from "he is"....."'cause" is different from"because".

h. Proper nouns - words which can be both common and proper nouns are counted as the same...."Jack and jack" are not counted separately.

i. Other Cases - Words formed by adding "y" to a word in the Dale list are considered different...."squeak, squeaky" are two different words. A word formed by adding two or more suffixes, to a listed word, one of which when added to the listed word is counted with it, that word is considered different from the root word...."happen, happening" are the same, but "happenings" is a different word. Words formed by adding "en" to a word in the list are considered different words...."gold, golden" are two diffenent words.

The Readability Index

(The following information is essential in analyzing a passage)

Title: ______________ Author ______________ Edition ______________

Publisher ______________ Date ______________ Volume ______________

Location of Sample: (Quote first and list lines and give page numbers)

a. First line ______________ Page ______________

b. List line ______________ Page ______________

Computation:

a. Average sentence length...divide the number of words in the sample by the number of sentences in the sample and multiply the result by .06. = ______________

b. Ration of prepositional phrases...divide thenumber of prepositional phrases in the sample by the number or words in the sample and multiply the result by 9.55 = ______________

c. Ratio of hard words....divide the number of hard words in the sample by the number of words in the sample and multiply the result by 10.43 = 1.9892

d. Add the constant... ______________

Readability Index =

Name of Analyst ______________ Date of Analysis ______________

A

a
about
across
act
afraid
afternoon
again
against
ago
air
all
almost
alone
along
already
also
always
am
American
an
and
animal
another
answer
any
anything
apple
are
arm
around
as
ask
at
away

B

baby
back
bad
ball
band
bank
baske
be
bear
beat
beautiful
because
bed
bee
been
before
begin
behind
being
believe
bell
belong
beside
best
better
between
big
bill
bird
bit
black
bless
blind
blood
blow
blue
board
boat
body
bone
born
both
bottom
bow
box
boy
branch
brave
bread
break
breakfast
bridge
bright
broken
brother
brought
brown
buidl
building
built
burn
busy
but
butter
buy
by

C

cake
call
came
can
cap
cape
captain
car
care
careful
carry
case
catch
cause
cent
center
chair
chance
change
chief
child
children
choose
Christmas
church
circle
city
class
clean
clear
clock
close
cloth
clothes
cloud
coal
coat
cold
color
come
coming
company
cock
cool
corn
corner
cost
could
count
country
course
cover
cow
cried
cross
crowd
crown
cry
cup
cut

D

dance
dark
day
dead
deep
did
die
different
dinner
do
doctor
does
dog
done
don't
door
double
down
draw
dream
dress
drink
drive
drop
dry
dust

E

each
ear
early
earth
east
easy
eat
edge
egg
eight
either
else
end
England
English
enough
even
evening
ever
every
everything
except
expect
eye

F

face
fair
fall
family
fancy
far
farm
farmer
fast
fat
father
feed
feel
feet
fell
fellow
felt
fence
few
field
fight
fill
find
fine
finger
finish
fire
first
fish
fit
five
fix
floor
flower
fly
follow
food
foot
for
forget
fourth
found
four
fresh
friend
form
from
front
fruit
full

G

game
garden
gate
gave
get
gift
girl
give
glad
glass
go
God
going
gold
golden
gone
good
got
grain
grass
gray
great
green
grew
ground
grow
guess

H

had
hair
half
hall
hang
happy
hard
has
hat
have
he
head
hear
heard
heart
heavy
help
her
here
herself
hide
high
hill
him
himself
his
hold
hole
home
hope
horse
hot
house
how
hundred
hunt
hurry
hurt

I

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J

jump
just

K

keep
kept
kill
kind
king
kiss
knee
knew
know

L

lady
laid
lake
large
last
late
laugh
lay
lead
learn
leave
left
leg
lesson
let
letter
lie
life
lift
light

like
line
lion
lips
listen
little
live
load
long
look
lost
lot
loud
love
low

M
made
mail
make
man
many
march
mark
market
matter
may
me
mean
measure
meat
meet
men
met
middle
might
mile
milk
mill
mind
mine
minute
miss
money
month
moon
more
morning
most
mother
mountain
mouth
move
Mr.
Mrs.
much
music
must
my

myself

N
name
near
neck
need
neighbor
neither
nest
never
new
New York
next
nice
night
nine
no
noise
none
noon
nor
north
nose
not
note
nothing
now
number

O
oak
ocean
of
off
office
often
old
on
once
one
only
open
or
other
our
out
outside
over
own

P
page
paint
pair
paper
part
party
pass
path
pay

pan
people
pick
picture
piece
place
plain
plant
play
please
point
poor
post
pound
present
press
pretty
pull
put

Q
quarter
queen
quick
quiet
quite

R
race
rain
ran
rather
reach
read
ready
real
reason
red
remember
rest
rich
ride
right
ring
river
road
road
rock
roll
roof
room
rose
round
row
run

S
said
sail
salt
same
sand

sat
save
sew
say
school
sea
season
seat
second
see
seed
seen
self
sell
send
sent
serve
set
seven
several
shake
skall
shape
she
sheep
shine
ship
shoe
shop
short
should
show
shut
sick
side
silk
sign
silver
sing
air
sister
sit
sir
size
skin
sky
sleep
slow
small
smile
smoke
snow
so
soft
sold
soldier
some
something

sometimes
song
soon
sound
south
space
speak
spot
spread
spring
square
stand
star
start
station
stay
step
stick
still
stone
stood
stop
store
storm
story
straight
street
strike
strong
such
sugar
suit
summer
sun
suppose
sure
surprise
sweet

T
table
tail
take
talk
tall
taste
teach
teacher
tear
tall
ten
then
thank
that
the
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them
then
there

these
they
thick
then
thing
think
this
those
though
thought
thousand
three
through
throw
tie
till
time
tire (d)
to
today
together
told
tomorrow
tongue
too
took
top
touch
town
trade
train
tree
true
try
turn
twelve

two

U
uncle
under
until
up
upon
us
use
V
valley
very
visit
W
wait
walk
wall
want
war
warm
was

wash
waste
watch
water
wave
way
we
wear
weather
week
wall
went
were
west
what
wheat
wheel
when
where
whether
which
while
white
who
whole
whom
why
wide
wild
will
win
wind
will
win
wind
window
wing
winter
wish
without
woman
wonder
wood
word
work
world
would
write
wrong

Y
yard
year
yellow
yes
yesterday
yet

you
young
your

Note:
all meanings
i.e.
Spring
season
jump
water
steel
coil

SRA READING-EASE CALCULATOR

1. Count off 100 words. Count all numbers as one word. Count <u>a</u>, <u>and</u>, and <u>the</u> whenever they appear.

2. Count the number of sentences in the 100 words, estimating the fraction of the last sentence. Set dial so that arrow points to number of sentences. The dial is marked so that it may be set for ¼, ½, or ¾ of a sentence.

3. Count the number of syllables in the 100 words. Count all numbers, pronouns, and well known names as one syllable.

4. Find the number of syllables on the vertical scale. The color opposite this number indicates the reading-ease.