TECHNICAL MANUAL

Lexile® Framework for Reading

Development and Validity Evidence

Bringing Meaning to Measurement

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January 2022

The Lexile® Framework for Reading Development and Validity Evidence

Technical Manual

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Table of Contents

List of Tables

List of Figures

The Lexile Framework for Reading

A reader's comprehension of text is dependent on many factors—the purpose for reading, the ability of the reader, and the text being read. The reader can be asked to read a text for many purposes including entertainment (literary experience), to gain information, or to perform a task. Each reader brings to the reading experience a variety of important factors: reading ability, prior knowledge, interest level, and developmental readiness. For any text, there are three factors associated with the readability of the text: complexity, support, and quality. All of these reader and text factors are important considerations when evaluating the appropriateness of a text for a reader. The Lexile Framework for Reading focuses primarily on two features: reader ability and reading text complexity.

The Lexile Framework for Reading measures for both texts and readers typically range from above 200L to below 1600L, but measures can range from below 0L for beginning reader materials (e.g., BR150L) or above 1600L for advanced materials. Within any single classroom, there will be a range of reading materials to reflect the student range of reading ability and interest in different topics and types of text.

Reading Text Complexity

All symbol systems share two features: a semantic component and a syntactic component. In language, the semantic units are words. Words are organized according to rules of syntax into thought units and sentences (Carver, 1974). In all cases, the semantic units vary in familiarity and the syntactic structures vary in complexity. The comprehensibility or difficulty of a text is dominated by the familiarity of the semantic units and by the complexity of the syntactic structures used in constructing the text. The Lexile Framework for Reading utilizes these two dominant features of language to measure reading text complexity by examining the characteristics of word frequency and sentence length. In addition, when measuring early reader texts, the Lexile Framework for Reading utilizes characteristics found to be important to the complexity of early reader text such as word decodabilty, patterning, and repetition.

Variables that Impact the Text Complexity of Upper Level Text

Semantic component. Most operationalizations of the semantic component are proxies for the probability that an individual will encounter a word in a familiar context and thus be able to infer its meaning (Bormuth, 1966). This is the basis of exposure theory, which explains the way receptive or hearing vocabulary develops (Miller and Gildea, 1987; Stenner, Smith, and Burdick, 1983). Klare (1963) hypothesized that the semantic component varied along a familiarity-to-rarity continuum. This concept was further developed by Carroll, Davies, and Richman (1971), whose word-frequency study examined the reoccurrence of words in a five-million-word corpus of running text. Knowing the frequency of words as they are used in written and oral communication provided the best means of inferring the likelihood that a word would be encountered by a reader and thus become a part of that individual’s receptive vocabulary.

Variables such as the average number of letters or syllables per word have been observed to be proxies for word frequency. There is a strong negative correlation between the length of words and the frequency of word usage. Polysyllabic words are used less frequently than monosyllabic words, making word length a good proxy for the likelihood that an individual will be exposed to a word.

In a study examining receptive vocabulary, Stenner, Smith, and Burdick (1983) analyzed more than 50 semantic variables in order to identify those elements that contributed to the difficulty of the 350 vocabulary items on Forms L and M of the *Peabody Picture Vocabulary Test*—Revised (Dunn and Dunn, 1981). Variables included part of speech, number of letters, number of syllables, the modal grade at which the word appeared in school materials, content classification of the word, the frequency of the word from two different word counts, and various algebraic transformations of these measures.

The first word frequency measure used was the raw count of how often a given word appeared in a corpus of 5,088,721 words sampled from a broad range of school materials (Carroll, Davies, and Richman, 1971). For example, the word "accident" appears 176 times in the 5,088,721-word corpus. The second word frequency measure used was the frequency of the "word family." A word family included: (1) the stimulus word; (2) all plurals (adding "-s" or "-es" or changing "-y" to "-ies"); (3) adverbial forms; (4) comparatives and superlatives; (5) verb forms ("-s," "-d," "-ed," and "-ing"); (6) past participles; and (7) adjective forms. For example, the word family for "accident" would include "accidental," "accidentally," "accidentals," and "accidents," and they would all have the same word frequency of 334. The frequency of a word family was based on the sum of the individual word frequencies from each of the types listed.

Correlations were computed between algebraic transformations of these means (mean frequency of the words in the test item and mean frequency of the word families in the test item) and the rank order of the test items. Since the items were ordered according to increasing difficulty, the rank order was used as the observed item difficulty. The log of the mean word frequency provided the strongest correlation with item rank order (r = -0.779) for the items on the combined form.

The Lexile Framework for Reading currently employs a 1.4 billion-word corpus when examining the semantic component of text. This corpus was assembled from the more than 90,000 texts that were measured by MetaMetrics for publishers from 1998 through 2012.

Syntactic component. Klare (1963) provides a possible interpretation for how sentence length works in predicting passage difficulty. He speculated that the syntactic component varied with the load placed on short-term memory. Crain and Shankweiler (1988), Shankweiler and Crain (1986), and Liberman, Mann, Shankweiler, and Westelman (1982) have also supported this explanation. The work of these individuals has provided evidence that sentence length is a good proxy for the demand that structural complexity places upon verbal short-term memory.

While sentence length has been shown to be a powerful proxy for the syntactic complexity of a passage, an important caveat is that sentence length is not the underlying causal influence (Chall, 1988). Researchers sometimes incorrectly assume that manipulation of sentence length will have

a predictable effect on passage difficulty. Davidson and Kantor (1982), for example, illustrated rather clearly that sentence length can be reduced and difficulty increased and vice versa.

Based on previous research, it was decided to use sentence length as a proxy for the syntactic component of reading difficulty in the Lexile Framework for Reading.

Variables that Impact the Text Complexity of Early Reader Texts

Texts designed for early readers are distinct from texts designed for more accomplished readers because they are usually designed specifically to facilitate reading development. For all readers, making meaning of the texts is always the focus, but for early readers, developing an understanding of how to "crack the code" requires specific attention. Early readers must develop the ability to hear sounds in words, develop sight words, and acquire word recognition strategies (Fitzgerald and Shanahan, 2000) as they develop the comprehension and fluency characteristic of more advanced readers. A number of studies support the finding that the presence of specific text features support the development of skills associated with code cracking. For example, word repetition reinforces sight-word learning and development of the sounds associated with spelling patterns (e.g., Vadasy, Sanders, & Peyton, 2005). Repeated phrases also reinforce scaffolding development of a variety of word recognition strategies (e.g., Ehri & McCormick, 1998). The use of words familiar in oral language enhances readers' ability to make meaning from words and permits more attention to word recognition (e.g., Muter, Hulme, Snowling, & Stevenson, 2004). Inclusion of several types of text-characteristic support may further support students' growth as readers. Research suggests that to appropriately describe early reader reading text complexity it is necessary to consider several text characteristics at multiple linguistic levels (Graesser & McNamara, 2011; Graesser, McNamara, & Kulikowich, 2011; Kintsch, 1998; and Snow, 2002). In general, levels of text characteristics include word level (e.g., word structure, word frequency), within-sentence level (e.g., syntax), and across-sentence/discourse level (e.g., referential cohesion). The research base supporting the importance of multiple levels of text characteristics for early phases of learning to read is extensive (Mesmer, Cunningham, & Hiebert, 2012) and has identified the importance of considering the impact of interaction between the features (Merlini Barbaresi, 2003; and Biber, 1988).

In order to determine which text characteristics had the greatest impact on reading text complexity for early readers, MetaMetrics identified 22 unique text characteristics at four linguistic levels: sounds-in-words, words (structure and meaning), within-sentence syntax, and across-sentence/discourse.

- *Sounds-in-Words*—number of phonemes in words, phonemic Levenshtein Distance, and mean internal phonemic predictability
- *Word Structure*—decoding demand, orthographic Levenshtein Distance, number of syllables in words, and mean internal orthographic predictability
- *Word Meaning*—age of acquisition, abstractness, and word rareness
- *Within-Sentence Syntax*—sentence length and grammar

- *Across-Sentence/Discourse*—linear edit distance, linear word overlap, cohesion triggers, type-token ratio, longest common string, edit distance, Cartesian word overlap, information load, and compression ratio

From these characteristics, 238 operationalizations were developed to capture the varied ways in which the characteristics could be quantified in terms of their presence in the text. Three hundred and fifty early reader texts designed for readers in Kindergarten through Grade 2 were selected to represent the range of text types early readers are likely to encounter. These included decodable books, phonics readers, leveled books, high-frequency readers, and various trade books. Two separate sub-studies were conducted to determine the relative challenge of the texts. One study collected primary-grade educators' ratings of the complexity of the 350 texts and the other gathered Grade 1 and 2 students' responses to a subset of 89 texts from the full set of 350 study texts. From these studies a text-complexity logit scale was created so that each text could be assigned a measure (Fitzgerald, Elmore, Koons, Hiebert, Bowen, Sanford-Moore & Stenner, 2015; Fitzgerald, Elmore, Hiebert, Koons, Bowen, Sanford-Moore & Stenner, 2016).

The Lexile Scale

In developing the Lexile Scale, the Rasch model (Wright and Stone, 1979) was used to estimate the difficulties of the items and the abilities of the persons on the logit scale.

The calibrations of the items from the Rasch model are objective in the sense that the relative difficulties of the items will remain the same across different samples of persons (specific objectivity). When two items are administered to the same group it can be determined which item is harder and which one is easier. This ordering should hold when the same two items are administered to a second group. If two different items are administered to the second group, there is no way to know which set of items is harder and which set is easier. The problem is that the location of the scale is not known. General objectivity requires that scores obtained from different test administrations be tied to a common zero—absolute location must be sample independent (Stenner, 1990). To achieve general objectivity, the theoretical logit difficulties must be transformed to a scale where the ambiguity regarding the location of zero is resolved.

The first step in developing a scale with a fixed zero was to identify two anchor points for the scale. The following criteria were used to select the two anchor points: they should be intuitive, easily reproduced, and widely recognized. For example, with most thermometers the anchor points are the freezing and boiling points of water. For the Lexile Scale, the anchor points are text from seven basal primers for the low end and text from *The Electronic Encyclopedia* (Grolier, Inc., 1986) for the high end. These points correspond to the middle of first grade text and the midpoint of workplace text.

The next step was to determine the unit size for the scale. For the Celsius thermometer, the unit size (a degree) is $1/100^{th}$ of the difference between freezing (0 degrees) and boiling (100 degrees) water. For the Lexile Scale, the unit size (a Lexile) was defined as $1/1000^{th}$ of the difference between the mean difficulty of the primer material and the mean difficulty of the encyclopedia

samples. Therefore, a Lexile by definition equals $1/1000^{th}$ of the difference between the difficulty of the primers and the difficulty of the encyclopedia.

The third step was to assign a value to the lower anchor point. The low-end anchor on the Lexile Scale was assigned a value of 200.

Finally, a linear equation of the form:

$$[(\text{Logit} + \text{constant}) \times \text{CF}] + 200 = \text{Lexile text measure} \qquad \text{Equation (1)}$$

was developed to convert logit difficulties to Lexile calibrations. The values of the conversion factor (CF) and the constant were determined by substituting in the low-end anchor point and then solving the system of equations.

The Lexile Scale ranges from below 200L to above 1600L. There is not an explicit bottom or top to the scale, but rather two anchor points on the scale (described above) that describe different levels of reading comprehension. The Lexile Framework for Reading Map, a graphic representation of the Lexile Scale from 200L to 1500L+, provides a context for understanding reading comprehension (see Appendix A).

Calibration of Text Difficulty of Upper Level Texts

The research study on semantic units (Stenner, Smith, and Burdick, 1983) was extended to examine the relationship of word frequency and sentence length to reading comprehension. In 1987(a), Stenner, Smith, Horabin, and Smith performed exploratory regression analyses to test the explanatory power of these variables. This analysis involved calculating the mean word frequency and the log of the mean sentence length for each of the 66 reading comprehension passages on the *Peabody Individual Achievement Test* (Dunn and Markwardt, 1970). The observed difficulty of each passage was the mean difficulty of the items associated with the passage (provided by the publisher) converted to the logit scale. A regression analysis based on the word-frequency and sentence-length measures produced a regression equation that explained most of the variance found in the set of reading comprehension tasks. The resulting correlation between the observed logit difficulties and the theoretical calibrations was 0.97 after correction for range restriction and measurement error. The regression equation was further refined based on its use in predicting the observed difficulty of the reading comprehension passages on eight other standardized tests. The resulting correlation between the observed logit difficulties and the theoretical calibrations across the nine tests was 0.93 after correction for range restriction and measurement error.

Once a regression equation is established linking the syntactic and semantic features of text to the difficulty of text, the equation can be used to calibrate test items and text. The result of the research was a regression equation linking the syntactic and semantic features of text to the difficulty of text. This equation can now be used to calibrate test items and text within the Lexile Framework for Reading.

Calibration of Text Difficulty of Early Reader Texts

To bring the observed difficulties (logit scores) of early reader texts from the two studies previously described (Fitzgerald, Elmore, Koons, Hiebert, Bowen, Sanford-Moore & Stenner, 2015; Fitzgerald, Elmore, Hiebert, Koons, Bowen, Sanford-Moore & Stenner, 2016) onto the Lexile scale, a theory-based linking procedure was conducted. First, Lexile text measures were calculated based only on the syntactic and semantic features of the text as done with upper level texts. Next, for approximately 10% of the texts the discrepancy between the observed difficulty and the theoretical Lexile reading measure was large, so the texts were flagged and not used in subsequent analyses. Finally, using the remaining 90% of the texts in the study, a linear linking function (SD line) was calculated. In linear linking, a transformation is chosen such that scores on two sets of data are considered to be linked if they correspond to the same number of standard deviations above (or below) the mean in some group of data elements (Angoff, 1984, cited in Petersen, Kolen, and Hoover, 1989; Kolen and Brennan, 2014).
The result of the linear linking function was that the early reader observed difficulties were transformed to Lexile text measures while still maintaining the relative ordering of the difficulty of the texts derived from the educator judgments and student performances.

Once observed Lexile reading measures were calculated, a random forest regression technique was employed to evaluate the importance of the 238 operationalizations of characteristics that research suggests affect reading text complexity of early reader texts. This process was conducted in several stages and is described in detail by Fitzgerald and Elmore and their colleagues (2015). The first step in the analysis was to set baseline performance. Eighty percent of the texts were selected for this training process and 20% were held as a validation sample. Three separate random forest regressions were conducted, one each for: (1) the 80% of the 350 texts that the teachers ordered (n = 279); (2) the 80% of the texts that the students were presented (n = 71), and (3) the two sets of texts combined (N = 350). Each random forest regression produced importance values for each of the 238 variables in relation to the text-complexity logit scale.

The next step in the analysis involved an iterative variable-selection procedure in which the variables with the smallest importance values were systematically removed and the effect on the model re-calculated. This process determined whether fewer variables could predict reading text complexity as well or nearly as well as the 238-variable model. The result was a set of nine variables:

- Word level variables—monosyllable decoding, syllable count, age of acquisition, word rareness, and abstractness
- Within-sentence and across-sentence/discourse level variables—intersentential complexity, phrase diversity, non-compressibility, and text density

Lastly, a final set of three random forest regression models was trained using the nine variables with the teacher text set, the student text set, and the two text sets combined. The resulting correlations for the teacher, student, and combined models were 0.89, 0.71, and 0.88, respectively. The validation samples, 20% of the teacher texts (n = 71) and 20% of the student texts (n = 19), were combined and a final random forest regression was run with the nine selected

variables as predictors. The model was validated with a correlation of 0.85 and RMSE of 9.68. The final model can now be used to calibrate texts intended for early-readers.

The nine variables have been grouped into four Early Reading Indicators based on the linguist level addressed:

- Decoding Demand (Decoding)—syllable count and monosyllable decoding demand
- Semantic Demand (Vocabulary)—abstractness, word rareness, and age of acquisition
- Syntactic Demand (Sentences)—intersentential complexity
- Structure Demand (Patterns)—non-compressibility, phrase diversity, and text density

The Enhanced Lexile Text Analyzer®

When text is analyzed by MetaMetrics, all electronic files are initially edited according to established guidelines used with the enhanced Lexile Text Analyzer software. These guidelines include the removal of all incomplete sentences, chapter titles, and paragraph headings; and running of a spell check. The text is then submitted to the enhanced Lexile Text Analyzer that examines the lengths of the sentences and the frequencies of the words for upper-level texts and the nine early-reader variables for lower-level texts. The enhanced Lexile Text Analyzer first looks at the text features of a piece of text and attempts to determine if the text is written for early readers (early reader texts) or for more advanced readers (upper level texts). Based on the results of the examination, the enhanced Lexile Text Analyzer applies the most appropriate word and sentence/discourse variables to the measurement process. The enhanced Lexile Text Analyzer then reports a Lexile reading measure for the text. If the measure of the text is 650L or below, the four Early Reading Indicators are also reported.

Reporting Lexile Reading Measures for Readers

Lexile measures are reported as a number followed by a capital "L" for "Lexile." There is no space between the measure and the "L," and measures of 1,000 or greater are reported without a comma (e.g., 1050L). All Lexile measures should be rounded to the nearest 5L to avoid over interpretation of the measures. As with any test score, uncertainty in the form of measurement error is present.

Lexile measures that are reported for an individual student should reflect the purpose for which they will be used. If the purpose is research (e.g., to measure growth at the student, grade, school, district, or state level), then actual measures should be used at all score points, rounded to the nearest integer. A computed Lexile measure of 772.5L would be reported as 773L. If the purpose is instructional, then the Lexile measures should be capped at the upper bound of measurement error (e.g., at the 95th percentile of the national Lexile reading norms) to ensure developmental appropriateness of the material. MetaMetrics expresses these as "Reported Lexile Reading Measures" and recommends that these measures be reported on individual score reports. The grade level caps used for reporting Grades 2–8 Lexile reading measures are shown in *Table 1*.

In instructional environments where the purpose of the Lexile reading measure is to appropriately match readers with texts, all scores below 0L should be reported as "BRxxxL." No student should receive a negative Lexile reading measure on a score report. The lowest reported value below 0L is BR400L.

Some assessments report a Lexile reading range for each student, which is 50L above and 100L below the student's actual Lexile reading measure. This range represents the boundaries between the easiest kind of reading material for the student and the level at which the student will be more challenged, yet can still read successfully.

Table 1. Maximum reported Lexile reading measures, by grade.

Grade/Level	Lexile Cap
Kindergarten	850L
Grade 1	900L
Grade 2	1100L
Grade 3	1200L
Grade 4	1300L
Grade 5	1400L
Grade 6	1500L
Grade 7	1600L
Grade 8	1700L
Grade 9	1725L
Grade 10	1750L
Grade 11	1800L
Grade 12	1825L

Validity Evidence for the Lexile Framework for Reading

The 2014 *Standards for Educational and Psychological Testing* (America Educational Research Association, American Psychological Association, and National Council on Measurement in Education) states that "validity refers to the degree to which evidence and theory support the interpretations of test scores for proposed uses of tests" (p. 11). In applying this definition to the Lexile Framework for Reading, the question that should be asked is "What evidence supports the use of the Lexile Framework for Reading to describe reading text complexity and reader ability?" Because the Lexile Framework for Reading addresses reading comprehension, an important aspect of validity evidence that should be brought to bear is evidence showing that the construct being addressed is indeed, reading comprehension. This type of validity evidence has traditionally been called construct validity. One source of construct validity evidence for the Lexile Framework for Reading can be evaluated by examining how well Lexile reading measures relate to other measures of reading ability and reading comprehension.

Relationship of Lexile Reading Measures to Other Measures of Reading Comprehension

The Lexile Framework for Reading has been linked to numerous standardized tests of reading comprehension. When assessment scales are linked, a common frame of reference can be used to interpret the test results. This frame of reference can be "used to convey additional normative information, test-content information, and information that is jointly normative and content-based. For many test uses, … [this frame of reference] conveys information that is more crucial than the information conveyed by the primary score scale" (Petersen, Kolen, and Hoover, 1989, p. 222). Linking the Lexile Framework for Reading with other measures of reading comprehension produces a common frame of reference: the Lexile reading measure.

Table 2 presents the results from linking studies conducted with the Lexile Framework for Reading. In these studies, students were administered a Lexile reading assessment and another assessment of reading comprehension. There is a strong relationship between reading comprehension ability as measured by the Lexile Framework for Reading and reading comprehension ability as measured by other assessments. For each of the tests listed, student reading comprehension scores can also be reported as Lexile reading measures. This dual reporting provides a rich, criterion-related frame of reference for interpreting the standardized test scores. When a student takes one of the standardized tests, in addition to receiving his norm-referenced test information, the student can receive a reading list consisting of texts (books and articles) targeted to his or her specific reading level.

Table 2. Results from linking studies conducted with The Lexile Framework for Reading.

Standardized Test	Grades in Study	*N*	Correlation Between Test Score and Lexile Measure
Gates-MacGinitie Reading Test	2, 4, 6, 8, and 10	4,644	0.90
Metropolitan Achievement Test (8th ed.)	2, 4, 6, and 8	2,713	0.92
The Iowa Assessments (Iowa Tests of Basic Skills and Iowa Tests of Educational Development)	3, 5, 7, 9, and 11	4,146	0.91
Stanford Achievement Test (Tenth Edition)	2, 4, 6, 8, and 10	3,064	0.93
Oregon Reading/Literature Knowledge and Skills Test	3, 5, 8, and 10	3,180	0.87
Oklahoma Core Competency Tests (OCCT)	3 – 8	8,437	0.81 to 0.86*
Wyoming Performance Assessment for Wyoming Students (PAWS)	3, 5, and 8 11	2,293 442	0.91 0.84
Arizona Instrument to Measure Progress (AIMS)	3, 5, 7, and 10	5,599	0.89
Comprehensive Testing Program (CPT 4 – ERB)	2, 4, 6, and 8	644	0.88
TOEFL iBT	NA	2,867	0.65
TOEIC	NA	2,770	0.74
Kentucky Performance Rating for Educational Progress (K-PREP)	3 – 8	6,480	0.71 to 0.79*
North Carolina ACT	11	2,675	0.84
North Carolina READY End-of-Grades/End-of-Course Tests (NC READY EOG/EOC)	3, 5, 7, and 8 E2	7,709 2,068	0.92 0.89
Georgia Milestones EOG/EOC Assessments	3 – 9, and AME	12,415	0.82 to 0.86*
State of Texas Assessments of Academic Readiness (STAAR™)	3 – 8 English I English II	5,856 620 1,063	0.86 0.87 0.87
ACT Aspire PreACT ACT	3, 5, 7, and EHS 10 11 – 12	1,264 376 297	0.85 0.80 0.79
West Virginia SAT School Day Reading	11	4,637	0.79
South Carolina READY Reading	3 – 8	10,951	0.94
ISIP Early Reading test Advanced Reading test	1 – 3 4, 6, and 8	5,471 6,479	0.87 0.65

*Notes: * Tests were not vertically scaled; separate linking equations were derived for each grade/course.*

The Lexile Framework for Reading and the Difficulty of Basal Readers

Lexile reading measures are organized in a sequential manner, so a lower Lexile reading measure for a text indicates that the text is less complex than text with a higher Lexile reading measure. Validity evidence for the internal structure (the sequential structure) of the Lexile Framework for Reading was obtained through a study that examined the relationship of basal reader sequencing to Lexile reading measures. In a study conducted by Stenner, Smith, Horabin, and Smith (1987b) Lexile reading calibrations were obtained for units in 11 basal series. It was presumed that each basal series was sequenced by difficulty. So, for example, the latter portion of a third-grade reader is presumably more difficult than the first portion of the same book. Likewise, a fourth-grade reader is presumed to be more difficult than a third-grade reader. Observed difficulties for each unit in a basal series were estimated by the rank order of the unit in the series. Thus, the first unit in the first book of the first grade was assigned a rank order of one and the last unit of the eighth-grade reader was assigned the highest rank order number.

Correlations were computed between the rank order and the Lexile reading calibration of each unit in each series. After correction for range restriction and measurement error, the average disattenuated correlation between the Lexile reading calibration of text comprehensibility and the rank order of the basal units was 0.995 (see *Table 3*).

Table 3. Correlations between theory-based calibrations produced by the Lexile equation and rank order of unit in basal readers.

Basal Series	Number of Units	r_{OT}	R_{OT}	R'_{OT}
Ginn Rainbow Series (1985)	53	.93	.98	1.00
HBJ Eagle Series (1983)	70	.93	.98	1.00
Scott Foresman Focus Series (1985)	92	.84	.99	1.00
Riverside Reading Series (1986)	67	.87	.97	1.00
Houghton-Mifflin Reading Series (1983)	33	.88	.96	.99
Economy Reading Series (1986)	67	.86	.96	.99
Scott Foresman American Tradition (1987)	88	.85	.97	.99
HBJ Odyssey Series (1986)	38	.79	.97	.99
Holt Basic Reading Series (1986)	54	.87	.96	.98
Houghton-Mifflin Reading Series (1986)	46	.81	.95	.98
Open Court Headway Program (1985)	52	.54	.94	.97
Total/Means*	660	.839	.965	.995

r_{OT} = raw correlation between observed difficulties (O) and theory-based calibrations (*T*).
R_{OT} = correlation between observed difficulties (O) and theory-based calibrations (*T*) corrected for range restriction.
R'_{OT} = correlation between observed difficulties (O) and theory-based calibrations (*T*) corrected for range restriction and measurement error.
*****Mean correlations are the weighted averages of the respective correlations.

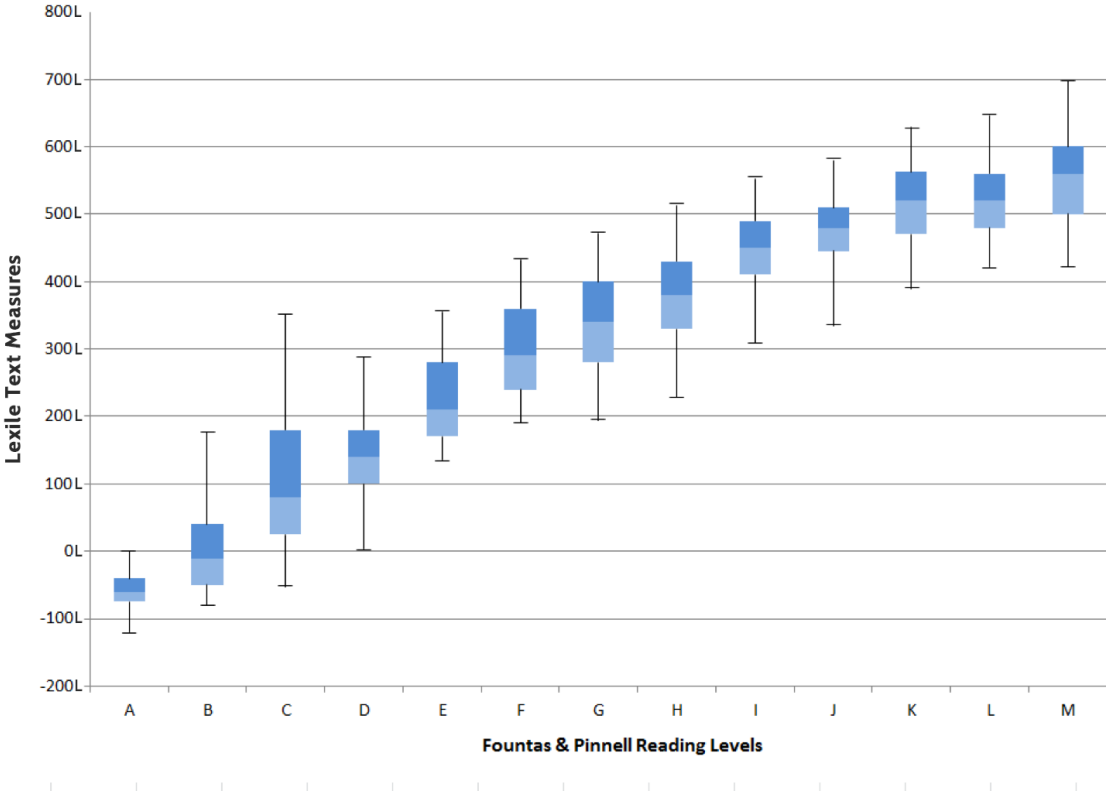
Based on the consistency of the results in *Table 3*, the Lexile reading theory was able to account for the unit rank ordering of the 11 basal series even with numerous differences in the series—

prose selections, developmental range addressed, types of prose introduced (i.e., narrative versus expository), and purported skills and objectives emphasized.

The Lexile Framework for Reading and Fountas & Pinnell Reading Levels

Koons, Elmore, Sanford-Moore, and Stenner (2017) explored the relationship between Fountas & Pinnell reading levels for a set of texts A through M (i.e. Kindergarten through Grade 2) and their corresponding Lexile reading measures to obtain construct validity evidence for the measurement of early reader texts. The Spearman correlation coefficient between the two text sets was 0.84, indicating a strong positive relationship. Because Fountas & Pinnell reading levels are "larger grained" than the Lexile reading measures, some variation of Lexile reading measures within each Fountas & Pinnell reading level was expected. *Figure 1* shows a series of box-and-whisker plots of the results. The box in each box-and-whisker plot depicts the interquartile range (IQR) with the bottom of the box at the 25th percentile of the distribution of Lexile reading measures, the line between the shaded portions at the median (50th percentile), and the top of the box at the 75th percentile. The bottom whisker depicts the text measure at the 5th percentile of the distribution and the top whisker depicts the text measure at the 95th percentile. *Figure 1* shows steadily increasing Lexile text reading measures across Fountas & Pinnell reading levels for each represented percentile except the 95th percentile of Level C (351L), which has a greater value than the 95th percentile of the two following levels (D: 288L; and E: 350L).

Figure 1. Progression of Lexile text measures and Fountas & Pinnell reading levels, Levels A through M.



The Lexile Framework for Reading and the Difficulty of Reading Test Items

Additional construct validity evidence was obtained by exploring the relationship between Lexile reading calibrations of item difficulties and actual item difficulties of reading comprehension tests. In a study conducted by Stenner, Smith, Horabin, and Smith (1987a), 1,780 reading comprehension test items appearing on nine nationally-normed tests were analyzed. The study correlated empirical item difficulties provided by the publishers with the Lexile reading calibrations specified by the computer analysis of the text of each item. The empirical difficulties were obtained in one of three ways. Three of the tests included observed logit difficulties from either a Rasch or three-parameter analysis (e.g., NAEP). For four of the tests, logit difficulties were estimated from item *p*-values and raw score means and standard deviations (Poznanski, 1990; Wright, and Linacre, 1994). Two of the tests provided no item parameters, but in each case, items were ordered on the test in terms of difficulty (e.g., PIAT). For these two tests, the empirical difficulties were approximated by the difficulty rank order of the items. In those cases where multiple questions were asked about a single passage, empirical item difficulties were averaged to yield a single observed difficulty for the passage.

Once theory-specified calibrations and empirical item difficulties were computed, the two arrays were correlated and plotted separately for each test. The plots were checked for unusual residual distributions and curvature, and it was discovered that the Lexile equation did not fit poetry items or noncontinuous prose items (e.g., recipes, menus, or shopping lists). This indicated that the universe to which the Lexile equation could be generalized was limited to continuous prose. The poetry and noncontinuous prose items were removed and correlations were recalculated. *Table 4* contains the results of this analysis.

Table 4. Correlations between theory-based calibrations produced by the Lexile equation and empirical item difficulties.

Test	Number of Questions	Number of Passages	Mean	SD	Range	Min	Max	r_{OT}	R_{OT}	R'_{OT}
SRA	235	46	644	353	1303	33	1336	.95	.97	1.00
CAT-E	418	74	789	258	1339	212	1551	.91	.95	.98
Lexile	262	262	771	463	1910	−304	1606	.93	.95	.97
PIAT	66	66	939	451	1515	242	1757	.93	.94	.97
CAT-C	253	43	744	238	810	314	1124	.83	.93	.96
CTBS	246	50	703	271	1133	173	1306	.74	.92	.95
NAEP	189	70	833	263	1162	169	1331	.65	.92	.94
Battery	26	26	491	560	2186	−702	1484	.88	.84	.87
Mastery	85	85	593	488	2135	−586	1549	.74	.75	.77
Total/ Mean	1780	722	767	343	1441	50	1491	.84	.91	.93

r_{OT} = raw correlation between observed difficulties (O) and theory-based calibrations (*T*).
R_{OT} = correlation between observed difficulties (O) and theory-based calibrations (*T*) corrected for range restriction.
R'_{OT} = correlation between observed difficulties (O) and theory-based calibrations (*T*) corrected for range restriction and measurement error.
*****Means are computed on Fisher Ƶ transformed correlations.

The last three columns in *Table 4* show the raw correlation between observed (O) item difficulties and theoretical (T) item calibrations, with the correlations corrected for restriction in range and measurement error. The Fisher Z mean of the raw correlations (r_{OT}) is 0.84. When corrections are made for range restriction and measurement error, the Fisher Z mean disattenuated correlation between theory-based calibration and empirical difficulty in an unrestricted group of reading comprehension items (R'_{OT}) is 0.93. These results show that most attempts to measure reading comprehension, no matter what the item form, type of skill or objectives assessed, or item type used, measure a common comprehension factor specified by the Lexile reading theory.

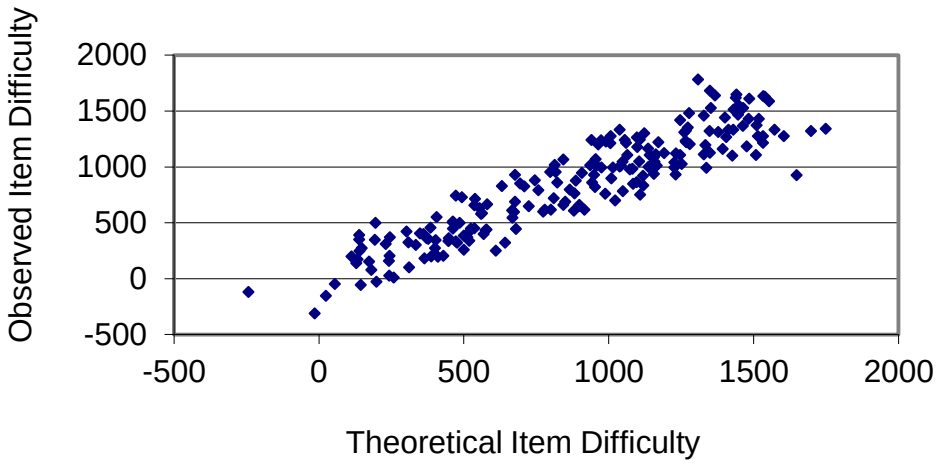
Text Measure Error Associated with the Lexile Framework for Reading

To determine a Lexile reading measure for a text, the standard procedure is to process the entire text. All pages in the work are concatenated into an electronic file that is processed by the enhanced Lexile Reading Analyzer software (developed by MetaMetrics, Inc.). The analyzer "slices" the text file into as many 125-word passages as possible, analyzes the set of slices, and then calibrates each slice in terms of the logit metric. That set of calibrations is then processed to determine the Lexile reading measure corresponding to a 75% comprehension rate. The analyzer uses the slice calibrations as test item calibrations and then solves for the measure corresponding to a raw score of 75% (e.g., 30 out of 40 correct, as if the slices were test items). The enhanced Lexile Reading Analyzer automates this process, but what "certainty" can be attached to each text measure?

Using a bootstrap procedure to examine error due to the text samples, the above analysis could be repeated (Efron, 1981; Sitter, 1992). The result would be an identical text measure to the first, because there is no sampling error when a complete text is calibrated.

There is, however, another source of error that increases the uncertainty about where a text is located on the Lexile Framework for Reading Map. The Lexile reading theory is imperfect in its calibration of the difficulty of individual text slices. To examine this source of error, 200 items that had been previously calibrated and shown to fit the model were administered to 3,026 students in Grades 2 through 12 in a large urban school district. For each item the observed item difficulty calibrated from the Rasch model was compared with the theoretical item difficulty calibrated from the regression equation used to calibrate texts. A scatter plot of the data is presented in *Figure 2*.

Figure 2. Scatter plot between observed item difficulty and theoretical item difficulty.



The correlation between the observed and the theoretical calibrations for the 200 items was 0.92 and the root mean square error was 178L. Therefore, for an individual slice of text the measurement error is 178L.

The standard error of measurement associated with a text is a function of the error associated with one slice of text (178L) and the number of slices that are calibrated from a text. Very short books have larger uncertainties than longer books. A book with only four slices would have an uncertainty of 89L whereas a longer book such as *War and Peace* (4,082 slices of text) would only have an uncertainty of 3L (*Table 5*).

Table 5. Standard errors for selected values of the length of the text.

Title	Number of Slices	Text Measure	Standard Error of Text
The Stories Julian Tells	46	520L	26
Bunnicula	102	710L	18
The Pizza Mystery	137	620L	15
Meditations of First Philosophy	206	1720L	12
Metaphysics of Morals	209	1620L	12
Adventures of Pinocchio	294	780L	10
Red Badge of Courage	348	900L	10
Scarlet Letter	597	1420L	7
Pride and Prejudice	904	1100L	6
Decameron	2431	1510L	4
War and Peace	4082	1200L	3

A typical Grade 3 reading test has approximately 2,000 words in the passages. To calibrate this text, it would be sliced into 16 125-word passages. The error associated with this text measure would be 45L. A typical Grade 7 reading test has approximately 3,000 words in the passages and the error associated with the text measure would be 36L. A typical Grade 10 reading test has approximately 4,000 words in the passages and the error associated with the text measure would be 30L.

The Find a Book tool (hub.lexile.com/find-a-book/search) contains information about each book analyzed: author, Lexile reading measure and Lexile Code, awards, ISBN, and developmental level as determined by the publisher. For some books, Find a Book also provides Lexile text measures by chapter along with selected vocabulary words.

Lexile Item Bank

The Lexile Item Bank contains over 10,000 reading comprehension items that have been developed since 1986 for research purposes with the Lexile Framework for Reading.

Passage selection. The passages used for item development are excerpted from authentic text, authored by MetaMetrics' staff, or commissioned by MetaMetrics' staff. Excerpted authentic text passages are selected from "real world" reading materials that students encounter both in and out of the classroom. Sources include textbooks, literature, and periodicals from a variety of interest areas and material written by authors of different backgrounds. Passages authored or commissioned by MetaMetrics staff are created to model "real world" reading materials. The following criteria are used to select passages from authentic and authored passages:

- The passage consists of one main idea or contains one complete piece of information.
- Understanding the passage is independent of the information that comes before or after the passage in the source text.
- Understanding the passage is independent of prior knowledge not contained in the passage.

When writing items based on published text, item writers examine blocks of text that have Lexile reading measures within 100L of the source text (source targeting). Item writers select four to five source-targeted text blocks for potential item development. If it is necessary to shorten or lengthen a passage in order to meet the criteria for passage selection, the item writer can immediately recalibrate the text to ensure that it is still targeted to within 100L of the complete text. Items are then developed in conjunction with their associated passages.

When writing original passages, MetaMetrics staff who are experienced in item development and have experience with the everyday reading ability of students at various levels, write original content calibrated to specific Lexile reading zones. Please see "Item Writer Training" in the next section for a detailed description of MetaMetrics' item development process.

Item format. The native-Lexile reading item format is an embedded completion task. The embedded completion format is similar to the fill-in-the-blank format. When properly written,

this format directly assesses the reader's ability to draw inferences and establish logical connections between the ideas in the passage (Haladyna, 1994). The reader is presented with a passage of approximately 30 to 125 words in length. The passages are shorter for early readers and longer for more advanced readers. The passage is then response illustrated (a statement is added at the end of the passage with a missing word or phrase followed by four options). From the four options presented, the reader is asked to select the "best" option that completes the statement. With this format, all options are semantically and syntactically appropriate completions of the sentence, but one option is unambiguously the "best" option when considered in the context of the passage.

The statement portion of the embedded completion item can assess a variety of skills related to reading comprehension: paraphrase information in the passage, draw a logical conclusion based on the information in the passage, make an inference, or make a generalization based on the information in the passage. The statement is written to ensure that by reading and comprehending the passage the reader is able to select the correct option. When the embedded completion statement is read by itself, each of the four options is plausible.

Items used to assess the reading ability of early readers include picture items, picture/word audio enhanced items, one-sentence items, and two-sentence items. These items are designed using Lexile appropriate vocabulary, sight words, images, and other text characteristics typically associated with early reading. More information on foundational reading items is provided in the next section.

The components of the Lexile Item Bank reading comprehension items and their descriptions are included below.

> *Passage*—the ancillary text for which an item is written. For most items, the Lexile reading measure of the passage is considered the Lexile reading measure of the item. Each passage is used for only one item. For picture items, an image is in place of the passage. For one-sentence items, the passage consists of the stem only. And for two-sentence items, one sentence acts as the passage.
>
> *Stem*—the question or embedded completion statement. For embedded completion statements, they should appear as if they were written as part of the passage. The statement portion of the embedded completion item can assess a variety of skills related to reading comprehension: paraphrase information in the passage, draw a logical conclusion based on the information in the passage, make an inference, identify a supporting detail, or make a generalization based on the information in the passage. The statement is written to ensure that by reading and comprehending the passage the reader is able to select the correct option.
>
> *Correct answer*—the correct response. The correct answer (key) typically has a Lexile reading measure similar to the measure of the passage.

Distractor(s)—the three wrong responses that are semantically and syntactically correct. These should be attractive responses if the reader has not read the passage. The distractors have similar Lexile reading measures as the correct answer.

Foundational reading items. Early in their pathway to reading, students develop foundational reading skills which are associated with improved reading outcomes in later stages of reading development and ultimately reading comprehension (National Governors Association & CCSSO, 2010; National Reading Panel, 2000). To support teachers with evaluating the foundational reading skills of students during their early literacy development, and inform instruction appropriate assessment items are needed. In 2019, MetaMetrics conducted research to expand the Lexile Item Bank to include items on the Lexile scale that measure foundational reading skills for children ages 3 to 7/Pre-K to Grade 2 (Webb, Sanford-Moore, Koons, Baker, Hinson, Pringle, and Thorpe, 2021). This research led to the development of a foundational reading framework consisting of three primary domains — Alphabet Knowledge, Phonological Awareness, and Phonics. Each domain is further divided into two or more subdomains (see *Table 6*).

Table 6. Foundational reading domains and subdomains, by grade.

Domain	Subdomain	Grade		
		PK	K	G1
Alphabet Knowledge	Alphabetic Awareness	x	x	
	Letter Sequence		x	
Phonological Awareness	Syllables		x	
	Onsets and Rimes		x	
	Phoneme Isolation		x	x
	Phoneme Blending		x	x
	Phoneme Segmenting		x	x
	Phoneme Manipulation			x
	Rhyme			x
Phonics	Consonant Sounds		x	x
	Consonant Digraphs and Blends			x
	Letter Sound Correspondence		x	
	Vowel Sounds		x	x
	Word Families			x

Targeting each of the foundational reading domains and subdomains in *Table 6*, MetaMetrics developed items (N = 102) which were then reviewed by subject matter experts, teachers, and test development researchers in summer 2019 and field-tested in fall 2019. The participants in the field-test study included a total of 1,738 students in Pre-kindergarten (n = 222), Kindergarten (n = 901) and Grade 1 (n = 615) across 30 U.S. states representative of all geographical regions. The students were from 111 classrooms in 73 different schools. Analysis of the resulting data placed each item on the Lexile scale.

Item writer training. Item writers are professional writers, classroom teachers, and other educators who have had experience with the everyday reading ability of students at various

levels. Experienced item writers help to ensure that all Lexile Item Bank reading comprehension items are valid measures of reading comprehension. New item writers practice item writing and reviewing over one to two months so that senior curriculum specialists can provide them with specific and individualized feedback to ensure proper training. Item writers are provided with training materials concerning the embedded completion item format and guidelines for selecting passages, developing statements, and selecting options. The item writing training materials also contain examples of poorly constructed items to illustrate the criteria used to evaluate items and corrections based on those criteria. Item writers are also provided vocabulary lists to use during statement and option development. The vocabulary lists were assembled from word lists compiled by MetaMetrics based on vocabulary research related to determining the Lexile reading measures (difficulty) of words (MetaMetrics, 2006). The rationale was that these words should be part of a reader's "working" vocabulary since they had been learned the previous year.

Item writers are given extensive training related to "sensitivity" issues. Item writing training materials provide examples of sensitivity issues and identify areas to avoid when selecting or writing passages and developing items. The following areas are covered: violence and crime, sources of common phobias, negative emotions such as death and family issues, offensive language, drugs/alcohol/tobacco, sex/attraction, race/ethnicity, class, gender, religion, supernatural/magic, parent/family, politics, animal cruelty and hunting, environmental issues, brand names, and junk food. These materials were developed based on material published by McGraw-Hill (Guidelines for Bias-Free Publishing, 1983) related to universal design and fair-access—the equal treatment of the sexes, fair representation of minority groups, and the fair representation of disabled individuals.

Item review. All items are subjected to a multi-stage review process. First, items are reviewed and edited by item writers and reviewers according to the 25 criteria identified in the item writing materials and for sensitivity issues. Approximately 25% of the items developed are deleted for various reasons. Where possible, items are edited and maintained in the item bank. Items are reviewed and edited by a group of specialists that represent various perspectives—curriculum specialists, content editors, fact checkers, sensitivity reviewers, and test developers. These individuals examine each item for sensitivity issues, grammar and spelling, and item quality (stem, key, and distractors).

During the second stage of the item review process, items are either "approved as presented," "approved with edits," or "rejected." Approximately 10% of the items written are "approved with edits" or "rejected" at this stage. When necessary, item writers receive additional feedback and training.

Item analyses. As part of the linking studies and research studies conducted by MetaMetrics, items in the Lexile Item Bank are evaluated in terms of difficulty (relationship between logit [observed Lexile reading measure] and theoretical Lexile reading measure), internal consistency (point-biserial or point-measure correlation), and bias (ethnicity and gender where possible). Where necessary, items are deleted from the item bank or revised and recalibrated.

In addition to content and sensitivity reviews during the development process, Lexile Item Bank items are field-tested as part of MetaMetrics on-going research. Lexile Item Bank items may be

field-tested as part of stand-alone research field tests or they may be embedded within research tests for concurrent projects. During the spring of 1999, 8 levels of a Lexile reading assessment were administered in a large urban school district to students in Grades 1 through 12. The 8 test levels were administered in Grades 1, 2, 3, 4, 5, 6, 7-8, and 9-12 and ranged from 40 to 70 items depending on the grade level. A total of 427 items were administered across the 8 test levels. Each item was answered by at least 9,000 students (the number of students per level ranged from 9,286 in Grade 2 to 19,056 in Grades 9-12). The item responses were submitted to a Winsteps Rasch analysis. The resulting item difficulties (in logits) were assigned Lexile reading measures by multiplying by 180 and anchoring each set of items to the mean theoretical difficulty of the items on the form.

MetaMetrics continues to add new items to its item bank and regularly evaluates items for potential use on linking studies. Each time items are administered, their empirical data are evaluated to determine whether they should be removed from the item bank, revised and retested, or kept for future use on tests developed for MetaMetrics' partners, linking studies, and research studies.

The Lexile Framework and Instruction

To encourage optimal progress with the use of any reading materials, teachers need to be aware of the complexity level of the text relative to a student's reading level. A text that is too difficult may serve to undermine a student's confidence and diminish learning. Frequent use of text that is too easy may foster poor work habits and unrealistic expectations that will undermine the later success of the best students.

When students confront new kinds of texts and texts containing new content, the introduction can be softened and made less intimidating by guiding the student to easier reading. On the other hand, students who are comfortable with a particular genre or format or the content of such texts can be challenged with more difficult reading levels, which will reduce boredom and promote the greatest rate of development of vocabulary and comprehension skills.

Similarly, teachers can use Lexile reading measures to guide a struggling student by selecting texts at the lower end of the student's Lexile reading range (e.g., 50L below his or her Lexile reading measure). At the same time, teachers can also motivate advanced students by challenging them with reading texts at the midpoint of their Lexile reading range or slightly above (i.e., 25L above to 100L above his or her Lexile reading measure).

The Lexile Framework for Reading and Forecasted Comprehension Rates

An examinee with a Lexile reading measure of 600L who is given a text measured at 600L is expected to have a 75% comprehension rate. This 75% comprehension rate is the basis for selecting text that is targeted to the individual's reading ability, but what exactly does it mean? And what would the comprehension rate be if this same examinee were given a text measured at 350L or one at 850L?

The 75% comprehension rate for an examinee-text pairing can be given an operational meaning by imagining the text is carved into item-sized slices of approximately 125–140 words with a question embedded in each slice. An individual who answers three-fourths of the questions correctly has a 75% comprehension rate.

Suppose instead that the text and the examinee measures are not the same. It is the difference in Lexile reading measures between the examinee and text that governs comprehension. If the text measure is less than the examinee measure, the comprehension rate will exceed 75 percent. If not, it will be less. The question is "By how much?" What is the expected comprehension rate when a 600L individual reads a 350L text?

If all the item-sized slices in the 350L text had the same calibration, the 250L difference between the 600L examinee and the 350L text could be determined using the Rasch model equation. This equation describes the relationship between the measure of an examinee's level of reading comprehension and the calibration of the items. Unfortunately, comprehension rates calculated by this procedure would be biased because the calibrations of the slices in ordinary prose are not

all the same. The average difficulty level of the slices *and* their variability both affect the comprehension rate.

Although the exact relationship between comprehension rate and the pattern of slice calibrations is complicated, Equation 2 is an unbiased approximation:

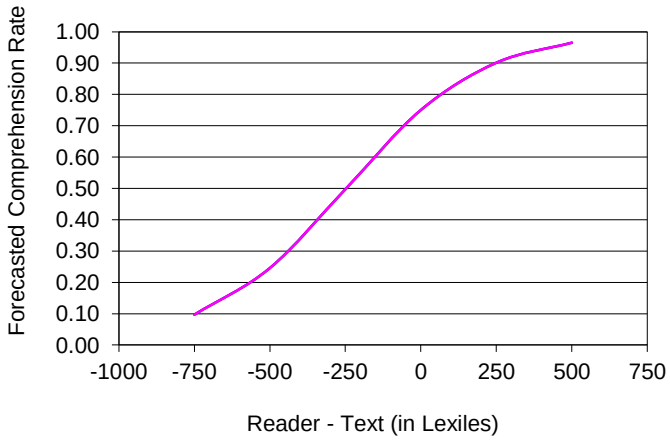
$$Rate = \frac{e^{ELD+1.1}}{1+e^{ELD+1.1}} \qquad \text{Equation (2)}$$

where ELD is the "effective logit difference" given by

$$\text{ELD} = (\text{Examinee Lexile measure} - \text{Text Lexile measure}) \div 225. \qquad \text{Equation (3)}$$

Figure 3 shows the general relationship between examinee-text discrepancy and forecasted comprehension rate. When the examinee measure and the text calibration are the same (difference of 0L) then the forecasted comprehension rate is 75 percent. In the example in the preceding paragraph, the difference between the examinee measure of 600L and the text calibration of 350L is 250L. Referring to *Figure 3* and using +250L (examinee minus text), the forecasted comprehension rate for this examinee-text combination would be 90 percent.

Figure 3. Relationship between examinee-text discrepancy and forecasted comprehension rate.



Tables 7 and *8* show comprehension rates calculated for various combinations of examinee measures and text calibrations.

Table 7. Comprehension rates for the same individual with materials of varying comprehension difficulty.

Examinee Reading Measure	Text Measure	Sample Titles	Forecasted Comprehension Rate
1000L	500L	*Tornado* (Byars)	96%
1000L	750L	*The Martian Chronicles* (Bradbury)	90%
1000L	1000L	*Reader's Digest*	75%
1000L	1250L	*The Call of the Wild* (London)	50%
1000L	1500L	*On the Equality Among Mankind* (Rousseau)	25%

Table 8. Comprehension rates of different examinee abilities with the same material.

Examinee Reading Measure	Calibration for a Grade 10 Biology Textbook	Forecasted Comprehension Rate
500L	1000L	25%
750L	1000L	50%
1000L	1000L	75%
1250L	1000L	90%
1500L	1000L	96%

The subjective experience of 50%, 75%, and 90% comprehension as reported by examinees varies greatly. A 1000L examinee reading 1000L text (75% comprehension) reports confidence and competence. Individuals listening to such an examinee report that the examinee can sustain the meaning thread of the text and can read with motivation and appropriate emotion and emphasis. In short, such examinees appear to comprehend what they are reading. A 1000L examinee reading 1250L text (50% comprehension) encounters so much unfamiliar vocabulary and difficult syntactic structures that the meaning thread is frequently lost. Such examinees report frustration and seldom choose to read independently at this level of comprehension. Finally, a 1000L examinee reading 750L text (90% comprehension) reports total control of the text, reads with speed, and experiences automaticity during the reading process.

The primary utility of the Lexile Framework for Reading is its ability to forecast what happens when examinees confront text. With every application by teacher, examinee, or librarian there is a test of the framework's accuracy. The Lexile Framework for Reading makes a point prediction every time a text is chosen for an individual. Anecdotal evidence suggests that the Lexile Framework for Reading predicts as intended. That is not to say that there is an absence of error in forecasted comprehension. There is error in text measures, examinee measures, and their difference modeled as forecasted comprehension. However, the error is sufficiently small that the judgments about examinees, texts, and comprehension rates are useful.

Examinee forecasted comprehension rate. Using Equation 3 with different combinations of examinee measure and text difficulty, a forecasted comprehension rate can be determined. *Table 9* shows the changes in the forecasted comprehension rate for different combinations of examinee and text interactions.

Table 9. Effect of examinee-text discrepancy on forecasted comprehension rate.

Examinee Lexile Reading Measure	Text Lexile Measure	Difference	Forecasted Comprehension Rate
1000L	970L	30L	77.4%
1000L	975L	25L	77.0%
1000L	980L	20L	76.7%
1000L	985L	15L	76.3%
1000L	990L	10L	75.8%
1000L	995L	5L	75.4%
1000L	1000L	0L	75.0%
1000L	1005L	-5L	74.6%
1000L	1010L	-10L	74.2%
1000L	1015L	-15L	73.8%
1000L	1020L	-20L	73.3%
1000L	1025L	-25L	72.9%
1000L	1030L	-30L	72.4%

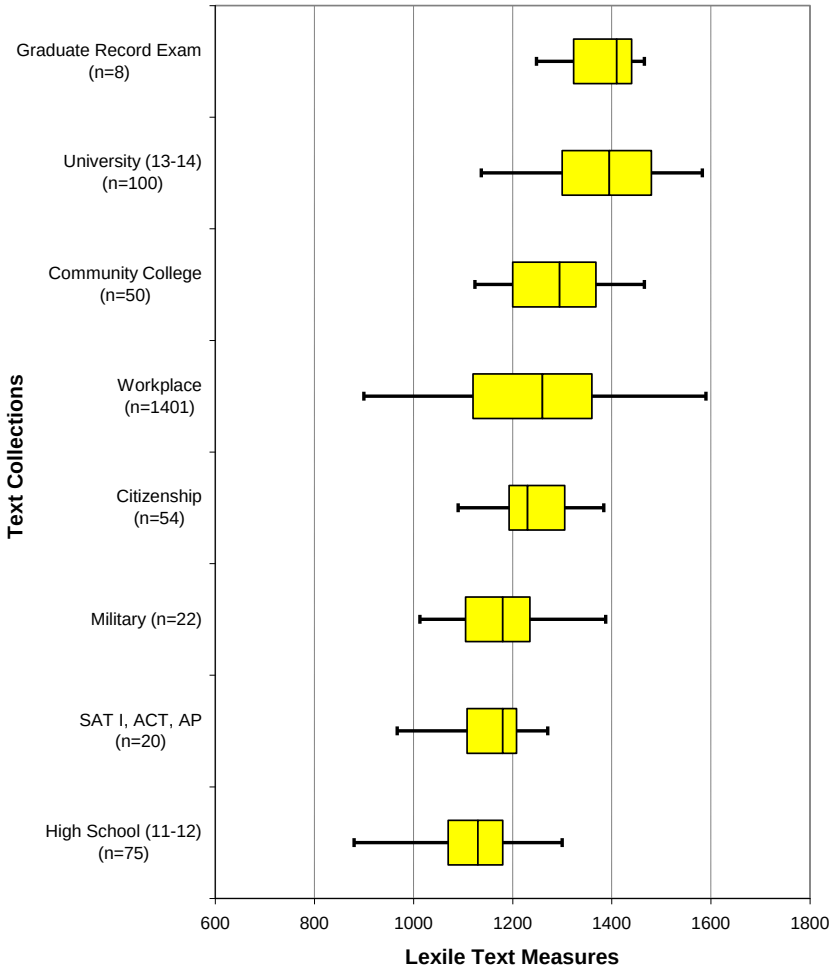
College and Career Reading Demands

There is increasing recognition of the importance of bridging the gap that exists between K-12 and higher education and other postsecondary endeavors. Many state and policy leaders have formed task forces and policy committees such as P-20 councils.

In the *Journal of Advanced Academics* (Summer 2008), Williamson investigated the gap between high school textbooks and various reading materials across several postsecondary

domains. The resources Williamson used were organized into four domains that correspond to the three major postsecondary endeavors that students can choose—further education, the workplace, or the military—and the broad area of citizenship, which cuts across all postsecondary endeavors. Williamson discovered a substantial increase in reading expectations and reading text complexity from high school to postsecondary domains—a gap large enough to help account for high remediation rates and disheartening graduation statistics (Smith, 2011).

Figure 4. A continuum of text difficulty for the transition from high school to postsecondary experiences (box plot percentiles: 5th, 25th, 50th, 75th, and 95th).[1]



In Texas, two studies (MetaMetrics, 2007; MetaMetrics, 2008) were conducted to examine the reading demands in various postsecondary options—technical college, community college, and 4-year university programs. Under Commissioner Raymond Paredes, the Texas Higher Education Coordinating Board (THECB), in conjunction with MetaMetrics, conducted a research study in 2007 (and extended in 2008) which addressed the focal question of "how well does a student need to read to be successful in community colleges, technical colleges, and universities

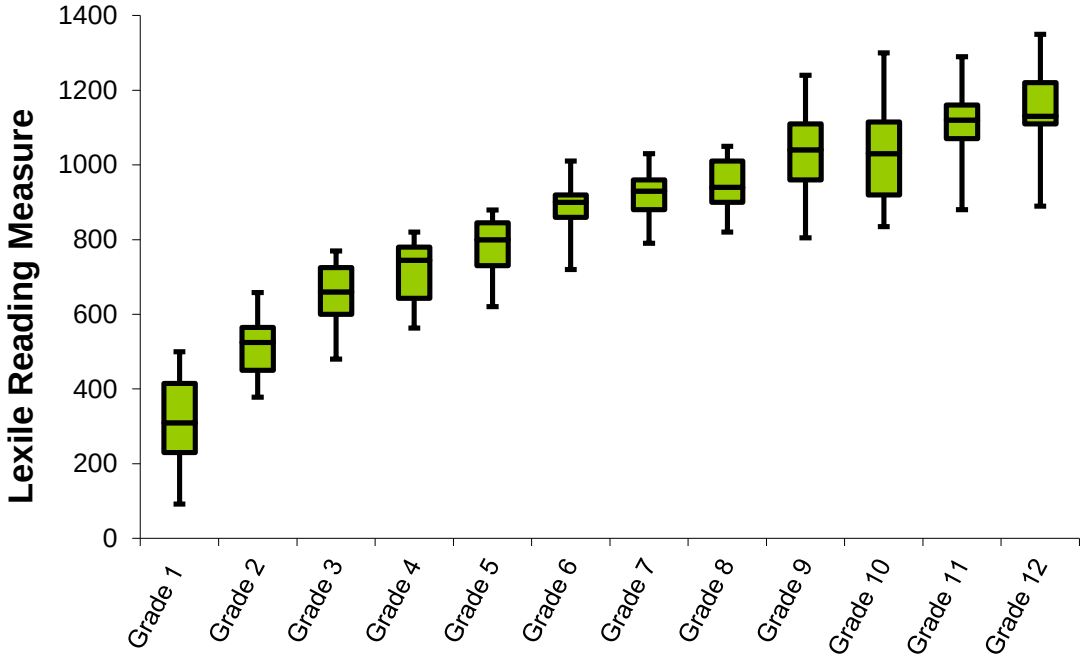
[1] Reprinted from Williamson, G. L. (2008). A text readability continuum for postsecondary readiness. *Journal of Advanced Academics, 19*(4), 602-632.

in Texas?" THECB staff collected a sample of books that first year students in Texas would be required to read in each setting. The reading text complexity of these books was measured using the Lexile Framework for Reading. Since the TAKS (Texas Assessment of Knowledge and Skills) had already been linked with Lexile reading measures for several years, the THECB study was able to overlay the TAKS cut scores onto the post high school reading requirements.

Expanding on Williamson's work, Stenner, Sanford-Moore, and Williamson (2012) aggregated the readability information across the various postsecondary options available to a high school graduate to describe the reading demands individuals will likely encounter as they prepare for college and careers. In their study, they included additional citizenship materials beyond those examined by Williamson (e.g., national and international newspapers and other adult reading materials such as Wikipedia articles). Using a weighted mean of the medians for each of the postsecondary options (education, military, work place, and citizenship), a measure of 1300L was defined as the general reading demand of postsecondary options and could be used to judge a student's "college and career readiness."

Between 2004 and 2008, MetaMetrics (Williamson, Koons, Sandvik, and Sanford-Moore, 2012) conducted research to describe the typical reading demands and develop a text continuum of reading materials across Grades 1–12. The grade-by-grade text distributions are presented in *Figure 5*.

Figure 5. Reading text complexity distributions, in Lexile reading units, by grade (whiskers represent 5th and 95th percentiles).



This continuum can be "stretched" to describe the reading demands students will likely encounter in Grades 1–12 when "on track" for college and career (Sanford-Moore and Williamson, 2012). This information can provide a basis for defining at what level students need to be able to read to be ready for various postsecondary endeavors such as further education

beyond high school and entering the work force. *Table 10* provides the stretch text measure ranges for Grades 1 through 12. Combining student results with criterion referenced indicators provides information to reference when matching students with reading materials that are at or above the recommendations in Appendix A for each grade level.

Table 10. Lexile reading ranges aligned to college- and career-readiness reading expectations, by grade.

Grade	2012 "Stretch" Text Measure
1	190L to 530L
2	420L to 650L
3	520L to 820L
4	740L to 940L
5	830L to 1010L
6	925L to 1070L
7	970L to 1120L
8	1010L to 1185L
9	1050L to 1260L
10	1080L to 1335L
11-12	1185L to 1385L

Recommendations for Using The Lexile Framework for Reading

Teachers can use the tools provided by The Lexile Framework for Reading to select materials to develop individualized reading lists that are tailored to individual students. In this era of student-level accountability and high-stakes assessment, differentiated instruction—the attempt "on the part of classroom teachers to meet students where they are in the learning process and move them along as quickly and as far as possible in the context of a mixed-ability classroom" (Tomlinson, 1999)—is a means for all educators to help students succeed. Differentiated instruction promotes high-level and powerful curriculum for all students, but varies the level of teacher support, task complexity, pacing, and avenues to learning based on student readiness, interest, and learning profile. One strategy for managing a differentiated classroom suggested by Tomlinson is the use of multiple texts and supplementary materials. A student's Lexile reading measure can be leveraged to aid comprehension and is a good starting point in the selection process of a book for a specific reader.

The Lexile Framework for Reading is an objective tool that can be used to determine a student's readiness for a reading experience; The Lexile Framework for Reading "targets" text (books, newspapers, periodicals) for readers at a 75-percent comprehension level—a level that is challenging, but not frustrating (Schnick and Knickelbine, 2000).

Another feature of The Lexile Framework for Reading is that it makes provisions for students who read below or beyond their grade level, because the reporting scale is not bounded by grade

level. See The Lexile Framework for Reading Map for literary and informational titles, leveled reading samples, and approximate grade ranges (Appendix A).

However, it is important to note that the Lexile reading measure should never be the only piece of information used when selecting a text for a reader. When matching a book with a reader, one must also consider other factors that may affect the relationship between a reader and a book. These factors include student developmental level, motivation, and interest; amount of background knowledge possessed by the reader; and suitability of the text and text difficulty. For example, if a student is highly motivated for a particular reading task (e.g., self-selected free reading), the teacher may suggest books higher in the student's Lexile reading range. If the student is less motivated or intimidated by a reading task, material at the lower end of his or her Lexile reading range can provide the basic comprehension support to keep the student from feeling overwhelmed.

The Lexile Framework for Reading does not prescribe a reading program, but it gives educators more knowledge of the variables involved when they design reading instruction. The Lexile Framework for Reading facilitates multiple opportunities for use in a variety of instructional activities. After becoming familiar with The Lexile Framework for Reading, teachers are likely to think of a variety of additional creative ways to use this tool to match students with books that students find challenging, but not frustrating.

Teach learning strategies by controlling comprehension match. The Lexile Framework for Reading permits the teacher to target readers with challenging text and to systematically adjust text targeting when the teacher wants fluency and automaticity (i.e., reader measure is well above text measure) or wants to teach strategies for attacking "hard" text (i.e., reader measure is well below text measure). For example, metacognitive ability has been well documented to play an important role in reading comprehension performance. Once teachers know the kinds of texts that would likely be challenging for a group of readers, they can systematically plan instruction that will allow students to encounter difficult text in a controlled fashion and make use of instructional scaffolding to build student success and confidence with more challenging text. The teacher can model appropriate learning strategies for students, such as rereading or rephrasing text in one's own words, so that students can then learn what to do when comprehension breaks down. Students can then practice these metacognitive strategies on selected text while the teacher monitors their progress.

Apply Lexile reading measures across the curriculum. Over 600 publishers provide Lexile reading measures for their trade books and textbooks, enabling educators to make connections among all of the different components of the curriculum to plan instruction more effectively. With a student's Lexile reading measure, teachers can connect him or her to hundreds of thousands of books. Using periodical databases, teachers and students can also find appropriately challenging newspaper and magazine articles that have Lexile reading measures.

Use the Lexile Framework for Reading to facilitate communicating with stakeholders. Lexile reading measures can be used to communicate with students, parents, teachers, educators, and the community by providing a common language to use to talk about reading growth and development. By aligning all areas of the educational system, parents can be included in the

instructional process. With a variety of data related to a student's reading level a more complete picture can be formed and more informed decisions can be made concerning reading-group placement, amount of extra instruction needed, and promotion/retention decisions.

It is much easier to understand what a national percentile rank of 50 means when it is tied to the reading demands of book titles that are familiar to adults. Parents are encouraged to help their children achieve high standards by expecting their children to succeed at school, communicating with their children's teachers and the school, and helping their children keep pace and do homework.

Through the customized reading lists and electronic database of titles, parents can assist their children in the selection of reading materials that are at an appropriate level of challenge and monitor the reading process at home. The "Lexile Find A Book" website also provides a quick, free resource to battle "summer slide" – the learning losses that students often experience during the summer months when they are not in school. Lexile reading measures make it easy to help students read and learn all summer long and during the school year. This website can help build a reading list of books at a young person's reading level that are about subjects that interest him or her. This website can be viewed at https://hub.lexile.com/find-a-book/search.

In one large school district, the end-of-year testing results are sent home to parents in a folder. The folder consists of The Lexile Framework for Reading Map on one side and a letter from the superintendent on the other side. The school district considers this type of material as "refrigerator-friendly." They encourage parents to put The Lexile Framework for Reading Map on the refrigerator and use it to monitor and track the reading progress of their child throughout the school year.

The community-at-large (business leaders, citizens, politicians, and visitors) sees the educational system as a reflection of the community. Through the reporting of assessment results, stakeholders can understand what the community values and more readily see the return for its investment in the schools and its children.

One way to involve the community is to work with the public libraries and local bookstores when developing reading lists. The organizations should be contacted early enough so that they can be sure that the books will be available. Often books can be displayed with their Lexile reading measures for easy access.

Many school districts make presentations to civic groups to educate the community as to their reading initiatives and how The Lexile Framework for Reading is being utilized in the school. Conversely, many civic groups are looking for an activity to sponsor, and it could be as simple as "donate-a-book" or "sponsor-a-reader" campaigns.

There are numerous ways to incorporate The Lexile Framework for Reading including:

- Building text sets that include texts at varying levels to enhance thematic teaching. These texts might not only support the theme, but also provide a way for all students to successfully learn about and participate in discussions about the theme, building knowledge of common content for the class while building the reading skills of

individual students. Such discussions can provide important collaborative brainstorming opportunities to fuel student writing and synthesize the curriculum.

- Sequencing materials in a reading program to encourage growth in reading ability. For example, an educator might choose one article a week for use as a read-aloud. In addition to considering the topic, the educator could increase the complexity of the articles throughout the course. This approach is also useful when utilizing a core program or textbook that is set up in anthology format. (The order in which the readings in anthologies are presented to the students may need to be rearranged to best meet student needs).
- Developing a reading folder that goes home with students and comes back for weekly review. The folder can contain a reading list of texts within the student's Lexile reading range, reports of recent assessments, and a form to record reading that occurs at home. This is an important opportunity to encourage individualized goal setting and engage families in monitoring the progress of students in reaching those goals.
- Selecting texts lower in the student's Lexile reading range when factors make the reading situation more challenging or unfamiliar. Select texts at or above the student's range to stimulate growth when a topic is of extreme interest to a student, or when adding additional support such as background teaching or discussion.
- Enhancing a student's experience with exposure to differentiated, challenging text at least once every two to three weeks.
- Leveraging the free Find a Book website (at https://hub.lexile.com/find-a-book/search) to support book selection and create booklists within a student's Lexile reading range to help the student make more informed choices when selecting texts.
- Utilizing database resources to infuse research into the curricula while tailoring reading selections to specific Lexile reading levels. In this way, students can explore new content at an appropriate reading level and then demonstrate their assimilation of that content through writing and/or presentations. A list of the database service providers that have their collections measured can be found at https://metametricsinc.com/products/library-products/.
- Using Lexile® WordLists (https://hub.lexile.com/wordlists) to identify subsets of words that are relevant to the context or application. Lexile WordLists contain approximately 50,000 unique words from the top four best-selling textbook programs (published after 2011) in science, math, social studies, and reading/English language arts. Some common uses include: identifying grade appropriate words to target vocabulary instruction and assessment; identifying words to include in instructional materials for domain-specific content; and selecting important academic words by grade and domain to highlight in reading passages, books or other instructional materials.

Use The Lexile Framework for Reading in the library. Augmenting libraries provides even more ways to leverage The Lexile Framework for Reading including:

- Making the Lexile reading measures of books available to students to better enable them to find books of interest at their appropriate reading level.
- Enabling comparison of student Lexile reading levels with the Lexile reading levels of the books and periodicals in the library to analyze and develop the collection to more fully meet the needs of all students.

- Leveraging the database resources to search for articles at specific Lexile reading levels to support classroom instruction and independent student research. A list of the database service providers that have had their collections measured can be found at https://metametricsinc.com/products/library-products/)
- Using the free Find a Book website (at https://hub.lexile.com/find-a-book/search) to support book selection and help students make informed choices when selecting texts.

Set and monitor reading program goals. Schools often write grant applications in which they are required to state how they will monitor progress of the intervention or program funded by the grant. Schools that receive funds targeted to assist students with improving their reading skills can use The Lexile Framework for Reading for evaluation purposes. Schools can use student-level and school-level Lexile reading information to monitor and evaluate interventions designed to improve reading skills. Progress tests throughout the year can be conducted to help monitor students' progress toward their goals.

Students' Lexile reading measures can also be used to identify reading materials that students are likely to comprehend with 75% accuracy. Students can set goals of improving their reading comprehension and plan clear strategies for reaching those goals using literature from the appropriate Lexile reading ranges. Measurable goals can be clearly stated in terms of Lexile reading measures. Examples of measurable goals and clearly related strategies for reading intervention programs might include:

> *Example Goal 1:* At least half of the students will improve reading comprehension abilities by 100L after one year of use of an intervention.
>
> *Example Goal 2: S*tudents' attitudes about reading will improve after reading 10 books at their 75% comprehension level.

These examples of goals emphasize the fact that The Lexile Framework for Reading is not an intervention, but a tool to help educators plan instruction and measure the success of the reading program.

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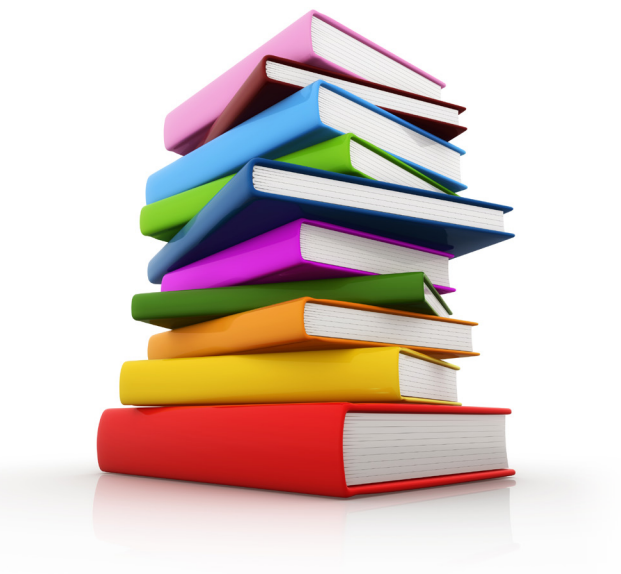
Appendix A

The Lexile® Framework for Reading Map



LEXILE FRAMEWORK® FOR READING

Matching Readers With Text

1340L *Silent Spring* CARSON
The basic element, carbon, is one whose atoms have an almost infinite capacity for uniting with each other in chains and rings and various other configurations, and for becoming linked with atoms of other substances. Indeed, the incredible diversity of living creatures from bacteria to the great blue whale is largely due to this capacity of carbon. The complex protein molecule has the carbon atom as its basis, as have molecules of fat, carbohydrates, enzymes, and vitamins. So, too, have enormous numbers of nonliving things, for carbon is not necessarily a symbol of life.

900L *We Are the Ship: The Story of Negro League Baseball* NELSON
Rube ran his ball club like it was a major league team. Most Negro teams back then weren't very well organized. Didn't always have enough equipment or even matching uniforms. Most times they went from game to game scattered among different cars, or sometimes they'd even have to "hobo"—which means hitch a ride on the back of someone's truck to get to the next town for a game. But not Rube's team. They were always well equipped, with clean, new uniforms, bats, and balls. They rode to the games in fancy Pullman cars Rube rented and hitched to the back of the train. It was something to see that group of Negroes stepping out of the train, dressed in suits and hats. They were big-leaguers.

330L *Seals* ARNOLD
Earless seals live in oceans.
Thick blubber keeps seals warm.
A seal's back flippers help it swim fast.
A seal on land is slow.
Its claws dig into rocks and ice.
Many seals have dark brown or gray fur.
Some have spots.
Seals molt every year.

TEXT LEXILE RANGES TO GUIDE READING FOR COLLEGE AND CAREER READINESS

GRADES	CCSS LEXILE TEXT RANGE
11–12	1185L–1385L
9–10	1050L–1335L
6–8	925L–1185L
4–5	740–1010L
2–3	420L–820L
1	190L–530L

Common Core State Standards for English Language Ar ts, Appendix A (Additional Information), NGA and CCSSO, 2012

*** GN DENOTES GRAPHIC NOVEL**
IG DENOTES ILLUSTRATED GUIDE

Sample Titles

	LITERATURE TITLES	INFORMATIONAL TITLES
1500L+	1640L **The Plot Against America** (ROTH) 1530L **The Good Earth** (BUCK) 1520L **A Fable** (FAULKNER)	1650L **Twenty Years at Hull-House** (ADDAMS) 1600L **The U.S. Constitution and Other Key American Writings** (ASSORTED) 1600L **Sustaining Life: How Human Health Depends on Biodiversity** (CHIVIAN) 1590L **Captain John Smith: A Select Edition of His Writings** (SMITH) 1520L **Collapse: How Societies Choose to Fail or Succeed** (DIAMOND)
1400L	1460L **The Legend of Sleepy Hollow** (IRVING) 1450L **Billy Budd** (MELVILLE) 1420L **The Life All Around Me by Ellen Foster** (GIBBONS) 1420L **The Fall of the House of Usher** (POE) 1410L **Death in Venice** (MANN)	1490L **Rousseau's Political Writings** (ROUSSEAU) 1430L **America's Constitution: A Biography** (AMAR) 1440L **Fordlandia** (GRANDIN) 1410L **Profiles in Courage** (KENNEDY) 1400L **The Mysteries of Beethoven's Hair** (MARTIN & NIBLEY)
1300L	1390L **The Yellow Wallpaper** (GILMAN) 1350L **The Secret Sharer** (CONRAD) 1330L **The Jungle** (SINCLAIR) 1330L **Silas Marner** (ELIOT) 1330L **Gulliver's Travels** (SWIFT)	1390L **In Defense of Food: An Eater's Manifesto** (POLLAN) 1360L **Anne Frank: The Book, the Life, the Afterlife** (PROSE) 1340L **Walden and Civil Disobedience** (THOREAU) 1330L **The Professor and the Madman: A Tale of Murder, Insanity, and the Making of the Oxford English Dictionary** (WINCHESTER) 1300L **Arctic Dreams: Imagination and Desire in a Northern Landscape** (LOPEZ)
1200L	1290L **An Old-Fashioned Girl** (ALCOTT) 1280L **The House of the Spirits** (ALLENDE) 1280L **The Castle** (KAFKA) 1220L **The Silent Cry** (ŌE) 1210L **Chronicle of a Death Foretold** (GARCÍA MÁRQUEZ)	1290L **A Brief History of Time: From the Big Bang to Black Holes** (HAWKING) 1280L **Black, Blue, and Gray: African Americans in the Civil War** (HASKINS) 1230L **Stiff: The Curious Lives of Human Cadavers** (ROACH) 1230L **Knowing Mandela: A Personal Portrait** (CARLIN) 1200L **The Dark Game: True Spy Stories** (JANECZKO)
1100L	1180L **Sense and Sensibility** (AUSTEN) 1170L **The Amazing Adventure of Kavalier & Clay** (CHABON) 1150L **Great Expectations** (DICKENS) 1150L **A Room of One's Own** (WOOLF) 1130L **Democracy** (DIDION)	1160L **The Longitude Prize** (DASH) 1160L **In Search of Our Mothers' Gardens** (WALKER) 1150L **The Human Microbiome: The Germs That Keep You Healthy** (HIRSCH) 1150L **In My Place** (HUNTER-GAULT) 1100L **Something to Declare** (ALVAREZ)
1000L	1080L **I Heard the Owl Call My Name** (CRAVEN) 1070L **Savvy** (LAW) 1070L **Around the World in 80 Days** (VERNE) 1010L **The Pearl** (STEINBECK) 1000L **The Hobbit or There and Back Again** (TOLKIEN)	1030L **Phineas Gage: A Gruesome but True Story About Brain Science** (FLEISCHMAN) 1020L **This Land Was Made for You and Me: The Life and Songs of Woody Guthrie** (PARTRIDGE) 1010L **Travels With Charley: In Search of America** (STEINBECK) 1000L **Harriet Tubman: Conductor on the Underground Railroad** (PETRY) 1000L **Claudette Colvin: Twice Toward Justice** (HOOSE)
900L	980L **Dovey Coe** (DOWELL) 950L **Bud, Not Buddy** (CURTIS) 940L **Harry Potter and the Chamber of Secrets** (ROWLING) 940L **Heat** (LUPICA) 900L **City of Fire** (YEP)	990L **Seabiscuit: An American Legend** (HILLENBRAND) 980L **The Kid's Guide to Money: Earning It, Saving It, Spending It, Growing It, Sharing It** (OTFINOSKI) 950L **Jim Thorpe, Original All-American** (BRUCHAC) 930L **Colin Powell** (FINLAYSON) 920L **Talking With Artists** (CUMMINGS)
800L	GN840L* **The Odyssey** (HINDS) 830L **Baseball in April and Other Stories** (SOTO) 820L **Maniac Magee** (SPINELLI) 810L **Where the Mountain Meets the Moon** (LIN) 800L **Homeless Bird** (WHELAN)	880L **Volcanoes** (SIMON) 880L **The Circuit: Stories From the Life of a Migrant Child** (JIMÉNEZ) IG860L* **Animals Nobody Loves** (SIMON) 860L **Through My Eyes: Ruby Bridges** (BRIDGES) 830L **Quest for the Tree Kangaroo** (MONTGOMERY)
700L	770L **Walk Two Moons** (CREECH) 760L **Hoot** (HIAASEN) 750L **Esperanza Rising** (RYAN) 720L **Nancy's Mysterious Letter** (KEENE) 700L **The Miraculous Journey of Edward Tulane** (DICAMILLO)	790L **Be Water, My Friend: The Early Years of Bruce Lee** (MIOCHIZUKI) 760L **Stay: The True Story of Ten Dogs** (MUNTEAN) IG760L* **Mapping Shipwrecks With Coordinate Planes** (WALL) 720L **Pretty in Print: Questioning Magazines** (BOTZAKIS) 720L **Spiders in the Hairdo: Modern Urban Legends** (HOLT & MOONEY)
600L	690L **Firefly Hollow** (MCGHEE) 680L **Charlotte's Web** (WHITE) 660L **Holes** (SACHAR) 620L **The Year of Billy Miller** (HENKES) 610L **Mountain Bike Mania** (CHRISTOPHER)	690L **Sadako and the Thousand Paper Cranes** (COERR) 680L **An Eye for Color: The Story of Josef Albers** (WING) 680L **The Moon** (LANDAU) 660L **Remember: The Journey to School Integration** (MORRISON) 620L **Crittercam** (EINSPRUCH)
500L	590L **The Great Kapok Tree** (CHERRY) 580L **Tops and Bottoms** (STEVENS) 570L **Grace for President** (DIPUCCHIO) 540L **Ron's Big Mission** (BLUE & NADEN) 500L **Poppleton in Spring** (RYLANT)	IG590L* **Claude Monet** (CONNOLLY) 580L **What Magnets Can Do** (FOWLER & BARKAN) 560L **Molly the Pony** (KASTER) 550L **Martin Luther King, Jr. and the March on Washington** (RUFFIN) 510L **A Picture for Marc** (KIMMEL)
400L	480L **A Birthday for Frances** (HOBAN) 470L **Tales of a Fourth Grade Nothing** (BLUME) 450L **Amelia Bedelia** (PARISH) 440L **Fox on the Job** (MARSHALL) 420L **Hey, New Kid!** (DUFFEY)	480L **Rally for Recycling** (BULLARD) 480L **Grand Canyon** (GILBERT) 470L **Life in China** (CHUNG) 460L **Half You Heard of Fractions?** (ADAMSON & ADAMSON) 440L **Abraham Lincoln** (HANSEN)
300L	370L **Little Bear Book** (MINARIK) 350L **To the Rescue!** (MAYER) 340L **Snow** (SHULEVITZ) GN320L* **Spotlight Soccer** (SANCHEZ) 310L **I Spy Fly Guy!** (ARNOLD)	370L **Starfish** (HURD) IG340L* **We Can Be Friends** (JORDAN) 340L **Fernando Exercises!: Tell and Write Time** (KAY) 340L **Simple Machines** (RISSMAN) 310L **Visiting the Beach in Summer** (FELIX)
200L	290L **The Class Pet From the Black Lagoon** (THALER) 280L **Puddle** (YUM) 240L **Are You My Mother?** (EASTMAN) 210L **Green Eggs and Ham** (SEUSS) 200L **Tiny Goes to the Library** (MEISTER)	280L **Whales** (LINDEEN) 260L **Leaves in Fall** (SCHUH) 220L **Plants on a Farm** (DICKMANN) 210L **Counting in the City** (STEFFORA) 210L **The Tractor Race** (SCHUH)

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