Text Complexity in the Dynamic Learning Maps™ Alternate Assessment System

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Table of Contents

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The purpose of this white paper is to explain the research-based decisions that determine text complexity within the Dynamic Learning Maps Alternate Assessment System (DLM®). Text complexity is an important and complex construct within college and career readiness standards and has been defined clearly by the Common Core State Standards (CCSS) as being composed of and influenced by numerous factors (see Appendix A of CCSS). In this paper, those factors are explained with reference to the characteristics of students with significant cognitive disabilities, and how texts are authored in DLM to support this student population in comprehending text in increasingly complex ways.

What is Text Complexity?

Text complexity is the degree to which a text is easy or difficult to read and understand. Text complexity is influenced by factors at the word level, such as word frequency; the sentence level, such as the syntactic complexity of the sentence; the text level, such as number of connectives combining the sentences and paragraphs together; and factors outside the text, such as the characteristics of the task and the reader. Individual factors do not have a significant impact on text complexity, but combinations of factors significantly impact a text's level of difficulty.

The Common Core State Standards (CCSS) (NGSCBP & CCSSO, 2010) offer a three-dimensional model of text complexity (see Appendix A of CCSS). These three dimensions are:

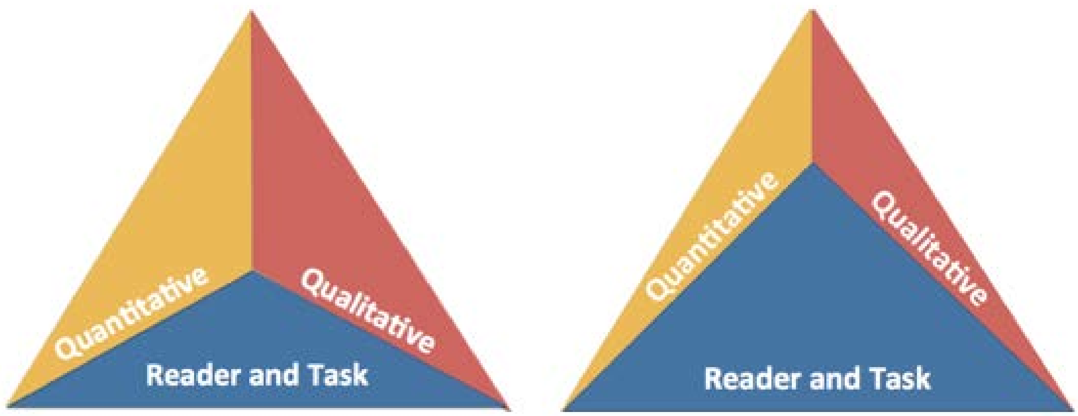
1. **Quantitative Text Features:** Traditional factors related to the complexity of the words, sentences, and paragraphs in a text.
2. **Qualitative Text Features:** The levels of meaning, structure, clarity, and language demands imposed by the text.
3. **Reader and Task Characteristics:** The characteristics of the reader (*i.e.*, background knowledge and experience, motivation and interest, cognitive and linguistic skills) and the task (*e.g.*, identifying explicit details, comparing and contrasting, determining which claims support the argument an author makes).

For students without disabilities, each of these three dimensions carries a relatively equal weight when determining the overall complexity of a text. As students without disabilities age and progress through school, their characteristics as readers develop in such a way that they can successfully manage increasingly complex tasks while reading text that similarly increases in its quantitative and qualitative complexity. The same is not true for students with significant cognitive disabilities. The characteristics of this student population as readers require that texts be carefully authored to minimize the quantitative and qualitative demands, in order to allow the task demands to increase over time.

Figure 1 illustrates the relationship between these three dimensions for students with and without significant cognitive disabilities. For students without significant cognitive disabilities, the three dimensions have an equal impact on text complexity. In contrast, the characteristics of students with significant cognitive disabilities have a disproportionate impact on text complexity.

As such, the quantitative and qualitative complexity of text should increase over time, but not at the same rate that it increases for students without disabilities. The remainder of this paper describes how quantitative and qualitative complexity is controlled in DLM texts to ensure that the reader and task characteristics are appropriately addressed to allow students to successfully work on DLM English language arts Claim 1, *Students will comprehend texts in increasingly complex ways*.

Figure 1. The Dimensions of Text Complexity



CCSSO Text Complexity Model DLM Text Complexity Model

How are Texts Authored for the DLM System to Reduce Complexity?

To minimize the complexity of texts to allow students with significant cognitive disabilities to learn to read and to complete increasingly complex tasks, the DLM assessment system addresses several factors that contribute to the quantitative and qualitative complexity of texts. The following sections describe each factor.

Word-Level Factors

Word frequency, word concreteness, and word length each contribute to text complexity to a greater or lesser extent. However, each factor impacts text complexity most significantly in beginning-level texts. Given that nearly all students with significant cognitive disabilities can be classified as beginning readers regardless of their age (Dynamic Learning Maps, 2013), word-level factors influence text complexity for students with significant cognitive disabilities in ways that they may not for older readers without disabilities.

Word frequency.

Word frequency refers to the number of times a word is used in print sources. The higher the word frequency for a given word, the more often the word is encountered when reading. Readers have an easier time recognizing high frequency words because familiar words become encoded deeply in memory (Gerhand & Barry, 1998; Graesser, Cai, Louwerse, & Daniel, 2006; Just & Carpenter 1980; Rayner, 1998). With better and easier word recognition, readers have more memory resources available for other critical reading processes, such as integration and comprehension (Drum, Calfee, & Cook, 1981; Kintsch & van Dijk, 1978; LaBerge & Samuels, 1974). In the DLM system, the use of high-frequency words is maximized across texts.

Word concreteness.

Word concreteness refers to the degree to which a word has a physical basis. Word concreteness influences word recognition by signaling to readers a physical representation of a word, making it easier to process and understand (Holmes & Langford, 1976; Moeser, 1974; Paivio, 1971, 1986). Children learn concrete words (e.g., dog) before they learn abstract words (e.g., love), because concrete words are easier to conceptualize. As a result, concrete words are more entrenched in memory, making them easier to recognize and retrieve from memory. DLM texts contain high proportions of concrete words.

Number of syllables.

Words with one or two syllables are generally easier to read than words with more syllables. However, some higher-frequency, easy words have more than two syllables (e.g., potato), while some unfamiliar, difficult words have only one or two syllables (e.g., starch). Word length influences text complexity through its effect on the size and number of eye movements during reading, the saccade length (Rayner, Fischer, & Pollatsek, 1998). When a person reads text, each eye movement usually includes the current word and portions of the subsequent word (Blanchard, Pollatsek, & Rayner, 1989; O'Regan, 1980; Rayner, 1979). If the subsequent word is short, it is processed with the current word in the same eye movement. However, if the subsequent word is long, another eye movement is required and reading slows down (Drieghe, Rayner, & Pollatsek, 2005). Whenever possible, DLM texts contain familiar short words instead of longer, less familiar words.

Sentence-Level Factors

The grammatical difficulty of each sentence plays an important role in determining a text's overall complexity. Simple sentences contain only one independent clause, while complex sentences contain one independent clause and at least one subordinate clause. Complex sentences take longer to read, because they contain more information (DiStefano & Valencia, 1980; Graesser, Cai, Louwerse, & Daniel, 2006). For comprehension to occur, the information must be maintained in memory until the end of the sentence when it can be integrated. If the amount of information in a sentence exceeds the reader's available resources, reading slows and the information becomes more difficult to access or is forgotten, which hinders comprehension (Just & Carpenter, 1992). DLM texts contain complex sentences only when necessary to addresses a specific Essential Element. The following factors are specific examples of how grammatical complexity is controlled in DLM texts.

Negation words.

The presence of negation words (e.g., not) in a sentence can make it more complex. Negation words inform the reader that the information presented after the negation word is not true. Thus, readers must comprehend a sentence's meaning without the negation word before they use the negation word to transform the sentence's meaning (MacDonald & Just, 1989). Because of the extra processing required for sentences with negation words, readers encounter more difficulties processing these sentences than they do for sentences not containing negation words (Carpenter & Just, 1975; Glenberg, Robertson, Jansen, & Johnson-Glenberg, 1999; Reichle, Carpenter, & Just, 2000). Additionally, negation words cause the reader's focus to shift away from the information in the sentence and towards the negation itself, making it more difficult for readers to access the information later (Lea & Mulligan, 2002; Paterson, Sanford, Moxey, & Dawydiak, 1998; Sanford, Moxey & Paterson, 1996). As such, writers of DLM texts avoid the use of negation words.

Passive voice.

Before deriving a sentence's meaning, readers must transform a passive sentence into an active sentence by making the subject the object. Passive sentences are more difficult to comprehend because of this required transformation (Mehler, 1963; Miller & McKean, 1964), as well as their lower frequency in texts (Birner & Ward, 1998; Ferreira, 1994; MacWhinney & Bates, 1989; St. John & Gernsbacher, 1998). In DLM texts, all sentences are active sentences.

Pronouns.

Pronouns are words that refer to or substitute for an antecedent. Readers must determine the antecedent of the pronoun before they can acquire the sentence's meaning (Carpenter & Just, 1977; Hirst & Brill, 1980; Webber, 1986). Identifying an antecedent requires the storage in working memory of previously read information (Daneman & Carpenter, 1980, 1983; Baker, 1985). Antecedents located near a pronoun are easier to recognize (Greene, McKoon, & Ratcliff, 1992) than those that are far apart (Cirilo, 1980; Clark & Sengul, 1979). Despite the problems they might cause, pronouns also help create cohesion within and across sentences (Karmiloff-Smith, 1980; Marslen-Wilson, Levy, & Tyler, 1982; Garrod & Sanford, 1982; Webber, 1986). As a result, DLM texts only contain pronouns with highly-accessible antecedents.

Figurative language.

There are many forms of figurative language, but each serves the purpose of moving beyond the literal meaning of the text. Examples of figurative language include alliteration, personification, imagery, simile, and metaphor (Bailin & Gradstein, 2001). Each requires readers to infer information implied from the information explicitly stated in the text, and each assumes that readers have particular knowledge they can use to access the intended meaning of the text (Bailin, 1998). While adult readers process figurative language in parallel with the literal meaning of the sentence (Glucksberg, 2001), this parallel processing places significant demands on the reader and requires simultaneous processing of the context surrounding the figurative language. In DLM texts, multi-meaning words and other forms of figurative language are avoided, unless the text is intended to address a DLM Essential Element that requires the processing of multi-meaning words or other forms of figurative language.

Paragraph-Level Factors

Although their impact is not as significant as the sentence-level factors, paragraph-level factors still influence text complexity. Paragraph-level factors include the syntactic similarity of sentences, the presence of conditional sentences, content word overlap across sentences, and the total number of sentences in a paragraph. While each factor impacts text complexity, the total number of sentences in the paragraph is most important when the sentences are syntactically complex.

Number of sentences.

The number of sentences in a paragraph affects text complexity by influencing the amount of information processed. For each sentence, readers must recognize the words, integrate them together, and infer the sentence's meaning. In a paragraph, this process is repeated for each sentence, and the reader must then infer the paragraph's meaning using the sentences' meanings. Paragraphs with more sentences require more processing time, which increases demands on memory and can interfere with comprehension. The number of sentences in a paragraph influences its complexity more when the sentences have complex syntactic structures, but it does not influence on complexity for sentences with simple syntactic structures (Just & Carpenter, 1992). In DLM texts, the number of sentences in a paragraph increases slightly from grade to grade. This is controlled in relation to the complexity of the sentences required to address a particular Essential Element.

Syntactic similarity of sentences.

In a paragraph, the consistency of syntactic structure across sentences impacts the overall complexity of the text. If the sentences share a similar syntactic structure, readers process the arrangement of the important information once and then use that knowledge to process subsequent sentences, thus improving comprehension (Bormuth, Manning, Carr, & Pearson, 1970). However, if the sentences vary in their syntactic structures, readers process each sentence completely and independently, which decreases comprehension (Hale, 2001; Narayanan & Jurafsky, 1998). Texts authored for lower grades and lower linkage levels in the DLM system have syntactic similarity, but variation in syntactic structure increases slightly from grade to grade.

Content word overlap.

Content words include the nouns, verbs, and adjectives in a sentence, such as the names of people, items, or ideas. Readers retrieve from memory the meaning of each word they encounter to acquire the meaning of a sentence. This process takes more time when the words are not repeated. However, when words are repeated across sentences, their meanings remain in the forefront of memory. This benefit allows readers to bypass searching for the meaning of individual words and facilitates the integration of the meanings of sentences (Haviland & Clark, 1974; Kintsch & van Dijk, 1978; Kintsch & Vipond, 1979; van Dijk & Kintsch, 1977). The repeated use of content words reduces text complexity. Beginning readers, in particular, have more difficulty reading passages containing a large number of unique content words than with passages containing more content word overlap (Drum, Calfee, & Cook, 1981). Thus, content word overlap is maximized within DLM texts.

Number of conditional sentences.

Unlike the syntactic similarity of the sentences in a paragraph, conditional sentences can vastly increase a text's complexity. Conditional sentences contain connectors, such as “if,” “and,” “but,” and “not.” These connectors join together and indicate the relationship between the logical propositions, which are true or false. To understand conditional sentences, readers infer a tentative interpretation of the sentence according to the premises and connectors (Markovits & Barrouillet, 2002). They retrieve relevant information from memory for the initial interpretation (Janveau-Brennan & Markovits, 1999; Markovits, Fleury, Quinn, & Venet, 1998; Quinn & Markovits, 1998). Then readers must generate alternative interpretations for the sentence and decide whether the initial interpretation was correct (Johnson-Laird & Byrne, 1991; Johnson-Laird, Byrne, & Schaeken, 1992; Klaczynski & Narasimham, 1998). Beginning readers have difficulties generating alternative interpretations due to their memory constraints (Hale, Bronik, & Fry, 1997; Kail, 1992); they begin by processing only one interpretation at a time (Markovits, 2000; Markovits & Barrouillet, 2002). Deriving the meaning of conditional sentences requires a great deal of processing. Therefore, conditional sentences are avoided in DLM texts at lower grade levels and lower linkage levels.

Conclusion

Reading is a cognitive and linguistic process that involves the same skills for students with and without disabilities. The difficulties a student encounters while reading result from a combination of word-, sentence-, and paragraph-level text features, combined with the characteristics of the task and the characteristics of the individual reader. Because of the cognitive and linguistic profiles of students with significant cognitive disabilities, controlling the complexity of text features is required when the goal is to introduce increasingly complex comprehension tasks. If the complexity of text features is not controlled, students with significant cognitive disabilities will only be able to complete low-level comprehension tasks, and not the more complex reading tasks that are required by college and career-readiness standards. Therefore, DLM writers carefully control the quantitative complexity of the texts, slightly increase text complexity across the grades, and focus on the more complex comprehension tasks identified in the DLM Essential Elements.

Glossary

DLM Claim	A broad statement about what the DLM consortium expects students to learn and to be able to demonstrate within each content area. Each claim is subdivided into two or more conceptual areas.
DLM Essential Elements	Specific statements of knowledge and skills linked to the grade-level expectations identified in the Common Core State Standards. Dynamic Learning Maps Essential Elements build a bridge from the content in the Common Core State Standards to academic expectations for students with the most significant cognitive disabilities.
Learning Map	A learning map is a network of sequenced learning targets representing the entire spectrum of a student’s learning. In the DLM system’s learning map, multiple skills connect with one or more other skills, and this dynamic relationship among the skills allows uses to identify multiple learning pathways on which students might follow in their education.
Node	A node in the learning map represents a distinct and observable skill. Each node has one or more nodes contributing to its development, and each node then contributes to the development of one or more subsequent nodes.
Linkage Levels	A small section of the learning map that contains one or more nodes that represent critical concepts or skills needed to learn an Essential Element. Linkage levels are always directly related to grade-level Essential Elements, but extend back to foundational skills at the initial precursor level. There are typically five levels: initial precursor, distal precursor, proximal precursor, target, and successor. The nodes at the target level are most closely related to the expectation in the Essential Element.

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