# THE VARIANCE AMONGST THE RESULTS OF READABILITY FORMULAS REGARDING U.S. HISTORY TEXTBOOKS

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#### ABSTRACT

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Many U.S. history teachers use textbooks as the primary reading in their classrooms. Generally, the textbooks are written at a higher readability level than the grade level for which the text is intended. Also, the reliability of the readability levels published by textbook companies should be questioned. This investigation sought to explore the readability of textbooks for use in U. S. history classes. The research question in this study was: What is the variability of the three different readability formulas on selected U. S. history textbooks? In the study, three readability formulas were analyzed: the Flesch-Kincaid, Gunning (FOG), and Fry Graph. Three U. S. history textbooks previously used in classrooms were chosen for the study. Descriptive statistics were used to determine the variance amongst the results. The results show there was a great amount of variance amongst the readability formulas regarding U. S. history textbooks. Teachers should be aware of the variability amongst the formulas and question the readability level provided by the publishers. This project is dedicated to my friends and family that have provided financial and moral support that has helped me grow as a learner over the years.

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#### CHAPTER I. INTRODUCTION

Readability formulas have been used by educators since the early twentieth century. Davison and Bolt (1981) state, "Readability formulas were originally conceived in the 1920s and 1930s" (p. 30). Throughout the history of their use, the importance of readability formulas has increased, which has influenced major decisions about textbooks and other reading materials made by schools. To most professionals readability means the application of readability formulas (Fry, 2002). As a result, readability formulas are widely used to determine the readability of many books, including textbooks used in classrooms. Many schools use information regarding readability of textbooks to select texts they believe are the most appropriate for students in their school. Because the primary goal of reading is comprehension, it is important that textbooks be available for students at an appropriate level of difficulty. For classes that require extensive reading, this notion of readability and comprehension of text is extremely important. One class where there is an extensive reliance on textbook reading is social studies. The textbooks in social studies classes seem to be the primary way in which content is taught; therefore, it is essential that the readability of the texts used for such classes be known.

#### Statement of the Problem

Most of the reading done in social studies classrooms is from the classroom textbook. It is crucial for students to be able to understand what they are reading from their textbooks in any social studies class. Since it is the primary text used in the classroom, understandability of the text is even more important. Many textbooks are written at a higher readability level than the grade level for which they are intended. As a result, in the past students have struggled with, resisted or faked textbook reading (Ivey, 2010). When a textbook is too difficult, understandability is at stake.

In addition, the readability results can be deceiving and do not actually depict the difficulty or ease of the text in relation to the abilities of the readers using the textbook. Davison and Bolt (1986) concede, "Researchers have found that there are many aspects of readability which the formulas overlook and distort" (p. 4). It is important to keep in mind that the results of formulas are a prediction and not necessarily fact. In addition, the results of readability formulas vary. When readability formulas are applied to one individual text the formulas yield results that vary amongst different grade levels (Compton, Appleton, & Hosp, 2004). Subsequently, the results of the formulas can be misleading.

In addition, many publishers of textbooks put a great amount of emphasis on the readability of text. This is primarily due to the fact that schools buying textbooks think readability is one of the most important characteristics of a text, so they make textbook selections based on readability formulae. When schools purchase textbooks, the readability is a major factor that determines whether or not they think the textbook is appropriate for their students. Davison and Bolt (1981) state, "It is really a serious dilemma for people who want to create texts of high quality which are soundly organized and coherent and who at the same time want to respond to people who demand readability scores instead of relying on experience and judgment" (p. 30). Many schools and teachers do not understand that if a textbook has a lower readability level, it does not necessarily mean that it is easier to understand. Experienced teachers' and librarians' perspectives on the understandability of a textbook are not considered nearly as much as they should be.

#### **Research Questions**

The use of readability formulas is commonplace; however, the formula used may impact the grade level to which a particular social studies text is assigned. Therefore, the purpose of this investigation was to answer the following research question: What is the variability of three readability formulas on selected U. S. history textbooks? The study involved selecting three different readability formulas and applying them to U. S. history textbooks. The study will examine the readability data by formula and across the three textbooks used.

# Rationale

Textbooks are more commonly used in the social studies classroom than in any other content. Since there is so much dependency on these books, it is important that teachers are incorporating them appropriately into classroom instruction and that students understand the texts they are assigned to read. One factor typically used to select textbooks for instruction is readability, which is highly regarded by schools as a salient factor to consider when selecting texts. Armbruster, Osborn, and Davison (1985) state, "Readability formulas exert a powerful influence on American textbooks" (p. 18).

However, the predicted readability of textbooks is not always the most accurate and does not always reflect the ease or difficulty of the text. There are many factors that impact readability and different readability formulas consider various factors, but there is not one readability formula that considers all of the possible factors. Two factors that are often examined closely are vocabulary and sentences within the text. Jeanne Chall (1981) states, "A vocabulary and a sentence factor together predict comprehension difficulty of written text to a higher degree of accuracy" (p. 2). The two aspects of language combined allow for there to be a more reliable result, because more than one component is considered. The more factors measured, the more reliable the results. Since, readability is not clearly defined there is no criterion and consequently a specific readability formula cannot be considered a more predictive power than another formula (Wagenaar, Schrueder, & Wijhuizen, 1987). It is impossible for readability formulas to measure all components of readability and be consistent or reliable all of the time. Davison and Bolt (1986) concede, "Researchers have found that there are many aspects of readability which the formulas overlook or distort" (p. 4).

Since, there is not a readability formula that considers all possible aspects of readability the formulas' results will always overlook something. However, if this concept is taken into account and more than one readability formula is used to determine the readability of a text, the predicted readability grade level is likely to be more consistent and reliable. It is important that teachers and textbook selection committees be aware that various readability formulas may give different results, which could significantly impact the students' ability to read and understand the assigned text. The purpose of this study is to apply three readability formulas to U. S. history textbooks to evaluate the relationship between the results of the various readability formulas.

# Definition of Terms

This study focuses on using three different readability formulas. The three formulas are identified and defined below to provide background information for the reader and serve as a reference.

- <u>Text Readability</u> The grade level of readability that is determined by a particular readability formula.
- <u>Flesch-Kincaid Readability Formula</u> formula that focuses on the average number of syllables per word and words per sentence.
- <u>Fry Readability Graph</u> formula that focuses on the average number of syllables and average number of sentences per 100 words.
- <u>Gunning (FOG) Readability Formula</u> formula that focuses on mathematical calculations of sentence length and percentage of polysyllabic words

- <u>Readability scores</u> "Used to determine the grade level appropriateness of materials ranging from library books and periodicals, to instructional materials in all subjects such as social studies, science, mathematics, health, and even reading" (Rush, 1984).
- <u>Precision</u> The smaller the standard deviation, the more precise the results of the data are. On the other hand, as the standard deviation gets larger the results become less precise.
- <u>Appropriateness</u> Prediction or likelihood students in the grade level for which the textbook is intended will understand the text

<u>Accuracy</u> - the prediction of the sufficient comprehension level

<u>Passage</u> - Approximately 100 words of text from beginning, middle, or end of the textbook

# Limitations

There are many textbooks used within social studies classrooms by teachers. For this study only three different textbooks were used for analysis. In addition, only three readability formulas were used for this study. There are many other readability formulas that exist and if used within this study could result in different outcomes. Due to time restrictions, more U. S. history textbooks and readability formulas could not be used. This study only specifically looked at the readability of U. S. history textbooks frequently used in Northwest Ohio. Therefore, this study does not represent the readability of U. S. history textbooks used within the entire state or nation.

#### CHAPTER II. REVIEW OF LITERATURE

This study concerns the variability among readability formulas in selected U. S. history textbooks. More specifically, the research question was: What is the variability of three readability formulas on selected U. S. history textbooks? Before the readability formulas were analyzed, readability's impact on students' motivation to read was briefly investigated. Three readability formulas were used in the study and each one was thoroughly examined in this chapter. In addition, the differences between the readability formulas and the variables that they involve when determining readability were analyzed. Also, the consequences of relying so heavily on readability formulas were considered. The consequences were a result of readability formulas' inability to take all variables that influence the difficulty of a text into account. U. S. History textbooks were used for the study, so aspects of readability of these textbooks were examined.

#### Motivation and Readability

The difficulty of a text highly influences how motivated students will be to read it. The more difficult a text is, the more likely it is that students are going to get frustrated with what they are reading. As a result, when students are frustrated by a text they are less likely to be motivated to read it. Students are less likely to be motivated if the materials provided for students are not within the students' potential to learn (Kane & Warner, 1997). For example, it is very likely that a difficult textbook will not compliment students' learning in the classroom. Therefore, if a textbook has a higher readability grade level than the grade for which it is being used, the likely result will be that students will have difficulty understanding it. In addition, they will not be motivated to read the textbook. Readability heavily influences students' motivation to read a certain text.

#### **Readability Formulas**

The readability of a text can be determined through a variety of means. In particular, Rush (1984) states, "Readability scores are used to determine the grade-level appropriateness of materials ranging from library books and periodicals, to instructional materials in subjects such as social studies, science, mathematics, health, and even reading" (p. 4). Readability formulas are commonly used for a wide variety of texts; because they are objective, they do not consider many outside factors. Readability formulas have been widely used since the middle of the 20<sup>th</sup> century by textbook publishers (Oakland & Lane, 2004).

Print materials used in classrooms benefit from the use of an objective quantitative measurement of readability. Chall (1981) states, "Readability formulas are the most useful tools for the important task of measuring the difficulty of instructional materials" (p. 4). The formulas provide unbiased results that teachers can trust to predict the level of readability in broad terms to assist them when deciding whether or not the text is appropriate for an entire class. Rush (1984) adds, "Readability formulas are useful tools for obtaining estimates of the difficulty of text, when the intended audience for the text is known only in general terms" (p. 9). Readability formulas cannot take all students' needs into account, which is not the intention of the formulas. The formulas are a broad measure of the readability of a textbook and they give prospective buyers an idea for which grade levels the text is appropriate. Additionally, readability formulas mainly focus on the syntactic and semantic aspects of passages used when finding results. However, actual comprehension of the text is dependent on more than just sentence structure and the number of syllables in words.

#### Advantages of Readability Formulas

Edward Fry (1968) states, "Readability formulas have been around for many years and a good deal has been written about them" (p. 513). Research has shown that readability formulas can be useful tools, but they also have shown that the results can be distorted and unreliable. Over the years, it seems that the use of readability formulas has been generally accepted, thus earning the trust of many educators who are concerned with the difficulty of textbooks used in today's schools. According to Rubin (1981), "Readability formulas are available, objective, economical, and established" (p. 55). Since readability formulas are objective, outside factors cannot influence the level of readability. The fact that readability formulas are not subjective makes them more likely to be reliable and trusted.

The readability level of textbooks and books in general holds importance to many different people in the reading business who trust the results of readability assessments. Specifically, "readability formulas have had a widespread, long-term interest among professionals in the reading business" (Fry, 1968, p. 513). For example, teachers are concerned with the readability of the textbooks they use in their classrooms. The schools' personnel who choose the textbooks are concerned with the readability of textbooks. As a result, the textbook publishers are highly likely to write the textbooks to fulfill the wants and needs of the people purchasing the textbooks.

#### Disadvantages of Readability Formulas

Often times, textbooks are written so that a certain readability grade level is maintained throughout the textbook. Although, textbooks may have a readability grade level that is appropriate for the grade level using the textbook, it does not mean that the readability grade level corresponds with the comprehensibility of the text for the students using the textbook. Rubin (1981) argues, "One issue is that of defining the readability of texts. The problems children encounter in comprehension may lie not just in the length of sentences or word difficulty as traditional readability formulas suggest, but in the complexity of the conflicts portrayed in the story" (p. 25). The actual content of what children are reading has a major role in the understandability of the text and needs to be considered more when determining the readability level. There are other factors that readability formulas do not consider that have an integral role in the comprehensibility of text. Armbruster et al., (1985) state, "Readability formulas fail to take into account many characteristics of text that are known to affect comprehension-for example, content difficulty and familiarity, organization of ideas, author style, page layout" (p. 18). It is likely that the background knowledge that students have on the topic they are reading heavily impacts how comprehensible a text is for a student. In addition, the language patterns used in the text are not considered. According to Zhihui and Schleppegrell (2010), language patterns used in textbooks are unfamiliar to adolescents and present comprehension challenges (p. 588). Language patterns are another component of writing that impact the understandability of the text that should be considered when determining whether or not students will comprehend the text.

Readability formulas only account for the actual text and do not consider the readers as individuals. Only the difficulty of the text is being measured by formulas (Giles & Still, 2005). Since the text is the only component considered, many other components of reading are ignored and the true readability of the text is not portrayed by the results of the formulas. Rush (1984) concedes, "Readability formulas being strictly text based, do not reflect the interactive nature of the reading process" (p. 4). Since the actual readers are not considered during the process of learning, the reader is not regarded. Thus, readability formulas only potentially determine the

level of readability for a wide range of students and not a specific group within the population that will be using the textbook. All students' abilities differ within various schools and it is likely that formulas' results do not portray how difficult a text may be for a specific class that will use the textbook. Rush also states, "Readability formulas are useful tools for obtaining estimates of the difficulty of text, when the intended audience for the text is known only in general terms" (p. 9).

Since readability formulas do not consider all aspects of reading, the results are simply estimates and should not be taken as fact. In addition, "Readability formulas are useful in matching reading materials to general audiences of some assumed level of reading ability level of reading ability" (Rush, 1984, p. 16). The results of formulas should definitely be considered when choosing textbooks for a specific grade level, because they do give people a general idea of the difficulty. However, depending on the classroom the students may be reading at a higher or lower grade level and not fall within the general audience that is used when predicting the readability grade level.

In addition, the different readability formulas results vary and are not always consistent. Since the formulas used to determine readability do not always have consistent results the reliability of such formulas is questioned. The findings of a study (Pitcher & Zhihui, 2007) focusing on leveled texts suggest the variations of readability levels determined by certain formulas was much larger than expected. The measurements of readability determined by different formulas often are more diverse than expected. As a result, reliability of such formulas should be analyzed and the results should not be considered fact.

#### Common Readability Formulas

Readability formulas have been used for over 80 years. There has been controversy surrounding all readability formulas because each formula relies on different variables. The three readability formulas used in the study are the Flesch-Kincaid, Gunning (FOG), and the Fry Readability Graph. Each formula uses different variables to determine the readability of text. The variables used include number of words, sentence length, average number of syllables, and vocabulary. Since, all three of the readability formulas measure readability based on different variables the results are likely to differ. Each readability formula used in the study is explained below. The person who created the formula is introduced and information about how or why the formula was made is provided. In addition, the variables that are used in the formulas are described.

# Flesch-Kincaid

Rudolph Flesch had a major role in readability gaining importance and popularity. He gained an interest in readability when he was an assistant in a college readability lab. He earned a Ph. D in educational research and his dissertation focused on readability. The dissertation was completed in 1943 and was titled *Marks of a Readability Style*. In the dissertation, the readability formula that was introduced focused on affixes and personal pronouns. The formula gained popularity when "publishers discovered that readership increased 40 to 60 percent when the formula was used" (Du Bay, 2007, p. 96). In 1948, Flesch introduced a second Reading Ease formula. This formula is similar to the one used in this particular study, because the only variables it focused on were the "number of syllables and number of sentences for each 100 word sample" (DuBay, p. 57). The Flesch-Kincaid readability formula is the Reading Ease formula

used in the study, and it is based on the average number of syllables per word and words per sentence (DuBay, p. 57).

# Gunning (FOG)

Robert Gunning created the Gunning readability formula. Gunning was a graduate of Ohio State University and "entered the field of textbook publishing in 1935" (DuBay, 2007, p. 60). Gunning believed that reading problems of students and high school graduates in the mid-1930s stemmed from unnecessary complexity within writing. Gunning's interest in readability was quite apparent when he "founded the first consulting firm that specialized in readability in 1944" (DuBay, p. 61). The first readability formula that Gunning created was the Fog Index. The two variables that this formula was dependent on was "average sentence length and the number of words with more than two syllables for each 100 words" (DuBay, p, 61). The reading formula that is being used for this study has the same characteristics as the Fog Index. The Gunning (FOG) readability formula applied in the study determines the reading grade level using this formula: ".4 (average sentence length + percentage of words of 3 or more syllables, or polysyllables)" (Klare, 1963). This formula is similar to the Flesch-Kincaid formula in the sense that the number of syllables is considered.

#### Fry Readability Graph

Edward Fry introduced the Fry Graph as a way to predict the readability of a text. He created the formula in 1968 while "working as a Fullbright scholar in Urwanda teaching teachers to teach English as a second language" (DuBay, 2007, p. 84). The graph originally determined readability through high school. According to Dubay, later the graph was extended to predict the readability of materials meant for primary and college levels (DuBay). The Fry Graph involves three 100-word passages selected from a book. The average number of syllables and average

number of sentences per 100 words is plotted on the graph to determine the grade level (DuBay,). Similar to other formulas, the Fry Readability Graph is dependent on sentences within the passage. However, there is not as much of an emphasis on the number of words or the difficulty of words in the passage.

# Consequences of Readability Formulas

When publishers try to decrease the readability grade level of a text they make the sentences shorter since many reading formulas are dependent on the number of syllables in words and sentence length. Although doing this reduces the readability grade level the decision also has a negative effect on the understandability of the text. Davison and Bolt (1981) agree, "At best, the need to shorten sentences distracts a writer from other important considerations, such as discourse organization and the inferences which the reader must make" (p. 27).

Another way that publishers shorten sentences is by removing words that they think are unnecessary. Often times the words that are not included are connective words. Research (Armbruster et al., 1985) suggest:

Shortening sentences can also have disastrous effects. Dividing sentences by separating clauses and deleting connectives such as "and," "but," "then," and "because" often makes them harder, rather than easier, to understand-because the reader must infer the missing connectives. (p. 20)

When sentences are shortened the terms are not as thoroughly explained and there is ambiguity. As a result, this makes the text harder to understand. Davison and Bolt (1981) state, "In conclusion, readability formulas have a generally negative effect on the writing and revising of texts to be used as reading materials" (p. 30). When publishers only pay attention to numbers that come from the results of the readability formulas rather than the actual content it will take away from the effectiveness of the text in the classroom. The main priority is for the students to learn the content and that should be the ultimate goal of publishers instead of maintaining a specific readability grade level.

It is important to keep in mind that not all formulas are actually effective and since this is true there should not be so much emphasis on the results of readability formulas. In addition, "Some research has found that readability formulas fail to predict how easily readers comprehend particular texts" (Armbruster et al., 1985, p. 18). The results of readability formulas do not actually predict whether or not students will understand the text, it only provides a general idea of the level of readability. In addition, when publishers write the text to maintain a specific level of readability it becomes harder to understand. Also, "when readability formulas are used as the basis for writing texts, the results may be texts that are more, rather than less difficult to understand" (Armbruster et al., p. 19). When publishers change the sentences in efforts to lower the readability level the sentences become more complicated and confusing instead of simplifying the text. Research states, "simplifying the vocabulary often involves substituting vague words for precise words, that the costs of using "easy" words include some loss of meaning and more than a little ambiguity" (Armbruster et al., p. 20). There are some difficult words that are necessary because they explain the content the best. However, these words are often removed and replaced because they make the readability grade level higher. The new words that are used may be simpler, but they actually make the content harder to understand.

Although, readability formulas have been used over the years and have been shown to determine the difficulty of a text on a broader scale they do not determine the understandability of texts for a specific classroom that will actually use the textbook. According to Chall (1981), "Readability formulas do not determine how easy or hard the materials should be for a class, a

group, or an individual, instead, they give only estimates of how difficult the materials probably are" (p. 3). The only way to find if a text is understandable for certain students is if they actually read the text for themselves. Chall writes, "At best, readability formulas give only predictions of readability. The ultimate test of difficulty is a tryout or field test with readers for whom the material is intended" (p. 3). Students' interaction with the text is important and gives the teacher a better idea of how difficult the text is. Readability formulas only consider the text and do not regard the students that will be reading the text. Rush (1984) concedes, "Readability formulas, being strictly text based, do not reflect the interactive nature of the reading process" (p. 4). The reading process involves the student actually reading the text and taking time to comprehend and process what they have read.

The actual ability of the student should be taken into account. Mechanics and the difficulty of the text are important, but they are not the only factors in the understandability of the text. Therefore, Fuchs, Fuchs and Deno (1983) adds, "Such a reliance on the mechanics of text, rather than the content of a passage or the skills of a reader, may explain at least partially the failure of the readability formulas to predict students' actual performance on the passages" (p. 12). Since there are so many consequences that come with using readability formulas it should not be the only measure of how difficult a text is. As a result, "relying on readability formulas as the sole index of text difficulty probably does far more harm than good" (Armbruster et al., 1985, p. 19). It is important to gain a better understanding of how the students will comprehend the text. In addition it is necessary for the people choosing the textbooks to actually read the text themselves. An appropriate level of readability does not always automatically indicate it is an understandable text that students will easily comprehend.

#### Classroom Teachers and Readability

It is likely that many teachers are not as familiar as they should be with all the factors involved in determining readability as well as those factors that are not considered when predicting readability. Davison and Bolt (1986) state, "Readability is familiar to educators mainly in terms of readability formulas" (p. 4). Since it is widely known that readability formulas are primarily used when determining the readability grade level of a text most teachers automatically associate readability with readability formulas. However, additional insight from teachers would be useful in determining what text is the most appropriate for the classroom. Although the results of readability formulas should be considered, outside factors should also be taken into account. Bonnie Burns (2006), concedes, "in determining readability, one must not forget the importance of teacher judgment in matching books to readers" (p. 39). The background knowledge of teachers makes them highly qualified to judge such factors. Also, "Teachers who are experienced in teaching a particular grade level often have a very good sense of what material can be read by students at that grade level" (Davison & Bolt, p. 29).

Another person involved in the school and whose perspective would be useful, is the librarian. Librarians have an idea of what books are appropriate for what students and the reading abilities of students. In addition, "decision about the matching of textbooks to children are probably best made by trained and experienced judges-the teachers and librarians who have worked with children and who have witnessed the interactions of a lot of children with a lot of books" (Armbruster et al., 1985, p. 20). The insight of teachers would be very useful because they have knowledge of the abilities of the students using the text. Since readability formulas only determine the level of readability of a general audience, the perspective of teachers is essential. However, this perspective is not taken into account and readability formulas are relied

on instead. Sewall (1987) states, "Classroom instructors and selection committees insist on knowing what readability scale and what calculated level of difficulty a publisher uses in producing a text" (p. 24). Furthermore, many teachers and other personnel selecting the text think that readability formulas are the only effective way to determine readability they trust the results and choose textbooks based on the results of the formulas used by the publisher.

# Alternatives to Readability

Instead of publishers relying completely on only a readability formula, they should also use multiple formulas to determine the readability grade level of a text. Davison and Bolt (1981) suggest:

... if a particular text passage is to be part of a book or series of materials intended for readers of a particular level of reading ability, then a standard procedure might be to see what the text level of difficulty is, as measured by two or three of the commonly used readability formulas-and it is a good idea to take an average of the results, since there is always the possibility of an error of a grade or two in the results of any one formula. (p.

3)

It is likely that if more readability formulas are used then the final grade level determined will be much more reliable. Readability formulas vary, and if more are used, more important factors regarding readability of a text will be included in the final result. The school librarian may have a better idea of what would be most appropriate for the students that will be actually using the text at the school. Furthermore, "the librarian can be asked to comment on the placement of the selections in a particular grade level given the general population at the school" (Davison & Bolt, 1986, p. 28). This is a great alternative because readability formulas only consider the general population and do not consider the individual groups that will be using the text.

If teachers would like a better perception of the difficulty of the text for their students, they could actually see how the students will interact with the text. Davison and Bolt (1986) suggest, "average or middle-range students can be asked read aloud sample selections being considered and the teacher can listen for errors, applying the standards normally used in the classroom" (p. 29). This gives teachers an idea of whether or not the vocabulary in the text is too difficult. This is beneficial because the readability formulas give distorted results because of more difficult vocabulary used in the text. There are other factors that should be considered when determining the readability of a text. In addition, "Readability formulas neglect characteristics of readers that affect comprehension-such as their motivation, interest, purpose, perseverance" (Armbruster et al., 1985, p. 18). All of these outside components play an important role in whether or not students will understand, or even want to understand, what they are reading. There are additional components of reading that are essential to consider when determining the readability of a text. Rubin (1981) states:

... "the difficulty or ease with which a reader will comprehend a text depends at least upon: (a) the underlying conceptual difficulty of the topic or content of the text, (b) how clearly the content is expressed, and (c) the extent to which the reader has the requisite knowledge of the world, knowledge of the language, and knowledge of the comprehension process itself" (p. 55).

The background knowledge that a student has of the content that he/she is reading about is very important during the reading process. Teachers should also consider the background knowledge the students will have coming into the class when determining which textbook to use.

The comprehension of text is not considered enough by publishers when they determine the readability grade level of a specific text. One way to figure out the students' comprehension of a text is to give all the students the same test with questions regarding readability. Fry (1968) concedes, "you can determine reading difficulty of the books by looking at the mean comprehension scores of a class who has read the books. In using comprehension scores you run into the problem of equal difficulty of comprehension tests" (p. 515). The only way to test comprehension and get consistent results is if all teachers used the exact same test to determine comprehensibility. This would allow for the results of the comprehension tests to be more objective.

#### Social Studies Textbooks/U. S. History Textbooks

Subjects become more complicated and difficult when students reach high school. The terms used become much more difficult and as a result the text written is harder to understand. Specifically, "science, social studies, and other subjects require the use of specialized, technical vocabulary. The occurrence of such vocabulary artificially increases the number of hard (unfamiliar) words, thus inflating readability scores" (Rush, 1984, p. 15).

U. S. history is a difficult subject to understand; as a result the text is also difficult and harder for students to comprehend. Since, the content is harder, the reliance on the readability grade level holds less importance. According to Nelda Spinks (1993), "usually textbook selection centers around content of the book, organization of that content, supplementary materials, and services provided by the publisher" (p. 1). The content is the priority and the vocabulary used is essential for learning the content. According to Sewall (1987), "in some eleventh-grade programs, only college bound students take genuine U. S. history courses" (p. 15). Since, the content is known to be more difficult, some schools do not require all students to take U. S. history in high school. College bound students that are taking the course are more likely to understand a text that has a higher readability grade level. When attempting to reduce the

readability grade level of a social studies textbook, the content is always at risk. It is a constant battle deciding how to keep content and maintain an appropriate level of readability. Sewall agrees, "sometimes, social studies textbooks lose that evidence in reaching to remake the past in accordance with conventional wisdoms and client wishes" (p. 15). It is impossible to keep all of the content and maintain the intended readability level.

## **Textbook Publishers**

Most textbook publishers aim to make the text easier for students to understand and write them at the appropriate readability level for the grade in which the text will be used. Most schools think that readability of the textbook they are purchasing is very important and they want the textbook to be written for the grade level they intend on using it for. So there is pressure on publishers to write textbooks to maintain a specific level of readability. Moreover, "in the business of publishing textbooks, there is mounting pressure for publishers to submit evidence of suitable readability, thus, textbook adoption committees may be contributing to what has been called a readability numbers game" (Chall, 1981, p. 3). Readability formulas are used to determine readability grade levels. Publishers begin writing their text to maintain a certain level of readability and by doing this they have to reduce the number of hard words and how many words are in a sentence. When publishers write the text so that it has a specific level of readability, they do not intend for it to result in poor writing that is harder to understand, but it still has a negative effect on the writing. Furthermore, "through the extensive use of readability formulas in publishing, some unintended bad effects have been found in the quality of the writing now common in school textbooks" (Davison & Bolt, 1986, p. 4). Shortening sentences and using less difficult words actually reduces the quality of writing and makes the text harder to understand.

#### Summary

In conclusion, readability formulas are objective and the results that the formulas provide are not influenced by the publishers that are determining the level of readability. Although, the results of the formulas are unbiased they still do not consider all components of readability. Many teachers might want to write textbooks that are more suited for their students' needs, but the reality is that this concept is not feasible. According to Ron Brandt, "well known authorities "advise" teams of paid writers who are understandably more concerned about churning out a product that meets their employer's specification than about inspiring student learning" (1985, p. 3). Since most people that are writing the textbooks do not have knowledge of the abilities of students that will be using the textbook it makes it difficult to write the text so it is understandable for the students using it.

Determining the understandability of a text is very important and one way to do this is to use readability formulas. However, readability formulas only determine an approximation of the readability level of the text (Doak & Doak, 2010). This is why it is beneficial to use more than readability formulas to determine what grade level the text is appropriate. Readability formulas do not consider comprehension of the text, which is an essential component of learning. To get the most consistent and reliable results more than one readability formula should be used or alternative ways of determining readability should be used to ensure that the text chosen is truly understandable for the students using it. "The most commonly used formulas are likely to be the Flesch-Kincaid, SMOG, and the Fry chart" (Doak & Doak, p. 151). The SMOG readability formula is a form of the Gunning (Fog) readability formula. The three readability formulas chosen for the study were the most widely used ones in the business of textbooks. Since these are the formulas most likely used by publishers it makes the readability levels found in the study potentially consistent with the readability levels determined by the publishers of the textbooks used in the study.

## CHAPTER III. METHODS AND PROCEDURES

The purpose of this investigation was to answer the following research question: What is the variability of three readability formulas on selected U. S. history textbooks? More specifically, the study investigated the readability of three different U. S. history textbooks used by classroom teachers in Northwest Ohio. Three different textbooks were used because of the possible variability of the readability results. Also, the more texts used increases the reliability of the findings. Three different reading formulas are also used in the study. The readability formula and the Fry Graph. This chapter will explain the methods and materials to be employed in carrying out this investigation.

# Methods

#### *Research Design*

This study primarily focused on the consistency of the results of employing readability formulas on U. S. history textbooks. The research design of this particular study was experimental. The independent variable in the study was the textbook passages and readability formulas used. The dependent variable in the study was the actual readability of the textbook. This was considered a quantitative study because the results of the readability formulas were examined and used to determine whether or not they were a reliable way to find readability of textbooks. Rush (1984) states, "readability formulas are objective, quantitative tools for estimating the difficulty of written material without requiring testing of readers" (p. 5). This means that subjectivity does not exist when determining readability and this makes the use of formulas more reliable than other methods. Descriptive statistics were used to determine the statistical significance of the variance amongst the results of the study.

#### Instrumentation

Readability Formulas

The three readability formulas used were the Flesch-Kincaid, Gunning (FOG) and the Fry Graph. The Flesch-Kincaid, Gunning and Fry Graph are well known and commonly used readability formulas appropriate for finding the readability of high school textbooks. According to Laura Chavkin (1997), the "Fry Readability Graph and Flesch Reading Ease Formula are well-known standardized instruments for determining readability that have been used by many educators in the past" (p. 3).

# Textbooks

The three textbooks chosen for the study were high school U. S. history textbooks that have been or are currently used in the classroom. The first textbook used was *America: Pathways to the Present*, which was published by Prentice Hall in 2002. Another textbook used was *America: Pathways to the Present*, which was published by Prentice Hall in 2003. The last textbook used was *The American Nation*, which was also published by Prentice Hall in 2003. Software

The software used to predict the readability was created by the company Micro Power & Light Company. This specific readability software can calculate the readability of text according to nine of the most popular readability formulas. The readability formulas included in the software are the Flesch Grade Level (Flesch-Kincaid), Flesch Reading Ease, FOG, SMOG, Powers-Sumner-Kearl, FORCAST, Spache, Dale-Chall and Fry Graph formula.

Procedures

First, the textbooks that would be used in the study were identified. The three U. S. history textbooks used for this study were chosen from The Children's Resource Center of the Jerome Library on the Bowling Green State University campus. Next, the three formulas that were used in the study were identified. The three formulas were chosen because they are the most frequently used and very likely used by textbook publishers. Then passages from the beginning, middle, and end of the three textbooks were randomly selected from each section of the textbooks.

Once the passages were selected, they were typed into the program, Notepad. A passage from the beginning, middle, and end were used from each of the three U. S. history textbooks. Then, the passages were uploaded into the software and it determined the readability of the passages. Next, the data were put in tables for analysis and Minitab was used for statistical analysis of the data.

The Readability Software program allows the user to specify the formulas to be used for specific passages. The user can choose more than one readability formula at a time and compare the results instantaneously. The Flesch-Kincaid and FOG readability formulas were chosen at the same time and compared right away. The option to use the Fry Graph to calculate the readability of the passage was available right after the other two readability formulas were specified and used to calculate the readability of the passages. After the Fry Graph option was chosen the program created a graph and specified the readability level of the passage. Once the readability levels were calculated the data were entered into a table format to compare and analyze the results. The data collected for this investigation are presented by textbook and by readability formula.

# Data Collection

The three different readability formulas were used when testing the readability of all three textbooks. After the data were typed into Notepad, the readability analysis was run using the software program. Then, scores were entered into a table using Microsoft Word so that the findings were organized and easier to analyze. Tables were also created comparing the readability results of each individual formula on each textbook. The program Minitab was used to figure the statistical significance of the variance amongst the results within the study. Minitab figured the standard deviations, confidence intervals, and means.

## Data Analysis

Each readability formula was used when determining the readability of each textbook. Three textbooks were used to ensure reliability of the formulas. Results of each formula for each textbook were compared. The results of particular formulas were compared among the textbooks used within the study. The average of the results was also analyzed thoroughly. The standard deviation was used to determine the statistical significance of the variance amongst the results. Davison and Bolt (1981) agree, "it is a good idea to take an average of the results, since there is always the possibility of an error of a grade or two in the results of any one formula" (p. 3). The results were analyzed, compared and averaged to decrease the chance of errors.

Analysis was used to determine precision, based on variability of three passages. This means the larger the standard deviation, the less precise the passage. On the other hand, it means the smaller the standard deviation, the more precise the passage. Appropriateness of text for grade level was also determined. Appropriateness translates to the ability of the formula to predict whether or not most tenth grade students could read the text with success.

# Summary

The purpose of this study was to determine the variability of readability among three social studies textbooks used in high schools. Since it is a quantitative study the results were compared using descriptive statistics. The descriptive statistics were used to determine the statistical significance amongst the results of the results. The tables created allowed for the data to be analyzed with greater ease. Determinations of the precision and accuracy of the readability formulas was also a part of the data analysis.

#### CHAPTER IV. DATA ANALYSIS AND DISCUSSION OF RESULTS

Chapter IV will present the data collected during this investigation. It will also discuss the results of the study as they relate to the research question, which was: What was the variability of the three different readability formulas on selected U. S. history textbooks? In chapter IV the data are displayed using tables. Tables were created for each textbook so the results of the readability formulas could be compared amongst the specific textbooks. The other tables displayed the results of the specific readability formulas and displayed the variability amongst the results of the particular formula used in the study. In addition, within the tables the passage and formula used to measure readability were specified. Also, the standard deviation was included within the tables. The standard deviation was used to measure the variability/precision of the results. This chapter will focus on the analysis of the data and discuss the results as they relate to the research question.

#### Data Analysis

The purpose of this investigation was to compare the readability levels of three different textbooks using three different readability formulae. The data collected for this investigation will be presented by textbook and by readability formula.

#### Textbook 1: The American Nation (2003)

Table 1 shows the readability levels of each of the three passages based on the Flesch-Kincaid, FOG, and Fry readability formulas. Table 1 also shows the average readability grade level of passage one in the first textbook was 10.53 and the standard deviation found was 1.75. Therefore, according to the three readability formulas used in Minitab, the average readability grade level of this passage is between grades 10 and 11. The mean of passage two was 10.6 and the standard deviation was 1.54. The average grade level of the passage was 12, which was

#### Table 1

Fle Passage Kin	Flesch-	FOG	Em	Moon	Standard
	Kincaid	Kincaid	Гту	wicali	Deviation
1	8.6	11.0	12.0	10.53	1.75
2	8.9	11.9	11.0	10.60	1.54
3	10.8	14.7	12.0	12.50	2.00

Textbook 1: The American Nation (2003)

higher than the other two passages, and the standard deviation was 2, which was also higher than the other two passages.

## *Textbook 2: America: The Pathways to the Present (2003)*

The results of the second textbook were very different from the results of Textbook 1. Table 2 shows there was a much wider range of readability grade levels within this textbook. The average grade level found in passage 1 was 12.30 and the standard deviation was 2.52, which is very high. The average readability level of the second passage was 9.667 and the standard deviation was 0.945. The average grade level of passage 3 was 14.03, which is significantly higher than the others within this textbook. The standard deviation was 1.90, which is considered to be a considerable difference, because a standard deviation of 2 is considered significant and this is very close to that.

# Textbook 3: America Pathways to the Present (2002)

There was less variability among the averages of the passages in textbook 3 (See Table

# Table 2

Passage	Flesch- Kincaid	FOG	Fry	Mean	Standard Deviation
1	11.9	15.0	10	12.30	2.52
2	8.6	10.4	10	9.67	0.95
3	12.2	13.9	Past 16	14.03	1.90

Textbook 2: America: Pathways to the Present (2003)

3). However, there was more variance among the results of the individual formulas regarding specific passages. The average grade level of the first passage was 11.7 and the standard deviation was 1.87. The mean of second passage's results was 11.90 and the standard deviation was 3.0. Lastly, the mean of the third passage's results was 12.77 with a standard deviation of 2.54.

Table 3

Textbook: America: Pathways to the Present (2002)

Passage	Flesch-	FOG	Fry	Mean	Standard
	Kincaid				Deviation
1	9.7	13.4	12	11.70	1.87
2	9.0	11.7	15	11.90	3.00
3	10.0	13.3	15	12.77	2.54

# Flesch-Kincaid

The Flesch –Kincaid formula uses the average number of syllables per word and words per sentence to determine readability. Table 4 presents the various Flesch-Kincaid readability results for the nine passages (three per textbook) used in this investigation.

Table 4

Flesch-Kincaid Readability Results

Textbook	Passage 1	Passage 2	Passage 3	Mean	Standard
					Deviation
1	8.6	8.9	10.8	9.43	1.193
2	11.9	8.6	12.2	10.9	2
3	9.7	9.0	10	9.57	.513

# FOG

The FOG formula uses mathematical calculations of sentence length and percentage of polysyllabic words to determine readability. Table 5 presents the various FOG readability results for the nine passages (three per textbook) used in this investigation.

Table 5

FOG Readability Results

Textbook	Passage 1	Passage 2	Passage 3	Mean	Standard
					Deviation
1	11	11.9	14.7	12.53	1.93
2	15	10.4	13.9	13.1	2.48
3	13.4	11.7	13.3	12.8	.954

The Fry formula uses the average number of syllables and average number sentences per 100 words to determine readability. Table 6 presents the various Fry readability results for the nine passages (three per textbook) used in this investigation.

Table 6

Fry Readability Results

Textbook	Passage 1	Passage 2	Passage 3	Mean	Standard
					Deviation
1	12	11	12	11.67	.58
2	10	10	Past 16	12	3.46
3	12	15	16	14	1.73

# Discussion of Results

The purpose of this investigation was to answer the research question: What was the variability of the three different readability formulas on selected U. S. history textbooks? Based on the data, there was variance amongst the results of the three readability formulas. In fact, there was actually variability found among the individual formulas.

This discussion of the results will focus on (a) the preciseness of the readability formulas (consistency of scores) across passages, and (b) the appropriateness of the scores considering the text is/was intended for use with U. S. history classes at the tenth grade level.

The first textbook used in the study had the most precise results. The passages had readability grade levels of 10.53, 10.60, and 12.59. These results were closest to the readability level for which the textbooks were intended, which is a grade level of 10. Therefore, the

readability results of this textbook suggest there was not as much variability in the readability results; however, the results show the textbook to be too difficult and not appropriate for the intended tenth grade classroom.

The results of the second textbook were neither precise nor appropriate. The passages had an average readability grade level of 12.30, 9.667, and 14.03. These results vary greatly, which means they are not precise. The results of this textbook were the least precise of the three textbooks that were used in the study. The only passage that had appropriate results was the second, because it was very close to the intended grade level of 10.

There was very little variance amongst the results of the third textbook used. As a result the readability scores were very precise, but not appropriate. The readability grade level of the three passages were 11.70, 11.90, and 12.77. On the other hand, the results were not appropriate. Since the intended grade level was 10, the average readability of the passages is too high. Especially the third passage, as it is nearly at a college readability level.

The Flesch-Kincaid was the most precise of the readability formulas used in the study. The largest standard deviation amongst the passages was 2.0 and the rest of the results had standard deviations smaller than 2.0. The third passage used from each textbook had the smallest standard deviation amongst all of the passages and readability formulas, with a standard deviation of .513. There was not much variability amongst the results of this formula. The average grade level determined for the passages ranged from 9.43 to 10.9. This formula also found the text to be most appropriate for the grade level it was intended for, which is grade 10.

The results of the FOG formula were also precise, with an exception of one passage. The formula's results had standard deviations that ranged from .954 to 2.48. In addition, there was little variability found amongst the results. However, the formula did not find the text to be

appropriate for grade 10. The average grade level of passages found were 12.8 to 13.1, which is high and these results predict that the readability of the textbook would be too difficult for students in grade 10.

The results of the Fry Readability formula had the least precise results. The standard deviations ranged from .58 to 3.46, which was the highest standard deviation found amongst the readability formulas. In addition, there was the most variability found amongst these results. The average grade levels found ranged from 11.67 to 14. These are high and as a result are not appropriate for students in  $10^{\text{th}}$  grade.

#### Summary

Chapter IV contains the data collected for this investigation. This chapter then presents the results of the investigation by analyzing the data by textbook and by readability formula. Based on the data collected, there was a significant difference amongst the results. The preciseness, variability, and appropriateness of the results were specifically analyzed. The textbook, *The American Nation (2003)*, had the most precise results, the least variability, and was found to be the most appropriate for students in grade 10. The Flesch-Kincaid readability formula had the most precise results, with the least variability found amongst the average predicted grade level for which the text would be appropriate. In addition, this formula found the textbooks to be the most appropriate for the grade levels for which the text is intended.

#### CHAPTER V. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Textbooks are widely used in the subject of social studies, so it is most important for these textbooks to be at an appropriate readability level. This is essential for the students' comprehension of the text. U. S. history is generally taught in the tenth grade at most high schools in Ohio. It is ideal for textbooks to be close to this grade level. If the textbook is lower, it may allow for greater understanding of the text. If the text is too much lower than the intended grade level, students are likely to lose interest; however, it is less beneficial for a textbook to be higher than the intended grade level. When it is too high, the comprehensibility of the text is lost.

Each readability formula emphasizes different characteristics of a passage. This is why it is important to compare the results of the formulas when determining the readability of a textbook to figure the understandability of the text for potential students using it. The purpose of this investigation was to answer the following research question: What was the variability of the three different readability formulas on selected U. S. history textbooks?

Chapter V will briefly summarize the study. Then, Chapter V will present the conclusions drawn from the data collected for this investigation. This chapter will conclude with recommendations for educators and researchers based on the results of this investigation.

#### Summary

The study determined whether or not there was variance amongst the results of the readability formulas regarding specific passages from U. S. history textbooks. Many textbooks are written at a grade level higher than the grade level for which it is intended. As a result, often times the text is not appropriate and students struggle with the text and resist reading it. Ivey (2010) concedes, in the past students have struggled with, resisted or faked textbook reading. Students should be able to comprehend what they are reading and if they are unable to do this

then they will be less likely to be motivated to read it and the students' ability to gain knowledge of the content is diminished.

The students' understanding of the content is crucial and it important that students can comprehend the text read in class and learn from it. Therefore, it is necessary for the text to be written at an appropriate grade level for the students using it. Readability formulas are a popular way to measure the appropriateness of text. Chall agrees, "Readability formulas are the most useful tools for the important task of measuring the difficult of instructional materials" (p. 4). Three popular and widely used formulas were used for this study, Flesch-Kincaid, FOG, and Fry Graph. In addition, three U. S. history textbooks that had been previously used in classrooms were analyzed. The results were compared using tables and descriptive statistics. The program Minitab was used when determining the descriptive statistics involving the data found. Overall, the aim of the study was to determine the variability amongst U. S. history textbooks and the readability formulas used to determine the comprehensibility of the text.

#### Conclusions

It appears that the difficulty of a textbook is not consistent across the entire textbook. In this study, passages had different readabilities at the beginning, middle and end of a textbook. Although, the entire textbook does not actually need to be the same grade level, growth of the students should also be accounted for and the readability level should increase. This particular study found that the third passage was generally more difficult than the first passage, which is appropriate.

There is little consistency amongst the readability formulas used in this study. The gradelevel results vary across the Flesch-Kincaid, SMOG, and Fry Chart formulas and results are not precise amongst individual formulas. Doak and Doak (2010) suggest there should not be a reliance on a single formula because there is too much variance amongst the scores, as was found in this study.

In addition, the study shows that the formulas lack preciseness. Since, the results found were not precise and varied greatly it can be concluded that readability formulas may not be the most reliable measure of readability. Rubin agrees, "One issue is that of defining the readability of texts. The problems children encounter in comprehension may lie not just in the length of sentences or word difficulty as traditional readability formulas suggest, but in the complexity of the conflicts portrayed in the story" (p. 25). In essence, other measure of comprehension should be considered before determining the readability of a text. This will ensure the appropriateness of the textbook for the students using it in the classroom.

## Recommendations

# Textbook Selection Committees

Since, social studies teachers will continue to use U. S. History textbooks in classrooms the understandability and comprehensibility of textbooks is a dilemma that will be around for years to come. Readability is a major component of understandability and comprehensibility of a text, so it should most definitely be considered when selecting textbooks for use in classrooms. It is important for administrators and teachers to keep in mind the variance amongst readability formulas when considering textbook purchases for a school.

When choosing a U. S. History textbook, administrators and teachers should inquire as to the readability of the textbook and what formula was used to determine the readability level of the textbook. In addition, it is essential that the specific aspects of writing and language measured by the formula be considered as well. Each readability formula measures different aspects of the text. Since readability formulas may not be the most reliable way to determine the readability of a textbook, other ways to determine the understandability and comprehensibility of a textbook should be considered. The input of faculty of the school is very important when choosing a textbook because they have the most experience with actually using the textbook in the classroom.

It is impossible for readability formulas to measure the true understandability of a textbook. There are other factors like socioeconomic status and achievement of the potential students that have an effect on how useable a textbook is in a classroom. For example, a lower readability level may be more appropriate for some classrooms. However, a more difficult readability level is likely to be more suitable for some classrooms. It is impossible for a single readability formula to determine the difficulty of an entire textbook for a particular classroom. Other factors need to be considered to find the most practical U. S. History textbook for a classroom.

#### Classroom Teachers

Textbooks are likely to be used regularly in U. S. history classes. It is important for classroom teachers to be aware of the comprehensibility of textbooks. If a textbook is being used that is written at a tenth grade readability level according to the textbook publisher, it is recommended that the teacher should not assume the entire book is written at that readability level. Classroom teachers should keep in mind that difficult words or vocabulary have an impact on the understandability of the text. If the textbook is written at a readability level higher than the grade of the students using the textbook there are alternative reading materials that could be used. Also, the classroom teacher can aid the comprehension of the text by going over difficult vocabulary before the students read the text. Teachers who are uncertain about the

understandability of a text can easily use the Flesch-Kincaid readability formula to find the difficult level of the text quickly. The formula is available on Microsoft Word and online for free. It is recommended to take advantage of such resources and encourage the understandability of text read by students. In addition, a cloze test could be used to test the students' ability to comprehend the text. This particular procedure involves "eliminating every Nth word in a passage with the distance between deletions being neither less than five words nor more than ten words" and the examinee attempts to reconstruct the passage by filling in the missing words (Stansfield, 1977, p. 2). This is not a very time consuming procedure and would benefit the classroom teacher greatly because he/she will gain a better perspective of the comprehensibility of the text that is used in the classroom.

#### Researchers

Regarding future research it would helpful to use more textbooks when comparing the results of the formulas. If more books were used the results would found would be more reliable. Textbooks from other subject areas could also be used in a study to determine and compare the variance amongst the readability of textbooks within different subject areas. A wider variety of readability formulas could also be used to find if there is any consistency amongst readability formulas. On the other hand, it could increase the variability amongst readability formulas.

A larger scale study could be conducted to try and predict one formula from another so that classroom teachers and others could determine the readability of one formula based on the results of another. This type of analysis would be helpful for researchers and classroom teachers alike to be able to use equations to predict one formula when given data about another formula.

# Summary

In conclusion, this study's purpose was to find the variance amongst different readability formulas regarding U. S. history textbooks. Three of the most commonly used readability formulas were used in the study (Doak & Doak, 2010). The results of the study demonstrate that there is actually a great amount of variance amongst the Flesch-Kincaid, Gunning (FOG), and Fry chart readability formulas.

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