An Evaluation of Introductory MIS Textbooks Based on Readability Measures

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INTRODUCTION

The American Assembly of Collegiate Schools of Business (AACSB) requires that all their accredited institutions of higher learning teach foundation business courses to all business majors. Included in those courses are the concepts of management information systems (MIS), normally taught as a separate, standalone course taken by undergraduate juniors and seniors. This course typically includes topics dealing with hardware, software, telecommunications, data and databases, types of information systems, systems development, information resource management issues and ethical concerns about computers and information. In addition, most MIS majors also take either this same generic introductory MIS course or a similar course, both of which would use an introductory MIS text.

The introductory MIS course can provide entry level managers with a different conceptual framework and tools than those learned in other business courses as well as an understanding of information management issues. In addition, awareness of these MIS issues can facilitate understanding of other business courses. Success in the MIS course, as well as all other courses, depends in part on the readability of the particular textbook chosen by the professor or by the textbook selection committee. Yet most professors rely on the reputation of the publisher, the ancillaries included with the text, the personality of the publishing representative, the reputation of the textbook author or other publisher services in choosing a text [1].

IMPORTANCE OF READABILITY MEASURES

Readability measures are useful because they can indicate the relative difficulty of instructional material [2, 3] and selection of instructional materials can be done more effectively by using readability information. Dreyer [3] warns professors that instructional difficulties can result when a substantial mismatch occurs between an individual's reading ability and the readability level of a selected textbook. Razek and Cone [4] found that material that required an unusually high level of effort on the part of the reader to obtain the desired information will cause frustration and anger and will tend to make the reader adopt a negative view of the entire class or training program, and possibly the professor or instructor as well. Therefore, readability levels and readability information are useful because this information can help ensure that students are given material written at the proper level of difficulty [5].

Professors seldom inquire about the readability level of the text [31]. Many professors may be unaware of the importance of readability or may simply assume that publishers have already taken readability into account. Our study shows such a wide range of readability levels between texts that the latter cannot be true. Often, this readability information is not available from the publisher. Professors, however, need this information to better select texts that will benefit their students. Since some books could be chosen for either undergraduate or graduate courses, it seems particularly important that professors know which textbooks best parallel the reading level of the class. Because the introductory MIS business course is normally taught to juniors and seniors, professors should seek texts targeted at the reading level of college juniors and seniors (15.0 to 16.0 grade level).

The readability levels of today's students have not improved in twenty—five years [6]. Because of this, it becomes even more important to know the readability level of a given text to ensure that the text is not too difficult for students to master. Readability makes a difference in instruction. If the text has an appropriate readability level, students are more likely to read the text before coming to class. If students have read the material prior to coming to class and the text is understandable, student learning will be enhanced. In addition, instructors will be able to cover the material in less time and spend more time on additional material or advanced projects of interest to the class. If, however, the chosen text is too difficult, students are less likely to read the text in its entirety or to understand it on its own. The instructor then will have to labor harder to ensure that students learn the material, spending less time on more rewarding, lesson enhancing examples, projects or new material not included in the text.

Another implication for professors who choose texts with too high a readability level for their students is that their student evaluations will be lower than if the text had an appropriate readability level. Student evaluations of faculty and courses can negatively influence promotion and tenure decisions. In addition, if the readability is too low, student evaluations may also reflect this fact (depending on the format of the evaluations). Student learning will also be negatively influenced by texts that have an inappropriate reading level; if the student has difficulty reading the text, he or she may either simply not read the material or will not comprehend the content as well as students with a higher reading level. While academics should strive to improve the reading level of their students, material that is too difficult will not improve the students' reading level but will instead result in frustration and reading stagnation by the students.

There are many factors that make a text "readable". Objective readability measures are only one of those factors. Readability scores evaluate the complexity of the written text itself, not the way it is organized or laid out or the student's motivation or ability. Formulas measure only things that can be counted, such as the number of words not on a common vocabulary list, the number of syllables per unit of length, or the number of words per sentence. Readability ratings, however, are one objective way to estimate the relative difficulty of textbooks, but they are probably not appropriate as the only means of textbook diagnosis. Graphical layout, the use of color, appropriate headings, charts, tables and summaries may also enhance the readability of a particular piece. But these enhancements are subjective in nature while the readability formulas yield an objective measure. Nevertheless, if the student cannot comprehend the material as it is written (which is evaluated by readability measures), then organization and layout do not matter.

READABILITY STUDIES

This study tested the readability level of a variety of major textbooks used in the required introductory MIS course and is a replication of work done by Nixon and Helms [1] which compared texts for the required business communications and business policy/strategy courses. Our assumption is that textbooks should be chosen that are appropriate for the reading level of the class. Because of the introductory nature of these texts, and because the introductory MIS course normally is a required course, it is especially important for the text to be written at an appropriate level of readability. If the text is too easy, the students will not be challenged and may in fact not learn as much as they can. If the text is too difficult, the students may feel that MIS is too difficult a discipline and may come to dislike computers or to perform poorly in the course. In addition, if a text is too difficult, students may decide that MIS is not a good career path for them and would, therefore, choose a major other than MIS.

Readability is the ease with which a text can be understood given its stylistic density [7]. The level of reading ease (or difficulty) is determined by sentence length, word length, paragraph length and vocabulary. Readability levels are computed by using mathematical formulas [8]. Readability formulas are designed to meet a genuine need of educators, journalists, and those in government and business for a convenient and inexpensive way to estimate the difficulty of written works [9]. For example, the government uses the formulas for a wide variety of purposes including military training manuals, tax guides, and federal regulations. The formulas may also be required as legal tests of readability in consumer documents and insurance policies [10].

Readability studies have addressed a multitude of materials, including the readability level of licensing examinations [11], sales training manuals [12], scientific journals [13], library guides and appendices [14], educational assessment textbooks [15], industrial education textbooks [16] and middle and junior high school textbooks [17, 18]. Other materials whose readability has been studied include published, accepted and rejected academic papers [19], software documentation [20, 21], abstracts [22], annual reports [23, 24] and business correspondence [25]. College textbooks have been the subject of many studies on readability [26, 1, 27, 28, 29, 30, 31].

READABILITY FORMULAS

Readability formulas have been documented for many years, but limited research has been published about them. Over 100 of these formulas are used by teachers, librarians, and publishers. These formulas use primarily such items as sentence length, number of hard words (not found in an accompanying dictionary), number of syllables and other similar summary indices in arriving at their readability scores. Readability scores used to be difficult to calculate because of the volume of hand calculations involved. Today the advent of computer-based tools to accomplish this task has greatly decreased the time involved in computing the measures so that anyone can compute the readability information. Using the computer greatly reduces the time, effort and potential for error involved in computing even one of these measures. In addition, there is no need to know the different formulas; the computer handles all such calculations. One such tool, Readability Calculations, by Micro Power and Light Company [32], provides six of the most popular readability measures. These are described in the methodology section.

The most popular readability formula is the Gunning Fog Index. According to Gunning [33], reading level is not intelligence level since most bestselling books and a large portion of literature classics are written at the seventh and eighth grade reading level. For example, The Atlantic has a Fog index of only 11 or 12. This paper has a Fog index of 16. It is generally accepted that texts with a Fog index of over 16 will be difficult to read.

Using all six of the measures provided in the tool we have chosen provides a better method to judge the suitability of a text for classroom use because computing only one formula may tend to give a false sense of accuracy. By computing more than one formula, a valuable element of comparison is added. The readability approach is easily calculated, but it diagnoses the textbook's difficulty rather than the student's motivation to learn. Many say that "readability is in the mind of the reader" [34]. Quantitative measures do not take into account the varying characteristics of the reader, including the individual reader's intellectual level, particular gifts or abilities, interests and motivations, nor do they consider the actual content of the text. Shelby [35] argued that quanti-

tative readability measures do, however, have a place in assessing written communication, when used as a tool in predicting readability. Shelby posited that readability statistics should be used as descriptive rather than prescriptive data, as relatively objective, diagnostic analytic tools to identify and describe specific characteristics of writing [35], and as a tool to determine whether writing has been geared to the reading level of its audience.

METHODOLOGY

Eleven leading introductory MIS texts were examined in order to determine the readability level of each. Five publishers were asked to name the top ten MIS texts for this course in terms of market share and who their competition was. In addition, three MIS professors at three different institutions were asked to name the top ten MIS texts for this course. A total of eleven texts were named and copies currently being used in the classroom were obtained from either the publishers or other MIS faculty. Appendix A lists the texts used in this study.

Because most readability formulas require passages of at least three hundred words in order to accurately reflect the readability level of a given work, each passage selected from each of the introductory MIS texts averaged slightly more than three hundred words. Two passages were selected from each introductory MIS text to be evaluated. One passage was chosen from what was considered by the authors to be the most elementary or introductory portion of the text and a passage of similar length was chosen from a technical portion of the text containing new information. In order to ensure the similarity in passages between texts, a passage comprising the first three hundred words (ending in a complete sentence) starting at the third section of the first (introductory) chapter was chosen as the most elementary passage and a section comprising the first three hundred words (ending in a complete sentence) regarding telecommunications hardware wiring and cabling (topics common to all such texts) was chosen as the more technical passage. Comparisons were made between texts and between passages in the same text. All of the texts contained material on both the introductory and the technical topics chosen.

The researchers used the following readability formulas in evaluating the introductory MIS textbooks, the Gunning Fog Index, Flesch Reading Ease Score, Flesch Grade Level, DaleChall, SMOG Grade Level and FORCAST Grade Level. These seemed to comprise a representative sample of readability formulas and were calculated using a Windows-based readability software package by Micro Power and Light Company, 1995 version [35]. Over one hundred other readability measures exist, such as the HarrisJacobsen, McCallCrabbs Standard test, SRA, Botel, Fry Readability Graph, Powers Reading Level (appropriate for elementary school material), Holmquist, Advanced Reading Inventory (ARI), Flesch-Kincaid, Coleman and Spache. The six measures used here are the most popular and were readily available using the package by Micro Power and Light. The following summary taken from the Readability Calculations Manual highlights each of the six measures used in this study [32].

Gunning Fog Index

One of the best known readability experts, Robert Gunning,

developed this formula for measuring a piece of writing. If the material has an index of seven, it is at the seventhgrade level and is easy to comprehend. An index of 12 is equal to a twelfthgrade level. When the index reaches 16, it is at a level where reading and comprehension are not easy. Few readers would be able to understand material with an index over 20. As applied in business, technical publications should score no higher than 14 (a sophomore college level) and no general business publication should score higher than 12 (a high school graduate level) [32]. The Fog Index tends to yield higher scores than other formulas. The Fog Index is designed to measure level of comprehension as opposed to level of speaking and is based on the total number of words, polysyllabic words and sentences.

Flesch Reading Ease Score

Elements included in the formula are average sentence length in words, average word length in syllables, average percentage of personal words, and personal sentences. This score was developed for assessing adult level material and, therefore, is not scored on a grade level but across a range from 0 to 100. The higher the score, the easier the material is to read. Scores normally fall between 0 and 100. Below 30 is very difficult; above 70 is quite easy.

Flesch Grade Level

Like the Flesch Reading Ease Score, the Flesch Grade level considers the number of words, syllables and sentences in its calculations. The US Military uses a version of this formula to assess the reading difficulty of many of its manuals. The level of grade is interpreted the same as the Gunning Fog Index.

DaleChall

The Dale-Chall formula uses a list of over 3,400 words well known to most American fourth graders. This formula also factors in the number of words and sentences in the sample passage. The DaleChall formula gives a score which is then corrected to a grade level.

SMOG Grade Level

The SMOG formula relies on a single variable, the number of words containing three or more syllables. While most other formulas focus on moderately high comprehension, the SMOG formula focuses on 100% comprehension. For this reason, the SMOG formula often produces higher difficulty scores than other formulas.

FORCAST Grade Level

The FORCAST formula focuses on functional literacy and ignores sentence length and punctuation. While it is frequently used in assessing the readability of forms, questionnaires, test and job materials not in normal sentence form, this measure can also be used for narrative materials and is targeted for young adults.

DATA ANALYSIS

Each text was sampled by using two different three-hundred word passages from the text. Where any of the results showed more than one grade level (e.g., 13-14), these two grade levels

were averaged. Table 1 provides the results of the elementary passage analysis; Table 2 provides the results of the technical passage analysis; and Table 3 provides the results of averaging the first two scores. As shown in Table 1, the texts ranged from a Gunning Fog Index of 13.50 to 21. Generally, the required introductory MIS course is at the junior or senior level. This level student should be comfortable with a text that has a maximum readability grade level of 15-16. The Flesch Reading Ease Score ranged from 10.53 (very difficult) to 46.46 (difficult), while the Flesch Grade Level ranged from the 11th grade level to the 17th. The Dale-Chall score ranged from 9 to 11 while the SMOG score ranged from 13 to 17.5 and the FORCAST score ranged from 11 to 13.

opposite to be the case. The readability scores for each text revealed overall that the more technical passages were in general more readable. Perhaps textbook authors try very hard to make the more technical passages more readable in order for the students to comprehend more easily the technical explanations of terms. Or it may be that the introductory material, while relatively elementary in nature, contains many more new words and concepts or longer words or longer sentences to introduce the innovative concepts of MIS to new students of the subject.

The authors of this paper assume that the overall readability of each text is based on the entirety of the text; therefore, we took the two passages sampled for each text and averaged their scores to

Table 1 Introductory Passage Readability Statistics

Text Number	1	2	3	4	5	6	7	8	9	10	11	Mean	Std. Dev.	Max.	Min.
Fog Index	16.00	14.50	13.50	20.00	17.00	19.00	20.00	16.00	21.00	17.00	14.00	17.09	2.60	21.00	13.50
Flesch Rdg. Ease	24.04	37.83	46.46	23.16	27.94	17.08	22.84	36.29	10.53	23.94	36.49	27.87	10.41	46.46	10.53
Flesch Grade Lev.	14.00	12.00	11.00	16.00	14.50	16.00	16.00	13.00	17.50	15.00	12.50	14.32	2.02	17.50	11.00
Dale-Chall	11.00	9.50	9.00	10.00	10.00	11.00	10.00	9.50	11.00	10.50	11.00	10.23	0.72	11.00	9.00
SMOG	14.50	13.50	13.00	17.00	15.00	16.50	17.00	14.00	17.50	15.00	13.00	15.09	1.67	17.50	13.00
FORCAST	13.00	12.00	11.00	12.00	12.00	13.00	12.00	12.00	12.50	13.00	13.00	12.32	0.64	13.00	11.00

Table 2 TECHNICAL PASSAGE READABILITY STATISTICS

Text Number	1	2	3	4	5	6	7	8	9	10	11	Mean	Std. Dev.	Max.	Min.
Fog Index	13.00	15.00	18.00	16.00	16.50	16.50	15.50	12.50	14.00	13.00	17.00	15.18	1.83	18.00	12.50
Flesch Rdg. Ease	46.62	41.69	26.97	36.60	40.23	39.33	41.35	53.55	45.26	43.12	33.47	40.74	6.98	53.55	26.97
Flesch Grade Lev.	11.00	12.50	16.00	14.00	14.00	13.50	13.00	10.00	11.50	11.00	14.00	12.77	1.77	16.00	10.00
Dale-Chall	9.50	10.00	10.50	10.00	10.00	10.00	9.00	9.00	10.00	9.00	10.00	9.73	0.52	10.50	9.00
SMOG	13.00	14.00	16.00	17.00	14.00	14.50	14.00	12.00	12.50	12.00	15.00	14.00	1.60	17.00	12.00
FORCAST	11.50	12.00	12.00	12.00	11.50	11.50	12.00	11.00	12.00	11.50	11.50	11.68	0.34	12.00	11.00

Key to Tables:

1 Ahituv, Neumann and Riley   4 Gupta   7 Martin, DeHayes, Hoffer & Perkins   10 Sprague and McNurlin

2 Alter   5 Laudon and Laudon, BIS   8 McLeod   11 Turban and Wetherbe

3 Gordon and Gordon   6 Laudon and Laudon, MIS   9 O=Brien

For the more technical passages, the texts ranged from a Gunning Fog Index of 12.50 to 18. The Flesch Reading Ease Score ranged from 26.97 (very difficult) to 53.55 (fairly difficult) while the Flesch Grade Level ranged from 10 to 16. The Dale-Chall score ranged from 9 to 10.5 while the SMOG score ranged from 12 to 17 and the FORCAST score ranged from 11 to 12.

While it might have been expected that the more technical passages would be more difficult to read, the analysis shows the

obtain a measure of the overall readability of the texts. Average scores revealed that the Gunning Fog Index ranged from 14.25 to 18.00. The Flesch Reading Ease Score ranged form 27.90 to 44.92, with the entire range being in the difficult zone. The Flesch Grade Level ranged from 11.50 to 15.00, an acceptable range. The Dale-Chall score ranged from 9.25 to 10.50 while the SMOG score ranged from 13.00 to 17.00, and the FORCAST score ranged from 11.50 to 12.25.

One single readability formula probably should not be the only criterion for textbook selection. However, in reviewing all of the scores, a pattern of reading ease or difficulty may be established. It is interesting to note that the ranges for the averages of each of the six readability measures is narrow, indicating that the authors are trying to target a similar audience. If one looks at Table 3, based on all readability scores, it appears that all eleven of the introductory MIS texts reviewed in this study are within an acceptable range of readability for college juniors and seniors. (Note that some of the Fog Index scores indicate a readability level that is too high but the other readability measures appear to indicate that the Fog Index is biased somewhat higher than the other measures.)

However, a review of the introductory sections compared to the technical sections reveals a much greater diversity in readability scores. In looking at all eleven introductory MIS texts, there is in fact quite a diversity in readability scores based on each section that was analyzed. Based on the Gunning Fog Index, in the introductory, non-technical material, Text 3 scored as the easiest to read while Text 7 scored as the most difficult In the technical material, using the Gunning Fog Index, Text 8 scored as the easiest to read while Text 3 scored as the most difficult. It is clear from this study that a text does not represent an "average" readability score but that each section may in fact be written at a slightly different level depending on the authors' desire to reach a more or less computer literate or experienced audience. Even those publishers who may furnish readability scores for their texts do not break down their readability scores in this manner. Instructors need to be aware of these differences and may want to measure short sections on their own in determining textbook selection.

CONCLUDING REMARKS

The lack of diversity of reading grade levels in this sample of texts for one business course does not preclude the necessity of determining the readability of any text when reviewing it for adoption. In a previous study, Nixon and Helms [1] found a wide diversity of readability scores in both business communication and business policy texts. Professors should be aware of appropriate criteria for textbook selection and should include readability as one of these criteria. Texts should be geared to the level of the student's ability and not be so difficult as to frustrate and confuse the students, thereby reducing the effectiveness of their learning and of the course in general.

On the other hand, texts should not be so easy as to lull the students into apathy or complacency. Textbooks must challenge students, but they must also present key concepts and material at an appropriate level. Professors should ask for the readability level of textbooks as they make their selection decisions. Publishers should also have this information available and clearly communicate these levels to their sales representatives as well as to instructors and professors. Selection of an appropriate textbook should be one of the items used in student evaluations of instructors. With the advent of custom publishing, professors should require publishers to furnish readability scores for each chapter, case or reading from a given text. Then the professor could select those chapters with appropriate readability levels to be combined for custom publishing.

Textbooks should be interesting and logically organized; they should meet the needs of a particular course, and use an appropriate vocabulary level, with sentences of a general length and structure to promote understanding of the text material. Professors in all disciplines need a valid, reliable framework to guide textbook selection. Readability is one element of such a framework.

Future research should incorporate the readability information along with other textbook selection criteria. Future research could be expanded to include the readability of other MIS course textbooks as well as courses in other disciplines. In addition, future research should focus on developing an overall measure incorporating other readability issues, such as graphical layout, and reader issues, such as background, motivation, or experience in the text's subject. Finally, future research should perhaps seek to represent not an average of the readability of various sections in a text but a summary of the readability measures of several different sections in the text. In addition, research attempting to correlate objective readability measures with student performance, number of majors declaring after taking the introductory MIS course or other outcomes of using a text would be interesting.

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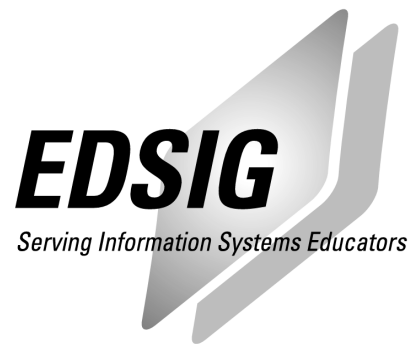
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