Improving Written Communication Skills in University Engineering / Technology Programs: The Grading Nightmare

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Introduction

The necessity of communicating in engineering and technology careers is of the utmost importance. Companies' and employees' success, in many instances, depends on their ability to communicate in a clear, complete, concise, and accurate manner. A significant number of university programs require various language skills ranging from basic English to technical report writing. Yet, employers still indicate that newly hired graduates have an extremely difficult time preparing internal memorandums, business or technical letters, and reports.

One of the major complaints from faculty members teaching these skills is the overwhelming and time-consuming process of grading assignments. As a result, many faculty reduce the number of required writing assignments to a minimum. Requiring students to prepare only three or four written assignments during the semester may make grading easier, but the students' writing skills are adversely affected by this shortsightedness of quality versus quantity [1]. This paper presents one method of requiring students to write a significant number of documents while maintaining minimum faculty-grading time.

Objective

The objective of this paper is to demonstrate how the Purdue University Building Construction Management department utilizes Microsoft Word 2000 Readability Statistics in assisting and evaluating student writing skills. The primary course used in this study was the course in Construction Documentation and Administration.

Construction Documentation and Administration deals primarily with the correspondence and written portion of the commercial construction process. Students were required to write a significant number of letters, reports, memorandums, and Requests for Information (RFI).

Strategy of Approach

Within the Construction Documentation and Administration course, students were required to generate the following documents:

1.   Technical Project Letters   45 each
2.   Memorandums   14 each
3.   Summary Reports   2 each
4.   Meeting Minutes   1 each

With an average semester enrollment of 75 students, the total number of documents generated was approximately 4,650. Obviously, the task of grading these documents was monumental; yet, we found that both student enthusiasm and the time students spent writing their documents, significantly diminished when documents were not graded in some fashion. The quality declined.

Audience Criteria

One method of possibly maintaining the quality of document produced without spending an inordinate amount of time critically reviewing each document is to require the students to write at a specific audience level. A key element of effective written communications in technical fields is knowing and learning how to write to your audience. Knowing your audience and writing to their specific level of knowledge is imperative if the message sent is to be understood. Understanding the audience's level of subject knowledge assists in developing content and the tone of the letter.

Audiences may typically be divided into three levels, (1) high, (2) medium, and (3) low [4]. Other sources refer to these levels as high-tech, low-tech, lay, and multiple [2].

A high-level audience may be identified as one in which the perceived level of knowledge of the topic or terms and conditions being expressed is equal to or greater than that of the writer. This may allow the writer to incorporate terms, expressions, acronyms, and abbreviations without providing explanation or definition.

Example: The VAV boxes are located primarily on the main distribution ductwork.

A medium-level audience may be one in which the perceived level of knowledge may be slightly less than that of the writer. Within the written document, the writer may be required to provide explanation or definition to establish a common understanding.

Example: The VAV (variable-air-volume) boxes are located primarily on the main distribution ductwork.

A low-level audience may be one in which the perceived level of knowledge is significantly lower than that of the writer. Entities that have no experience with the terminology may be in this category. Using advanced terminology, or terminology that requires significant background

information should be used sparingly; and explanation or definition is required to establish a common understanding.

Example: The VAV (variable-air-volume) boxes, which are used to control the amount of air distributed in a heating-cooling system, are located primarily on the main distribution ductwork.

Readability Statistics

Reviewing readability statistics is one way of analyzing a written document for certain audience criteria. By requiring students to utilize a common word-processing tool for displaying readability statistics, students are able to critically review and modify their documents to attain the specified audience level.

The primary word-processing software package used in the Construction Documentation and Administration course is Microsoft Word 2000, which displays readability statistics. The following illustrates how to view the Readability Statistics of a document.

(1) To set the Microsoft Word 2000 program to display the reading statistics of each document, the writer clicks on:

Tools
Options
Spelling & Grammar
Check spelling
Check grammar
Show readability statistics
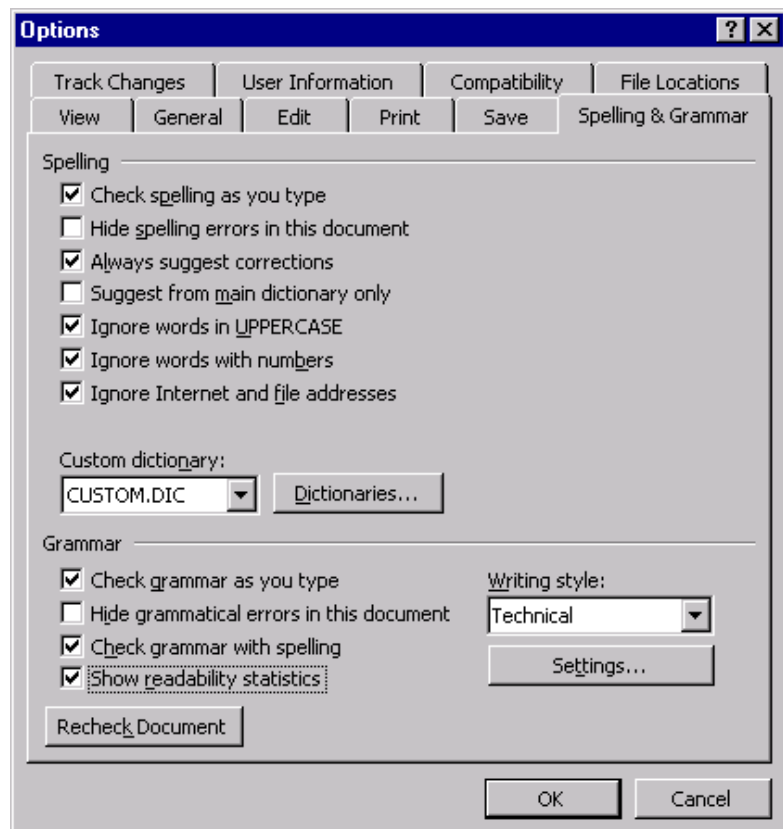OK

See Figure 1.

Figure 1. Example of Tools / Options menu in Microsoft Word 2000.

(2) The writer initiates the spell check /grammar check by either:

clicking on the spell-check command, Tools / Spell Check;

or, by clicking on the spell-check icon that appears on the toolbar as the letters ABC with a checkmark underneath the letters.

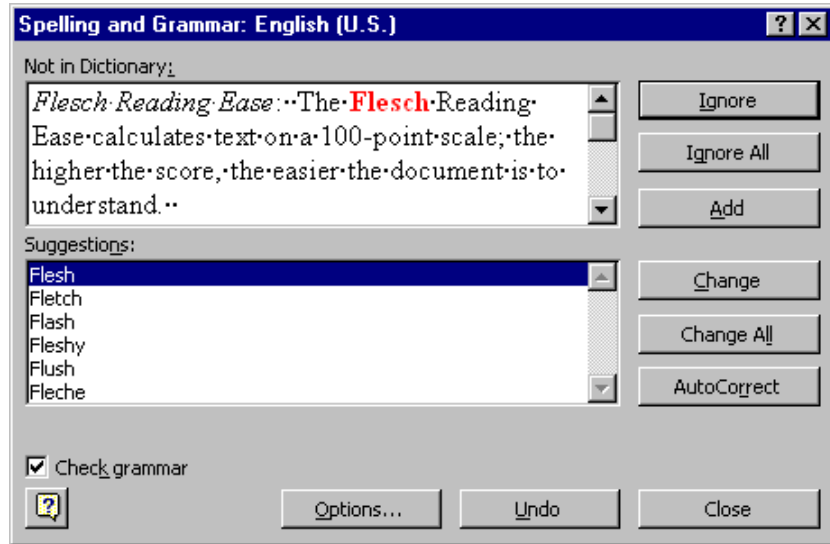Both will result in the menu that appears in Figure 2.

Spelling and Grammar: English (U.S.)

Not in Dictionary:

Flesch·Reading·Ease:··The·**Flesch**·Reading· Ease·calculates·text·on·a·100-point·scale;·the· higher·the·score,·the·easier·the·document·is·to· understand.··

Suggestions:

Flesh
Fletch
Flash
Fleshy
Flush
Fleche

Ignore
Ignore All
Add
Change
Change All
AutoCorrect

☑ Check grammar

Options... Undo Close

Figure 2. Example of Spell/Grammar check menu.

(3) When the program has completed the spell check /grammar-check function, the program will automatically display the Readability Statistics.

From now on, whenever the spell check /grammar check function is initiated and completed; the Readability Statistics will automatically be displayed.
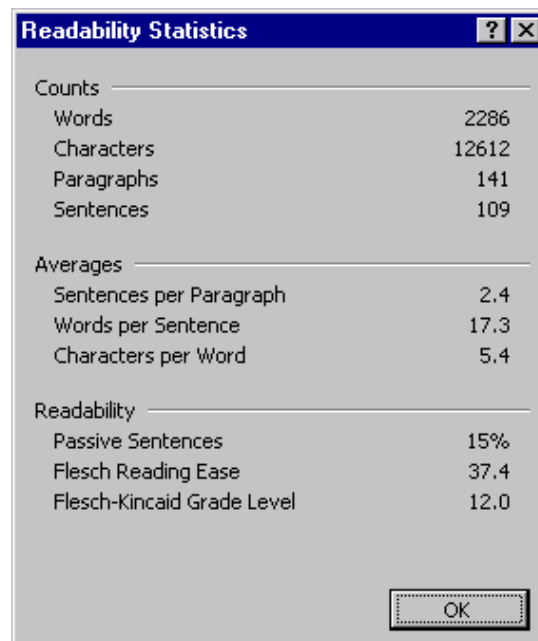
See Figure 3.

Readability Statistics

Counts
  Words   2286
  Characters   12612
  Paragraphs   141
  Sentences   109

Averages
  Sentences per Paragraph   2.4
  Words per Sentence   17.3
  Characters per Word   5.4

Readability
  Passive Sentences   15%
  Flesch Reading Ease   37.4
  Flesch-Kincaid Grade Level   12.0

OK

Figure 3. Example of Readability Statistics menu in Microsoft Word 2000.

In viewing the Readability Statistics, the writer discerns the reading level of the written document through the following items:

Passive Sentences
Flesch Reading Ease
Flesch-Kincaid Grade Level

Each of the three items is described here.

Passive Sentences: Passive sentences tend to be unclear and often contain unnecessary words. Passive sentences require helping verbs. By eliminating these helping verbs and re-writing in the active voice, clarity is enhanced and the number of words in a sentence may decrease [3]. Between 10 to 15 percent is an acceptable standard for the number of passive sentences contained within a document.

Flesch Reading Ease: The Flesch Reading Ease calculates text on a 100-point scale; the higher the score, the easier the document is to understand. Normal correspondence should be in the range of 60 to 70.

The formula that Microsoft Word uses to calculate the Flesch Reading Ease is as follows:

$$206.835 - (1,015 \times ASL) - (84.6 \times ASW),$$

where ASL is the average sentence length, and ASW is the average number of syllables per word.

The Flesch Reading Ease can be broken down into various levels as indicated in Table 1.

Table 1
Flesch Reading Ease Breakdown

Flesch Reading Ease Level	Description
90-100	Very easy
80-90	Easy
70-80	Reasonably easy
60-70	Standard
50-60	Reasonably difficult
30-50	Difficult
0-30	Very difficult

Flesch-Kincaid Grade Level: The Flesch–Kincaid Grade Level calculates text on a U.S. grade–school level. A score of 7.0 means that a seventh grader can understand the document. For normal correspondence, a target score of 7.0 to 8.0 is considered standard.

The formula that Microsoft Word uses to calculate the Flesch-Kincaid Grade Level score is as follows:

$$(.39 \times ASL) + (11.8 \times ASW) - 15.59$$

where ASL is the average sentence and ASW is the average number of syllables per word.

By requiring the students to utilize readability statistics for a method of writing self-evaluation, the students were forced to critically review and revise their own documents. Through this personal, hands-on review process, the majority of students significantly gained increasing improvement through one or more reviews on each document. With the quality of the document improving through this self-evaluation, the instructor was able to spend less time evaluating each document.

Methodology

One of the primary course requirements was to have the students develop technical letters based on specific information offered during the semester. After basic instruction on letter writing the students prepared letters on a weekly basis, typically writing two letters per week.

Requiring students to write technical letters for each class not only provided students the opportunity to gain proficiency at writing construction documents, it was also an excellent way of requiring students to write about certain topics within a brief period. Letter topics could vary and did not require a significant amount of the students' time while compelling them to write each day.

In the Construction Documentation and Administration course, the instructions to the students were to write a Technical Letter on the current topic being discussed for that class session, based on the required reading for the day. The topic and audience level was assigned beforehand and typically followed the criteria indicated in Table 2.

Table 2
Audience Level of Knowledge or Experience

Audience	Level of Knowledge or experience	Grade Level	Reading Ease
Owner			
High	Very experienced in construction processes; has developed past projects	11 to 12	Less than 60
Medium	Has been involved first hand in project development	9 to 10	60 to 70
Low	First-time project; little to no experience in projects	6 to 8	Above 70
Engineer			
High	Very experienced; has managed projects for a least 10 years	10 to 12	Less than 50
Medium	Has 6 to 9 years of project management experience	8 to 10	50 to 70
Low	Less than 5 years project experience; first time as lead project architect	6 to 8	Above 70

  Note: The Reading Ease Levels are those by Flesch that are presented in Table 1.
  Note: The Grade-Level of the audience is inverse to the reading-ease level: The higher the grade level ability of the audience, the lower reading-ease level required.

As an example of a technical writing assignment, the students were required to write a letter to the engineer of record indicating the need for clarification on the DDC control system. Based on the criteria in Table 2, the audience was to be the Engineer with the *Grade Level of 6 to 8* and *reading-ease level of Above 70*. Total passive sentences were not to exceed 15 percent.

Once the students completed their initial letter, they would run spell check / grammar check, and display the word-processing program's Readability Statistics. If the Statistics indicated that their document matched the appropriate grade level and reading ease, the student would then e-mail the document to the instructor. If the Readability Statistics indicated passive sentence, grade levels and reading-ease level not within the specified range, the students would be required to revise their letters until the level was met. Once the Readability Statistics were met, the student would copy and paste the Statistics into the letter and turn in the final draft through email.

Periodically during the semester, the students were required to turn in a hard copy of their letters to the instructor for complete review and critique. The quantity of assignments to be turned in was determined by the instructor's workload and time available to review the technical letters.

In this course, the technical letters served a multi-purpose. Not only were students becoming well acquainted with many construction documents and forms, the letters that the students were creating helped to determine potential test questions, and indicate attendance as well. Additionally, we were able to identify any students with significant writing problems early in the course, and direct them to the appropriate writing lab for specific assistance.

At the end of the semester, an evaluation form was given to the students for feedback on the entire course, but more specifically on the writing portion of the course.

In response to the question, "Did the technical letters help you develop critical thinking skills by requiring you to write?" 42 responded in the affirmative, 18 indicated a negative response, and 12 were undecided.

In response to the question, "Did the technical letters assist you in learning about technical related issues and terminology?" 58 responded in the affirmative, 4 responded in the negative, and 10 were undecided.

In response to the question, "Did the use of the Readability Statistics help in preparing your documents?" 62 indicated in the affirmative, 8 indicated in the negative, and 2 were undecided.

Additionally, the students were asked to provide comments regarding the overall writing requirements of the course. Some of the comments were:

- Provide more information on what you want
- Not so many assignments
- More written assignments, less quizzes
- Good way of getting students to research necessary topics
- Just take attendance, forget all this writing stuff
- When I graduate, the company I work for will provide a secretary to do all these letters

- After the first four or five letters, the assignments were easy to do
- Will we really be writing this much when we get out there?
- RS (*readability statistics*) helped clear up mistakes in my writing
- Readability stats made it easier to write

Conclusion

Although this study was not set up in an experimental fashion, the instructor believes the experience was successful, and will continue to require the students to critically review and revise their own documents through utilization of the word-processing program's readability statistics as one method of evaluation in future semesters. Overall, the student response was encouraging. In response to the question, "Do you believe that your writing skills have improved?" 49 indicated in the affirmative, 6 responded in the negative, and 18 were undecided.

From the instructor's perspective, it was obvious that the students' writing skills improved during the course of the semester. During the semester, there appeared to be a greater interest from the students to write their letters correctly the first time. When asked, "Do you believe that the use of Readability Statistics has improved your overall writing?" 39 indicated a positive response, 16 indicated in the negative, and 17 were undecided. Several comments from students indicated that re-writing their initial letters to conform to the requested levels was very difficult.

Regarding the time spent in reviewing and evaluating student writing, the instructor believes that requiring the student use of Readability Statistics has resulted in a time savings of 40-50 percent from previous semesters. In previous semesters, evaluating and reviewing student writing took approximately 12 per week. During the course of the semester of this study, the time spent in reviewing student technical letters accounted for approximately 6-7 hours per week.

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