



Evaluating the Accessibility of Online Informational Texts to Support Elementary School Students' Content Knowledge Development in History/Social Sciences and Science

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Abstract

Online informational texts are valuable resources for content learning. Various studies have highlighted the benefits of engaging elementary school students in reading online informational texts for developing their content knowledge [1]. Students' comprehension of online texts in various subjects contributes to their academic success [2]. However, little is known about the accessibility of online informational texts in history/social sciences and science that would affect students' comprehension of these texts. This exploratory study aims to identify areas that are related to online informational texts' accessibility. A content analysis [3] was conducted with 100 online informational texts, which were identified based on content specified in the California state standards for history/social sciences and for science. Twenty texts were selected for each grade level; 10 texts focused on history/social sciences and 10 texts were related to science. After multiple readings of each text, the researcher identified three main areas that affected accessibility of these texts: language, content, and text layout. The language area includes types and levels of academic vocabulary, varied sentence structures (e.g., complex sentences vs. simple sentences), and varied text structures (e.g., sequencing, description, and problem-solution as well as a combination of several text structures). The content area focuses on the degree of content familiarity to students (e.g., having adequate prior knowledge vs. reading completely new content). The text layout area is related to how an online text is presented to students (e.g., a whole text on one screen; videos and images as additional support for comprehension). Additionally, the interplay of these three main areas may affect accessibility. In selecting online texts for developing students' content knowledge of history/social science and science, teachers must consider the accessibility of online informational texts to maximize students' opportunities to read, comprehend, and learn content knowledge.

Keywords: *online informational texts, accessibility, content knowledge, elementary school children, comprehension, reading instruction*

1. Introduction

Online informational texts are valuable resources for content learning. Some examples of such texts in history/social sciences and science for elementary school students in 1st-5th grades are *Branches of U.S. Government* (<https://www.usa.gov/branches-of-government>), and *The Water Cycle* (<https://gpm.nasa.gov/education/water-cycle>). Various studies highlighted the benefits of online resources for student learning [1, 4]. Much research has focused on strategies for students to comprehend online texts [5,6,7]. Additionally, Ferguson (2020) recommended instructional strategies to support students' comprehension of online texts in content areas. Specifically, teachers can make unknown or difficult vocabulary accessible to students by providing a link to a definition and other related context for explaining concepts related to the vocabulary[4]. However, little is known about the accessibility of online informational texts in history/social sciences and science that would affect students' comprehension of these texts. Accessibility, defined beyond physical access to online texts, centers more around students' ability to read and comprehend texts. Online texts tend to be less accessible because many online texts are not written for elementary school students. Some textual and navigation factors can present challenges to accessibility of online texts for students [8, 9], particularly for struggling readers and students who are learning English [9].



2. Methodology

This exploratory study aims to identify areas that are related to online informational texts' accessibility. The researcher conducted a content analysis [3] of 100 online informational texts, which were identified based on content and concepts specified in the California grade state standards for history/social science and for science for 1st-5th grade students. For example, one of the 2nd grade science standards is related to "The Roles of Water in Earth's Surface Processes" [10]. The online text, *The Water Cycle* (<https://gpm.nasa.gov/education/water-cycle>), closely relates to this standard.

Twenty texts were selected for each grade level; 10 texts focused on history/social sciences, and 10 texts were related to science. After multiple readings of each text and comparisons of texts in history/social science and those in science, the researcher identified three main areas that affected accessibility: language, content, and text layout.

3. Findings

Two sample texts were selected to illustrate the three areas (language, content, and text layout) that affect accessibility of online informational texts. The first text, which relates to history for 5th graders, is *Segregation in the United States* (<https://www.history.com/topics/black-history/segregation-united-states>). The second text, which relates to science for 2nd graders, is *Types of Clouds* (<https://scijinks.gov/clouds/>). These two sample texts are representative of 100 texts that display variations in the three factors impacting accessibility (language, content, and text layout). Within the context of this study, language includes academic vocabulary, sentence structure, and text structure. Content of an informational text refers to the topic of the text and other related information (e.g., weather is supplemental information relevant to the main topic of different types of clouds in the text). Text layout is how content is presented with or without support of media (e.g., video, image, link to an explanation of a concept), how a reader navigates through the text (e.g., reading a whole article with multiple scrolls), and how the presence of other irrelevant, distracting information affects a reader's focus during the reading process (e.g., ads).

3.1 Language

As shown in Table 1 Accessibility Analysis of Language in Sample Texts, academic vocabulary is not just words related to one specific content area, which always represent content concepts. Students need to know how to pronounce these words AND how to understand the concept and content that these words represent. For the text of *Types of Clouds*, academic vocabulary is mostly related to different types of clouds and other weather-related words, such as "air mass". In the text of *Segregation*, given the complexity of this topic, academic vocabulary covers a wide range of segregation-related topics, including notable historical figures, events, and court cases. Additionally, academic vocabulary appears less frequently in *Types of Clouds* than in *Segregation*. Academic words are also more varied and frequent in *Segregation* than in *Types of Clouds*.

Both texts have three basic types of sentence structure (simple, compound, and complex sentences). The text of *Segregation* also has complex-compound sentences. Additionally, the sentence lengths are generally much shorter in *Types of Clouds* than those in *Segregation*. The presence of varied sentence structures and lengths is higher in *Segregation* than that in *Types of Clouds*.

Text structure of informational text includes 5 basic patterns: description, sequence, compare and contrast, cause and effect, and problem and solution. Informational texts tend to have more complex text structures. First, each text can have more than one text structure. Each text structure can appear at the paragraph level. It is also possible that the same text structure is used in more than two consecutive paragraphs. Second, one paragraph may have more than one text structure. For example, one part of a paragraph may have the text structure of sequence in its first part, while the following part may follow the structure of cause and effect. The text, *Segregation*, reflects such complexity of text structures. The variability of text structure in *Segregation* can present some challenges to even 5th graders.

Due to the complexity and variability of the text structure in *Segregation*, the text structure examples in the table below will be summarized from the original text. By contrast, text structure examples of *Types of Clouds* will be quoted verbatim.



Table 1 Accessibility Analysis of Language in Sample Texts

	<p>Segregation in the United States (https://www.history.com/topics/black-history/segregation-united-states) This informational text focuses on a brief history of segregation in the United States.</p>	<p>Types of Clouds https://scijinks.gov/clouds/ This informational text briefly describes the characteristics of 10 common clouds and 4 special clouds.</p>
Academic Vocabulary	<ol style="list-style-type: none"> 1. Academic vocabulary covers a wide range of topics with varying levels of familiarity, from historical figures (e.g., Abraham Lincoln, Herbert Hoover) to historical events (e.g., WWII, Great Migration) to court cases (e.g., Brown v. Board of Education; Shelley v. Kramer). 2. In many paragraphs, there is at least one academic word/phrase that conveys a less familiar concept. Some examples are the Thirteenth Amendment, Black Codes, relegate, and Plessy v. Ferguson. 	<ol style="list-style-type: none"> 1. Most academic vocabulary covers the names for different types of clouds (e.g., cirrus clouds, mammatus clouds). Some words are weather-related words (e.g., <i>droplets, ice crystal, air mass</i>). <i>Other words include strands, tropical, terrain, condensed, exhaust.</i> 2. Not every paragraph has an academic word.
Sentence Structure	<p>Simple Sentence “In 1875, the outgoing Republican-controlled House and Senate passed a civil rights bill outlawing discrimination in schools, churches and public transportation.”</p> <p>Compound Sentence “There were separate waiting rooms for White people and Black people in professional offices and, in 1915, Oklahoma became the first state to even segregate public phone booths.”</p> <p>Complex Sentence “Segregation was made law several times in 19th and 20th-century America as some believed that Black and white people were incapable of coexisting.”</p> <p>Complex-Compound Sentence “Segregated schools and neighborhoods existed, and even after World War II, Black activists reported hostile reactions when Black people attempted to move into white neighborhoods.”</p>	<p>Simple Sentence “Cumulus clouds look like fluffy, white cotton balls in the sky.”</p> <p>Compound Sentence “They are beautiful in sunsets, and their varying sizes and shapes can make them fun to observe!”</p> <p>Complex Sentence “Cumulonimbus clouds grow on hot days when warm, wet air rises very high into the sky.”</p>
Text Structure	<p>Description The article describes the housing segregation that African-Americans experienced in 19th and 20th century America.</p> <p>Sequence The article provides a timeline about segregation during the 19th and 20th century (e.g., during the Depression, during the Great Migration).</p> <p>Compare and Contrast The article describes how Black and White people were treated and experienced differently in America (e.g., housing, busing).</p> <p>Cause and Effect</p>	<p>Description “Stratocumulus clouds are patchy gray or white clouds that often have a dark honeycomb-like appearance.”</p> <p>Cause and Effect “Cumulonimbus clouds grow on hot days when warm, wet air rises very high into the sky.”</p>



	<p>This article describes how Dr. Martin Luther King Jr. and the Civil Rights movement resulted in the birth of the Civil Rights Act.</p> <p>Problem and Solution</p> <p>The article describes several court cases (e.g., Brown v. Board of Education; Shelley v. Kramer) that challenged segregation.</p>	
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3.2 Content

As shown in Table 2 Accessibility Analysis of Content in Sample Texts, the text *Segregation* includes 9 different content areas, including historical figures, the Constitution, law, and economics. While 5th graders should have some background knowledge in certain content areas (e.g., historical figures like Abraham Lincoln, Martin Luther King, Jr.), other content areas (e.g., court cases and economics concepts) may be beyond their scope of prior knowledge. This article can present many challenges to 5th graders, and more so to English learners and struggling readers. The 4 content areas in the text *Types of Clouds* (water cycle; weather; geography; solar system) are likely more familiar as 2nd graders should have some background information in these areas.

Table 2 Accessibility Analysis of Content in Sample Texts

Segregation in the United States https://www.history.com/topics/black-history/segregation-united-states	Types of Clouds https://scijinks.gov/clouds/
<p>This text covers the following segregation-related content:</p> <ol style="list-style-type: none"> 1. Historical Concepts (colonization, red-lining, reverse red-lining, segregation, discrimination, apartheid schools) 2. Historical Figures (Abraham Lincoln, Herbert Hoover, Thurgood Marshall, Harry Truman, Linda Brown, Dwight D. Eisenhower, Orval Faubus, Rosa Parks, Dr. Martin Luther King Jr.) 3. Historical Events (Great Migration, World War II, Great Depression, Civil Rights Movement) 4. Government (The Supreme Court, Congress, House, Senate, Secretary of Commerce, Federal Zoning Committee, Public Works Administration, National Association for the Advancement of Colored People (NAACP), National Guard) 5. Constitution and Law (The Thirteenth Amendment, Jim Crow, Black Codes, Civil Rights Act, Elimination of Racial Balance Law) 6. Geography (Haiti; Liberia; Levittown, NY; Washington, DC; Nashville, TN; Virginia; Topeka, KS; Little Rock, AR; Roxbury, MA; South Boston, MA; Montgomery, AL) 7. Universities (Howard University, Fisk University, Hampton Institute) 8. Court Cases (Plessy v. Ferguson; Buchanan v. Warley; Shelley v. Kramer; Brown v. Board of Education) 9. Economics (foreclosure, subprime loans, Federal Home Loan Bank Board, Home Owners' Loan Corporation, the Housing Act of 1949) 	<p>This text covers the following cloud-related content:</p> <ol style="list-style-type: none"> 1. The Water Cycle (liquid, droplet, vapor, crystal) 2. Weather (wind currents, snow, rain, sky, air mass, hurricane, sunlight, sunset, fog, moisture) 3. Geography (mountain, hill, terrain, tropical region, sea) 4. Solar System (The Earth, The Sun, The Moon)



3.3 Text Layout

As shown in Table 3 Accessibility Analysis of Text Layout in Sample Texts, the text layout of *Segregation* can be as equally accessible as the layout of *Types of Clouds*. Even though the former, a longer text with longer paragraphs, requires more scrolling to finish reading it, it has much more support from additional media (e.g., videos, images, links). Additionally, its linear presentation of content, written in big font, fits the way that most readers process a print text. By comparison, the text *Types of Clouds*, with much shorter text and paragraphs, presents information in a smaller blue font and includes limited support from other media. The placement of text under each image within a row of three pictures may not fit well with a reader's way of processing text linearly. On the other hand, the pop-up ads in *Segregation* can cause some level of distraction.

Table 3 Accessibility Analysis of Text Layout in Sample Texts

Segregation in the United States https://www.history.com/topics/black-history/segregation-united-states	Types of Clouds https://scijinks.gov/clouds/
<ol style="list-style-type: none"> 1. The text is relatively long with 26 paragraphs. A reader needs to scroll down multiple times to get to a particular section of the text and ~8-10 times to get to the end of this article. 2. The text is written in big font and in a linear order (i.e., reading from top to bottom), and it has a link to many concepts that may be difficult to students (e.g., Thirteenth Amendment, Black Codes, Plessy v. Ferguson). 3. Videos and images are provided to explain some key concepts in detail (e.g., Red-Lining, Montgomery Bus Boycott). 4. There are pop-up ads, which appear at any time, and sponsored content at the end of the article. 	<ol style="list-style-type: none"> 1. This text is relatively short with one paragraph for each type of clouds. A reader only needs to scroll down 2 or 3 times to complete reading this article. 2. The text is written in small print with blue color. Each paragraph is placed under each image showing the type of cloud described in the paragraph. Hence, a reader needs to read from top-to-bottom as well as from left-to right at the same time. 3. A video in the beginning of the text introduces clouds whose descriptions will be presented in the text. The text has only two links: one is for detailed information about water droplets or ice crystals and the other is for making contrails clouds in the simulator. 4. There are no pop-up ads or other sponsored content.

4. Instructional Implications

As shown in Tables 1, 2, and 3, and as discussed in the Findings section, online information texts, like all print informational texts, include elements that affect comprehension (i.e., language, content, and text layout). Evaluating the accessibility of online texts is more complicated and critically necessary. Teachers must evaluate text accessibility before using online texts to maximize students' learning experience, and particularly for those who are struggling readers and who are learning English as a new language. First, while selecting online informational texts to supplement their curriculum for history/social science and science, teachers need to read thoroughly each text. Second, teachers must carefully evaluate each element (as shown in Tables 1, 2, and 3) as well as the interplay of these elements. For example, the pop-up ads in the text *Segregation* may negate the benefits of additional support from other media. Similarly, the smaller, blue print in the text *Types of Clouds* may cause a sense of uneasiness among some readers. Additionally, teachers need to consider a balance among three areas (language, content, and text layout). For example, while some content in the text *Segregation* may be unfamiliar to 5th graders, the text could be made more accessible if teachers capitalize on the additional media provided in the text to enhance students' comprehension of unfamiliar content and vocabulary. Third, teachers must build needed background information on the content less familiar to students before introducing a text like *Segregation*.



Additionally, teachers need to always remember the impact of language on students' comprehension ability. The text *Segregation* is a great example with complex language elements, where teachers can frontload academic vocabulary. There are several approaches that teachers can try out to improve accessibility of online texts. For example, some mini-lessons on sentence and/or text structure are needed. It is also a good idea to integrate teaching or reviewing sentence and/or text structure into grammar instruction. Using online texts that students are reading for grammar lessons can engage students in learning and contextualize such learning, which is more authentic and meaningful than grammar lessons with worksheets. Finally, it would be beneficial to both teachers and students when they reflect on using online informational texts and learn from one another's perspectives. Teachers can focus on the text accessibility and ways to make a less accessible text more accessible to students. Students can share their experiences of navigating and comprehending an online text, such as how they have identified easy and/or difficult parts of the text and how they have tried out strategies before and during reading.

5. Conclusion

This exploratory study has identified three areas (language, content, and text layout) that affect accessibility of online information texts, a rich source of information for content learning in history/social science or science. The findings show the complexity of evaluating these areas as well as variability in accessibility across texts. As shown in the sample texts, each text has its own strengths and weaknesses in accessibility. It is up to teachers to decide, based on their own reading and evaluation of text accessibility as well as student characteristics (e.g., struggling readers, multilingual students), as to which text is accessible to all students in support of their content knowledge development in history/social science and science. While using an online text, teachers must apply instructional strategies (e.g., frontloading academic vocabulary, building background knowledge) to improve the accessibility of the content for students. It is also valuable for both teachers and students to reflect on and learn from their experiences with online texts. In doing so, learning from online informational texts can be maximized for elementary school students' content knowledge development in history/social science and science.

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