course has been developed and established, this format could actually improve class-related time commitments of faculty without sacrificing course content or student education. Based on both our personal impressions and student feedback, we feel that the benefits of this course far outweighed the limitations for our situation. However, the effectiveness of this type of course format will always vary considerably among instructors, and it will not be desired or useful by some.

Summary

This course was developed to provide students at Texas Tech University, New Mexico State University and the University of Arizona enhanced exposure to professors with diverse expertise and students with related interests in animal breeding. Use of the Internet provides a powerful mechanism for this type of distance education course. The use of technology such as this must not come at the sacrifice of course material content. Many (38%) of the students thought the interaction with professors and students at other institutions was the best aspect of the course, while many others (38%) thought the weekly discussion was the most enjoyable aspect. However, most students also thought that the research proposal that required inter-institutional collaboration was the main limitation about the course. In a course such as this, the students must be made aware that when there is less formal class time, there is more of their time outside the classroom that must be devoted to the course. The general format of these types of courses should be flexible enough to use as a model for a variety of graduate level courses in agricultural sciences taught through distance education.

Literature Cited

Diebel, P. L., M. L. McInnis and W. D. Edge. 1998. Student use and perceptions of distance education technologies. NACTA Jour. 42(1):24-31.

Herring, A. D. and B. L. Barham. 1999. Use of web pages to both enhance animal science courses and serve as outreach mechanisms. J. Anim. Sci. 77(Suppl 1.):274(Abstr.).

Jackson. G. B. 1995. A planning model for teaching agricultural distance education courses and programs. NACTA Jour. 39(1):39-43.

Miller, W. W., J. C. King and D. L. Doerfert. 1996. Evaluating interaction in the distance education setting. NACTA Jour. 40:22 (Abstr.).

Schoknecht, P. A. and H. D. Hafs. 1999. Regionalization within the Northeast and Midatlantic: Today's reality and tomorrow's vision. J. Anim. Sci. 77(Suppl. 1):273(Abstr.).

Schurle, B. 1997 What are we going to do with all this technology stuff? NACTA Jour. 41(4):7-11.

Seykora, T. 1996. Experiences of teaching an animal breeding course via interactive television. NACTA Jour. 40:18 (Abstr.).

Readability of Turfgrass and Golf Course Management Textbooks, Periodicals, and Work-Related Manuals

Allen Zimmerman[1] and David Willoughby[2]
The Ohio State University, Wooster Campus
1328 Dover Road, Wooster, Ohio 44691

Abstract

We determined the readability indices of turfgrass and golf course management textbooks, periodicals, and work-related manuals by the Flesch method. These indices indicate that a) the readability of several commonly used turfgrass and golf course management textbooks is at the appropriate college level, b) the readability of feature articles in several turfgrass and golf course management related periodicals is at the same level as college textbooks, and c) the readability of some employee manuals is at the same level as college textbooks.

Introduction

Textbooks and periodicals are a crucial part of the teaching and learning experiences in turfgrass and golf course management courses. Textbooks, periodicals, and work-related manuals are important sources of information for graduates and other personnel in turfgrass and golf course management careers. However, in order for individuals to effectively use these materials, they must be able to comprehend what they read.

Therefore, the readability level of written materials that turfgrass and golf course management students and employees are required to use in educational and career settings is of major importance. College instructors and employers should be aware of, and concerned about, the

[1] Associate Professor
[2] Assistant Professor

reading ability of turfgrass and golf course management students and the readability of the materials that they will be required to use in college and in their place of employment.

Many indices have been developed to measure the readability of printed material. Zimmerman et al. (1995) discussed and summarized information about various readability indices. They reported that indices are based on empirical formulas that include such factors as numbers of words per sentence, syllables per word, and unfamiliar words (those not on an established list).

The authors also noted that a) some indices are expressed as "equivalent" grade levels such as Flesch-Kincaid and Gunning-FOG and b) other indices are expressed in units on a scale of zero to 100 such as Flesch and DRP. Consequently, there is a considerable difference between the numerical values and ranges obtained for these two types of indices.

Studies Involving the Readability of Turfgrass and Golf Course Management Textbooks, Periodicals, and Work-Related Materials

Several studies of the readability of college textbooks which included one or more horticulture texts were found in the literature; however, only two of these involved textbooks specific to turfgrass and golf course management. Zimmerman et al. (1995) included *Turfgrass Pest Management* by Bruneau (1991 edition) in the horticulture category in their study of the readability of textbooks used in first-quarter courses at a two-year technical college. Gough and Bates (1996) listed *Turfgrass Science and Management* by Emmons (1995 edition) and *Turfgrass Management* by Turgeon (1991 edition) in their study of current horticulture texts used at three land grant universities.

Only one study involving the readability of trade periodicals was found in the literature. Baur and Zimmerman (1998) included *Golf Course Management* in their study of the readability of feature articles in horticulture and agriculture trade periodicals. A review of the literature did not reveal any studies on the readability of work-related written materials in general or specific to horticulture.

Given the lack of information in the literature concerning the readability of materials used in turfgrass and golf course management, we conducted the study reported in this article. The purpose of the study was to assess the readability of turfgrass and golf course management textbooks, trade periodicals, and work-related manuals.

Materials and Methods

We identified six textbooks and three periodicals to be evaluated based on personal knowledge and an informal survey of horticulture faculty at several colleges. Copies of the texts were obtained from the authors' personal libraries or from publishers. The campus library served as the source for the periodicals.

Management personnel at several golf courses and lawn maintenance companies who were members of the turfgrass and golf course management advisory committee or were graduates of the program were asked to provide copies of work-related manuals. This process yielded three employee manuals and three equipment manuals for the study.

The procedures for obtaining the readability results for the textbooks and periodicals were based on those reported by Zimmerman et al. (1995) and Baur and Zimmerman (1998). In these two studies, the authors documented that the Flesch, Flesch-Kincaid, and Gunning-FOG indices yielded similar results regarding the relative readability of the written materials. Therefore, it was decided that only one index would be used to evaluate readability in this study.

The Flesch index was selected because it is automatically calculated by the word processing software used in the study (Word97). It is based on the following formula: 206.835 - [1.015 (average sentence length) + 0.846 (number of syllables per 100 words)]. Results for the Flesch index are expressed on a scale of zero to 100. It is important to note that this index uses an inverse scale. Materials at the most difficult readability levels have the lowest Flesch scores.

For each of the textbooks (Table 1) five passages with a minimum of 500 words (most passages had over 600 words) were evaluated. The passages were selected from pages near the beginning, one-fifth point, middle, four-fifths point, and end of the books. Readability scores obtained for the individual samples for each text were averaged to obtain a mean readability score.

Three issues of each of the periodicals (Table 1) that were published between March and June, 1999 were collected. Two feature articles were selected from each issue for evaluation. Authors included industry professionals, academicians, or staff writers of the publications. Article lengths were in the range of 800 to 2000 words. Starting at the beginning of each article, passages of a minimum of 500 words (most passages had over 600 words) were selected. Readability scores obtained for the individual samples for each periodical were averaged to obtain a mean readability score.

Given the relatively short length of the equipment and employee manuals (Table 1), each of these documents was evaluated as a single entity. Starting at the beginning of each manual, text of a minimum length of 3000 words was selected. This text section represented at least 30% of the total text of each manual.

Table 1. Mean Flesch Readability Scores for Turfgrass and Golf Course Management Textbooks, Periodicals, and Work-Related Manuals (Ranked by score within each category from the most difficult to easiest readability levels)

Category	*Flesch Score*[z]
Textbooks	
Turfgrass Ecology and Management (Danneberger, 1993)	33
Turfgrass Management (Turgeon, 1999)	37
Turfgrass Science and Management (Emmons, 1995)	46
Turfgrass Pest Management (Bruneau, 1991)	46
Fundamentals of Turfgrass Management (Christians, 1998)	48
Turfgrasses . . . Southern Zone (Duble, 1996)	48
Periodicals	
Grounds Maintenance	39
Golf Course Management	43
Landscape Management	47
Employee Manuals	
National Lawn Care/Sports Turf Company	44
Country Club Golf Course	45
Corporate Golf Course	71
Equipment Manuals	
Tractor	56
Turf Mower	64
Greens Mower	64

[z] Flesch is an inverse scale. Lower scores indicate more difficult readability.

Photocopies of the selected passages were scanned using an optical character recognition program. The scanned passages were saved in Word97 format. Headings, non-sentence phrases and periods, and any other non-text components were deleted. Scanning errors were also corrected. The readability statistics subprogram in Word97 was then used to obtain a direct value for the Flesch score.

Results and Discussion

The results of this study are displayed in Table 1. It is important to note again that Flesch is an inverse index. Consequently, lower values indicate more difficult readability.

It is helpful to place the Flesch scores in a practical context regarding readability. Zimmerman et al. (1995) provided an appropriate reference point with their statement that a Flesch score of approximately 48 is a typical threshold for college level texts. Four of the texts evaluated in this study had mean Flesch scores at or close to 48. The mean Flesch scores for the other two texts, *Turfgrass Ecology and Management* and *Turfgrass Management*, were 33 and 37. These values indicate that the readability level of these texts is much more difficult than that of the other four texts.

Zimmerman et al. (1995) stated that a Flesch score of 48 corresponds to a Gunning-FOG score of approximately 15. Gough and Bates (1996) reported that the mean Gunning-FOG scores of *Turfgrass Science and Management* and *Turfgrass Management* obtained in their study were 15.1 and 17.1. Therefore, the mean Flesch scores obtained for these two texts in the present study, 46 and 37, indicate readability levels consistent with the Gough and Bates study.

Zimmerman et al. (1995) reported that the mean Flesch score for *Turfgrass Pest Management* obtained in their study was 50. The mean Flesch score of 46 obtained for this text in the present study indicates a readability level consistent with the results of the Zimmerman et al. study.

Mean Flesch scores for feature articles in all three of the periodicals were lower than 48. Mean Flesch scores for two of the periodicals, *Grounds Maintenance* and *Golf Course Management*, indicate that these periodicals are more difficult to read than four of the college texts. Baur and Zimmerman (1998) reported that the average readability of the feature articles in the trade periodicals in their study was 45. They concluded that the readability of the periodicals was "approximately the same as the readability of first-year level college textbooks." (p 34).

Baur and Zimmerman also listed the mean Flesch score of feature articles in *Golf Course Management* as 42. The Flesch score of 43 obtained for this periodical in the present study indicates a readability level consistent with the results of the Baur and Zimmerman study.

Mean Flesch scores for all three of the equipment manuals indicate that these materials are written at a very easy readability level. This result is not surprising, because equipment manufacturers realize that at least some of the individuals who use their equipment will have poor reading skills. Consequently, the equipment manuals must be written at a level that is comprehendible to these individuals.

However, only one of the employee manuals is written at an easy readability level. The mean Flesch scores for the other two employee manuals indicate that they are relatively difficult to read; in fact, they fall in the mid-range of the texts evaluated. This result was not anticipated and suggests that all turfgrass and golf course management companies should evaluate the readability of their employee manuals. Those who have manuals that are difficult to read should a) consider rewriting their manuals at an easier level of readability to accommodate employees regardless of their reading skills or 2) evaluate the reading skills of their employees and provide opportunities for improvement if needed.

Conclusion

The results of this study indicate that the reading skills of students majoring in turfgrass and golf course management should be developed to a level that matches the readability of college textbooks. This will ensure that students as graduates will be able to read and understand all materials that they will encounter in industry.

Literature Cited

Baur, R. and A. Zimmerman. 1998. Readability of feature articles in trade periodicals. NACTA Jour. 42(2): 33-36.

Gough, R. and R. Bates. 1996. The readability of current and classic horticulture texts used at three United States land-grant universities. NACTA Jour. 40(1):6-8.

Zimmerman, A., R. Baur and L. Houston. 1995. Reading skills of first-year students at a technical college compared to textbook readability in first-quarter courses. NACTA Jour. 39(2):38-43.