

Understanding Text Complexity

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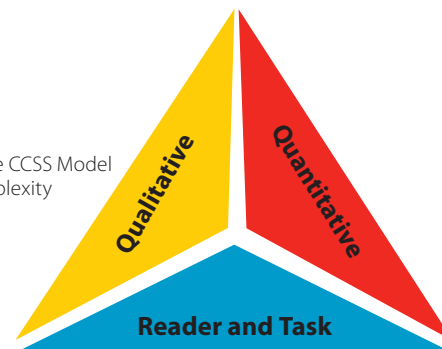
The reading habits and skills of too many American students today are inadequate for the challenges in college and the workplace (CCSSO 2011). Although the reading demands in higher education have not decreased, the complexity of texts in K–12 grades has declined over the years so that there is now a large gap between the complexity of texts that students read in high school and college. Moreover, K–12 students do not read challenging texts deeply and independently, so many college students struggle to understand assignments and must enroll in remedial reading classes. A report from ACT (2006) called *Reading Between the Lines* identified the ability to comprehend complex texts as a key differentiator across gender, race, and family income between students who are successful and those not in the first year of college. Thus, answering questions, making inferences, and understanding main ideas in text, although important for students at all grades, must be applied to appropriately complex and challenging texts. Teachers across America are now trying to understand (a) how to select appropriately complex texts and (b) how to provide instruction and assessment for complex texts at every grade level.



The Common Core State Standards (CCSS) for English Language Arts (ELA) describe ten anchor standards that extend across grades K–12 that specify the kinds of skills and understandings that students need at the end of each grade in order to be prepared for college readiness and the workforce (CCSSO 2011). The tenth standard identifies characteristics of text complexity and grade level bands of complexity (i.e., grades 2–3, 4–5, etc.) based on current quantitative metrics. The expectations for students are to read

grade level texts independently and proficiently, with scaffolding as needed at the higher ends of each band. This is the method that links standards to increased text complexity across American schools, so it is important to understand how text complexity is assessed.

Figure 1. The CCSS Model of Text Complexity



Understanding Text Complexity

Researchers, educators, and policymakers recognize that the complexity and difficulty of texts depend on interactions among the characteristics of readers, different features of the texts, and the particular reading situations. The CCSSO model of text complexity includes quantitative dimensions, qualitative dimensions, and reader-task considerations in order to take these interactions into account. This model is intended to help teachers understand, identify, and use features of text complexity in order to enhance student comprehension. In Figure 1, quantitative dimensions of texts refer to “countable” features such as sentence length and word frequency, which can be measured easily with computer analyses. Qualitative dimensions of text complexity include features such as meaning, purpose, and coherence that are subjective, variable, and measured better by humans. In addition to characteristics of the words in texts, complexity can vary with the knowledge, motivation, and purpose of the reader, so the CCSS model also pays attention to these variables. Each part of the model is examined in the following sections.

Quantitative Dimensions of Text Complexity

Researchers 50 years ago tried to distinguish text complexity with measures of “readability” calculated on such features as the length of sentences and words, e.g., the Flesch-Kincaid Readability index. Most measures of complexity generated in the 20th century focused on individual words

and sentences, but did not measure relationships among sentences and paragraphs in text. New models of reading comprehension and text complexity, along with advances in computing technology, computational linguistics, and cognitive science, have allowed scientists to design more sophisticated models and quantitative metrics of text complexity. From 2010 to 2011, an independent group of researchers conducted a comparison of seven technologies (shown in Table 1) to measure quantitative features of text complexity and provide overall scores of text complexity (Nelson, Perfetti, Liben, and Liben 2012).

The researchers provided the participating companies that designed the metrics the same sets of exemplar passages and texts from state and standardized reading achievement tests so that all metrics would be applied to the same sample of texts. (Coh-Metrix was not included in some analyses because it does not derive a single measure of text complexity.) The general findings were

1. The text difficulty measures predicted student reading achievement scores very well.
2. All measures correlated reasonably well with human ratings of the grade level on the Common Core exemplar texts, although the metrics with a broader range of variables had higher correlations than those that used only word difficulty and sentence length measures.
3. The measures discriminated text complexity slightly better for informational texts than narrative texts

Table 1: Overview of Metrics for Evaluating Text Complexity

Research Group	Metrics	Language Features Measured
MetaMetrics	Lexile	Word frequency, sentence length
Renaissance Learning	Advantage / TASA Open Standard (ATOS)	Word length, word grade level, sentence length, book length
Questar Assessment, Inc.	Degrees of Reading Power: DRP Analyzer	Word length, word difficulty, sentence length, within-sentence punctuation
The REAP Project: Carnegie Mellon	REAP (REAders-specific Practice) Readability	Word frequency, word length, sentence length, sentence count, parse tree of sentence and paragraphs, frequency of node elements
Educational Testing Service (ETS)	TextEvaluator™	Word frequency, word length, word meaning features, word syntactic features, word types, sentence length, paragraph length, within- and between-sentence cohesion measures, number of clauses, text genre
Pearson Knowledge Technologies (PKT)	Pearson Reading Maturity Metric	Pearson Word Maturity Metric, word length, sentence length, within sentence punctuation, within and between-sentence coherence metrics, sentence and paragraph complexity, order of information
Coh-Metrix: University of Memphis	Narrativity, Referential Cohesion, Syntactic Simplicity, Word Concreteness, Deep Cohesion	Word frequency, word length, word meaning features, word syntactic features, sentence length, sentence complexity, paragraph length, within-sentence and between-sentence cohesion measures

Understanding Text Complexity

and slightly better at lower-grade than higher-grade levels.

Perhaps the most important result of the report was the establishment of CCSS grade level bands of text complexity for each metric. The table from the CCSS Revised Appendix A (2012) is shown below and provides guidelines for text complexity at each grade band for all tested metrics. These can be used by schools to review the complexity levels of materials for all grades.

Table 2. CCSSO Grade Bands for Metrics of Text Complexity

Common Core Grade Bands	ATOS	DRP	FK	Lexile	TE	RM
2-3	2.75–5.14	42–54	1.98–5.34	420–820	2–35	3.53–6.13
4-5	4.97–7.03	52–60	4.51–7.73	740–1010	23–51	5.42–7.92
6-8	7.00–9.98	57–67	6.51–10.34	925–1185	36–64	7.04–9.57
9-10	9.67–12.01	62–72	8.32–12.12	1050–1335	52–74	8.41–10.81
11-CCR	11.20–14.10	67–74	10.34–14.2	1185–1385	59–86	9.57–12.00

The authors of the report emphasized that all metrics performed reasonably well, and there were differences across metrics on different samples of text, so there was no clear “best” metric. However, inspection of the data reveals that two measures, Reading Maturity and TextEvaluator™, usually had the highest correlations with student performance measures and human ratings even though the confidence intervals overlapped with other metrics. These two measures may have outperformed others because they include a wider variety of language features. An examination of TextEvaluator™ can reveal how quantitative measures of text complexity can be useful for teachers.

TextEvaluator™, developed by scientists at the Educational Testing Service (ETS), is a computer-based system for analyzing the relative complexity of multiple features of text (Sheehan, Kostin, and Napolitano 2012). TextEvaluator™ provides both an overall grade level score for a text plus scores for eight specific components of text complexity. The grade level score can be used by teachers to match students with appropriate texts and by review committees to evaluate text materials. In addition, teachers can use information about specific components of text complexity to focus instruction and assessment.

TextEvaluator™ is computer software that has three general steps. First, it identifies and extracts a large

number of language features, such as word frequency and sentence length, specified by scientists as important. These features are based on cumulative research and can include specific kinds of verbs, nouns, or other grammatical units. Linguistic features can also be extracted with reference to a growing number of linguistic databases that identify specific language features in different kinds of texts. Second, TextEvaluator™ examines more than 20 different linguistic features and combines related features into eight distinct component scores (syntactic complexity, vocabulary difficulty,

academic orientation, argumentation, concreteness, referential cohesion, degree of narrativity, and interactive or conversational style) based on statistical analyses of each component. Third, TextEvaluator™ combines

the component scores into complexity measures differently for informational, literary, and mixed-genre texts. This is important because components of complexity vary by genre, and other metrics that ignore genre may over- or underestimate text complexity in different genres.

TextEvaluator™ uses this information to generate a scaled score for each feature, as well as an overall grade level equivalent score for each text, so that texts can be compared with one another. Text review committees can use this information to compare complexity levels of different texts in various programs. Teachers can use the feature scores and grade level scores to guide the selection of texts for individual students for placement and instruction. For example, if students have difficulty reading new vocabulary, a teacher can choose texts with familiar vocabulary. TextEvaluator™, like other quantitative metrics of text complexity, can support the CCSS goal of helping students read and understand complex texts at every grade.

Qualitative Dimensions of Text Complexity

All texts have nuances that are not entirely captured by quantitative dimensions of complexity. Researchers have identified three text factors that contribute to ease of understanding and learning: structure, coherence,

Understanding Text Complexity

and audience appropriateness (Fisher, Frey, and Lapp 2012). Informational structure is sometimes signaled with headings, diagrams, boldface words, and other editorial cues. Students can benefit from learning how to use these cues and to identify text structures such as cause-effect, temporal sequence, and compare-contrast. Likewise, students can use the structure of narrative texts to identify settings, characters, plots, goals, and endings. Understanding text structures can help readers connect ideas throughout the text.

Text coherence refers to the logical and plausible connections of ideas within and across paragraphs. Coherence can be enhanced with explicitly stated connections, repeated concepts and key words, and clear pronoun references. Coherent texts link ideas clearly for readers. Texts that are considerate of the audience use familiar words and concepts, build on background knowledge, introduce new ideas and vocabulary at an appropriate pace, and provide information in interesting ways. For example, authors use a variety of literary devices to make texts interesting and unusual such as flashback, imagery, metaphor, and humor. These features are difficult to quantify because their complexity depends on the knowledge and experiences of the reader, but they are important because they engage readers in the meanings of texts.

Teachers and researchers have voiced concerns that the CCSSO model of text complexity relies too much on quantitative dimensions of text. The model's emphasis on qualitative dimensions and reader and task considerations are intended to respect the interactions with readers and tasks, and, thus, they complement the quantitative metrics. The CCSSO report, Appendix A, suggests that qualitative aspects of text complexity can be analyzed according to four key factors: levels of meaning, structure, language conventionality, and knowledge demands. The report provided Figure 2 as an initial guide to evaluate the qualitative dimensions of text complexity. The features in each category represent shifts from "easy" → "difficult" to indicate continua of complexity within each factor.

The qualitative features in Figure 2 can be used by groups of teachers to review and select appropriate texts for their students. The features can also be shared with parents and students to explain what makes text complex and difficult to understand. Recognizing features that contribute to text complexity helps readers adjust their reading and rereading and apply extra effort and strategies to certain features that are challenging.

Figure 2: Qualitative Dimensions of Text Complexity

Levels of Meaning (literary texts) or Purpose (informational texts)

- Single level of meaning → Multiple levels of meaning
- Explicitly stated purpose → Implicit purpose, may be hidden or obscure

Structure

- Simple → Complex
- Explicit → Implicit
- Conventional → Unconventional (chiefly literary texts)
- Events related in chronological order → Events related out of chronological order (chiefly literary texts)
- Traits of a common genre or subgenre → Traits specific to a particular discipline (chiefly informational texts)
- Simple graphics → Sophisticated graphics
- Graphics unnecessary or merely supplementary to understanding the text → Graphics essential to understanding the text and may provide information not otherwise conveyed in the text

Language Conventionality and Clarity

- Literal → Figurative or ironic
- Clear → Ambiguous or purposefully misleading
- Contemporary, familiar → Archaic or otherwise unfamiliar
- Conversational → General academic and domain-specific

Knowledge Demands: Life Experiences (literary texts)

- Simple theme → Complex or sophisticated themes
- Single themes → Multiple themes
- Common, everyday experiences or clearly fantastical situations → Experiences distinctly different from one's own
- Single perspective → Multiple perspectives
- Perspective(s) like one's own → Perspective(s) unlike or in opposition to one's own

Knowledge Demands: Cultural/Literary Knowledge (chiefly literary texts)

- Everyday knowledge and familiarity with genre conventions required → Cultural and literary knowledge useful
- Low intertextuality (few if any references/allusions to other texts) → High intertextuality (many references/allusions to other texts)

Knowledge Demands: Content/Discipline Knowledge (chiefly informational texts)

- Everyday knowledge and familiarity with genre conventions required → Extensive, perhaps specialized discipline-specific content knowledge required
- Low intertextuality (few if any references to/citations of other texts) → High intertextuality (many references to/citations of other texts)

How Can Teachers Use Information About Text Complexity?

Not everyone agrees that texts have become less complex across K–12. Hiebert (2011–12) argues that texts in K–3 have actually increased in difficulty since the 1960s, and she cautions that there is no evidence that making texts more difficult for young readers will lead to greater preparation for college. In fact, she suggests that making texts “harder, faster, earlier” may be harmful to third and fourth graders, many of whom already do not read at proficient levels. Hiebert (2012) suggests seven instructional actions that teachers can implement to help students cope with increased text complexity:

1. Focus on knowledge
2. Create connections
3. Activate students’ passion
4. Develop vocabulary
5. Increase the volume of reading
6. Build up stamina
7. Identify benchmarks

The last action, identifying benchmarks, includes teachers working together to identify exemplars and anchor texts at each grade level so that a shared understanding can be built about what factors contribute to text complexity. Exemplars can be shown to parents and students alike to discuss the features of text complexity. Components of TextEvaluator™, for example, might be used with a rubric of qualitative dimensions to show parents the features in texts that need to be understood. This could be very useful for parents who did not attend school in the United States or who do not speak English as their native language.

Detailed analyses of text complexity provide teachers with useful information about potential sources of reading difficulty for their students that they can use for diagnostic purposes and differentiated instruction (Common Core State Standards Initiative, 2012, Appendix A). Students can be taught about the sources of complexity, such as low text cohesion or high syntactic complexity, so they can learn and apply appropriate strategies for specific problems. In addition, teachers can create comprehension assessments that focus on specific features of text complexity to determine if their students understand key elements of grammar,

genre, structure, purpose, literary devices, and other contributors to complexity. Thus, teachers can provide explicit instruction about text features that affect comprehension and students can be taught to assess and address the features of text that may confuse them.

Teachers can also use information about text complexity to analyze and discuss texts in their curricula. For example, the Kansas Department of Education (2012) created many resources for teachers to help them understand the CCSS and text complexity. They help teachers create and use rubrics to analyze books in their curricula, and they provide instructional resources to support close reading of texts. Fisher, Frey, and Lapp (2012) provide examples of how teachers can work together to analyze multiple dimensions of text to determine which texts are appropriate for their students. These resources help teachers in professional learning communities understand text complexity, review texts, select anchor texts at grade levels, and provide instruction that considers various features of complexity. When teachers and students understand how text features influence reading difficulty, they can monitor and improve comprehension of their students more effectively.

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