COLLABORATIVE DEVELOPMENT OF AN ENGINEERING STYLE MANUAL

Jim Helbling, Department of Aerospace Engineering,
Angela Beck, Department of Humanities/Communications,
Patric McElwain, Department of Humanities/Communications

Embry-Riddle Aeronautical University,
Prescott, Arizona

Abstract

This paper recounts the development, testing, and publication of a style manual at Embry-Riddle Aeronautical University/Prescott Campus. This manual was jointly developed by faculty at the College of Engineering and the Department of Humanities/Communications in response to faculty concerns that, despite a required course in Technical Report Writing devoted to engineering students, these students were still having difficulty mastering the organization, formatting, and technical style of lab reports and other professional genre. This paper introduces the project and its academic context, describes the process by which the manual was composed and classroom tested, and outlines future plans for similar manuals at Embry-Riddle based upon the success of the *College of Engineering Style Manual.* Sample entries from the manual are provided in a set of Appendices as well.

Introduction

The following sections describe the development of the *College of Engineering (COE) Style Manual* at Embry-Riddle Aeronautical University (ERAU) in Prescott, Arizona. The manual was developed as a cooperative effort between the COE and the Department of Humanities/Communications (HU/COM) at ERAU to create a document that provided engineering students with basic guidelines for technical-writing assignments.

The impetus for creating this document was twofold. First, the manual was to address a perceived lack of written communication skills possessed by graduating seniors as identified in recent alumni surveys. Second, it was to provide a consistent template for engineering lab students to follow in creating lab reports, a genre critical to many engineering courses.

This paper begins by explaining the context that led to the development of the manual. This development process is described in detail in the subsequent sections, where the organization, composition, and testing and revision of the document is explained. This discussion is followed by a description of how the manual has been implemented in various engineering courses. The paper concludes with a discussion of plans for similar manuals at ERAU/Prescott.

Context

Embry-Riddle Aeronautical University consists of two residential campuses and an extended campus, which has educational sites internationally. One residential campus is located in Daytona Beach, Florida, while the other is located in Prescott, Arizona.

The Prescott Campus has approximately 1,800 students. In addition to flight-related degree programs, the Prescott Campus has other degree programs—Aerospace Engineering, Electrical Engineering, Global Security and Intelligence Studies, Aviation Business Administration, to name a few—including several not offered at the other two campuses.

Unlike many universities, where students take a variety of courses from different disciplines in order to find a career focus that suits their talents best, the ERAU student typically enters the University having already decided on a specific career path. In addition, while ERAU is a university in every sense of the word, ERAU's focus is on technical/technology-related disciplines such as engineering.

All engineering programs at ERAU require students to take a Technical Report Writing course as a prerequisite for advanced engineering courses; however, many students who have passed Technical Report Writing still exhibit difficulty adequately completing written assignments, as the majority of their courses in engineering almost exclusively require such skills as mathematics and engineering problem-solving. The lab report has proven particularly challenging. In order to better serve the students of the COE, then, the HU/COM and COE faculty decided to engage in a programmatic modification to the teaching of engineering writing derived from best practices in writing education. [1, 2, 3, 4, 5] This programmatic modification was threefold:

1. Instructors of the Technical Report Writing courses at ERAU developed a unified syllabus, set of lesson plans, and assignments that would target the genre-specific language and organizational elements of a technical lab report.

2. These writing instructors entered into various team-teaching ventures with the engineering instructors so that engineering students would have access to supplementary writing instruction in their engineering courses.

3. Both writing and engineering instructors collaborated on the development of a style manual that would provide further supplementary instruction and models of lab reports and technical writing conventions.

The following section describes the development of just such a style manual. It should be noted that ERAU decided to draft their own manual, rather than adopt one such as *The MIT Guide to Science and Engineering Communication*.[6] This decision was made to provide a specific lab report template that satisfied the varied engineering programs at ERAU and to provide consistency regardless of instructor, course, or program idiosyncrasies. Thus, the *COE Style Manual* is not only a unique document but was created to address the specific needs of ERAU's engineering students.

Development Process

Organization

The idea of the *COE Style Manual* was initiated during discussions held within a study group tasked with improving communication skills of graduating engineering seniors. This group was comprised of engineering and HU/COM faculty who shared the common experience of working with students who had poor communication skills. The overwhelming consensus of this group was that a standard manual containing a common lab report format and general writing style guidelines would be of great benefit to students in improving their writing skills.

The original organization of the manual was based upon feedback received from COE and HU/COM instructors who were queried as to their preferential content. The COE instructors provided their ideas as to the proper composition of an engineering lab report. The HU/COM instructors voiced their opinions as to the content of the style section of the manual (e.g., voice, tense, punctuation). The authors then formulated a basic outline and distributed the composition workload among themselves according to their respective strengths. The original manual was completed during the summer of 2003 and was distributed electronically to all COE faculty at the beginning of the Fall 2003 semester.

Composition

The *COE Style Manual* is comprised of 10 primary sections along with a Statement of Intent, references, and an index. (See Appendix A for a Table of Contents listing for the existing manual.) Two of the 10 primary sections provide a general lab report outline and a detailed description of each of the recommended sections of a standard lab report. (See Appendix B for the standardized outline of a lab report taken from Section 2 of the manual.)

The remaining 8 primary sections define general writing style guidelines in terms of proper report layout, rhetorical concerns, organizational patterns, grammatical choices, technical language choices, graphics guidelines, citation standards, and the use of software in compiling a technical document. Interspersed throughout the manual are numerous examples taken from existing student submittals and professional documents which reiterate the subject matter of each individual section or subsection. (See Appendix C and Appendix D for examples of how guidelines and examples are interwoven throughout the manual.)

Testing and Revision

In the Fall of 2003, the first draft of the *COE Style Manual* was published on-line and submitted to the faculty of the COE for comments and suggestions for revision. This first draft was also adopted as a reference textbook in two engineering courses, Materials Science with Laboratory and Aircraft Detail Design and made available to the students on-line through the University's Blackboard software. The course instructors consistently referenced the manual during class and requested student feedback throughout the semester. This student and faculty feedback was incorporated in subsequent revisions; further classroom testing and revision of the manual occurred over the course of three semesters.

When consensus was reached that a draft was completed that was ready for classroom use, the draft was finalized and sent to the printer. The first-run printing of the *COE Style Manual* was adopted by ERAU in Fall 2004. A print rather than another on-line edition was selected so that students could have uninterrupted access to the manual (as Blackboard on occasion goes offline), could bring the manual to class for use during lectures and exercises, and could annotate it as desired. Thus, the manual could be used not only as a reference but as a pedagogical tool.

Implementation

Implementation of the *COE Style Manual* consisted of three parts. First, all engineering students who enrolled in the Technical Report Writing course were required to purchase a hard copy of the *COE Style Manual* at the campus bookstore. The style manual was thus used in the course as a primary text. And, as previously mentioned, the instructors of Technical Report Writing wrote and implemented a unified syllabus for the course to ensure that consistency of approach and curriculum within all sections, including the use of the *COE Style Manual*.

Second, the COE faculty adopted the *COE Style Manual* as a reference work in their classes. Third, copies of the *COE Style Manual* were placed as reference tools in the engineering laboratories and in the ERAU library.

Assessment

Any gains engineering students have made in the writing of lab reports at ERAU may not be difficult to assess, but attributing any such gains solely to the implementation of the *COE Style Manual* is problematic as other factors in the revised engineering/technical writing programs have likely contributed to student improvement (e.g., a unified Technical Report Writing syllabus that targets the lab report genre, the supplemental instruction by HU/COM instructors in team-taught engineering courses).

Nonetheless, both students and faculty have offered positive evaluations of the *COE Style Manual*. These positive evaluations have been achieved in the form of semester-end evaluations, case-study interviews, and instructor commentary. Both qualitative and quantitative assessment is ongoing.

As part of this assessment process, during a scheduled ABET audit, ABET assessors evaluated the *COE Style Manual* and pronounced it to be a valuable addition to the engineering curriculum. In fact, several assessors brought copies of the *COE Style Manual* back tot their home institutions as a potential model.

The Future of the *COE Style Manual*

The *COE Style Manual* has been positively received by both students and faculty at ERAU/Prescott. Based upon this success, a second style manual is being drafted for the College of Arts and Sciences on campus; rather than lab reports, this new manual standardizes the

organization, formatting, and language required of senior theses. Plans for a manual for the College of Aviation are also being formulated, and it is likely that all three manuals will eventually be compiled into a single, University-wide style manual that would benefit all ERAU students and faculty.

The joint creation of this manual by the COE and HU/COM faculty has also provided a solid foundation for future collaborative efforts, including team-teaching ventures and the introduction of new humanities courses designed to better serve engineering students (e.g., History of Science and Technology).

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Biography

ANGELA BECK, Ph.D.
Currently an Assistant Professor in the Dept. of Humanities/Communications and the General Education coordinator for the College of Arts and Sciences at ERAU/Prescott. Her research interests include sociocognitive theories of composition and the development of teaching strategies (such as collaborative teaching) that help students move from novice to expert writers in their chosen disciplines.

JAMES HELBLING, M.S.A.E.
Currently an Assistant Professor of Aerospace Engineering at ERAU/Prescott where he teaches structural analysis, computer aided design, and aircraft detail design courses. He has 21 years of industry experience with McDonnell Douglas (now Boeing) and Northrop Grumman Corporation where he specialized in structural fatigue loading and served as manager of F-5/T-38 Engineering.

PATRIC McELWAIN, Ph.D.
Currently teaches technical communication, film, science fiction, and ethics at ERAU/Prescott. He is Chair of the Humanities and Communications Department, and his research interests include film studies, Anglo-American science fiction, and cultural studies. He believes that everything one needs to know about life can be gleaned from the television series *Buffy the Vampire Slayer*.

Appendix A: Table of Contents of the *COE Style Manual*

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Appendix B: Standardized Outline of a Lab Report

2.0 STANDARDIZED OUTLINE FOR LAB REPORTS

The following lists outline each of the sections of a standard lab report for the College of Engineering. Each section is listed in the order in which it appears in the final draft of the lab report. (See Section 3.0 Description of Lab Report by Sections for more guidelines.)

2.1 Front Matter:

- Title Page
- Abstract
- Table of Contents
- List of Tables
- List of Figures
- List of Symbols
- List of Abbreviations/Acronyms

2.2 Body of Lab Report

- Introduction
- Theory
- Apparatus and Procedures
- Results and Discussion
- Conclusions and Recommendations

2.3 End Matter

- References
- Attributions
- Appendix I: Sample Calculations
- Appendix II: Raw Data

Appendix C: Sample Section: Lab Report Format: Introduction

3.1 Introduction

- Contains five organizational sections: topic statement, background/context, gap, purpose statement, and textual outline.

    - Introduces the **research topic**—the scope of the report, or a technical definition of the object or concept being studied (as per Section 6.4 Technical Definitions):

      A "bug" is a coding error in a computer program which causes the program to malfunction. Software programmers frequently refer to "bugs in the equipment" and "working the bugs out."

    - Presents **background information** or context—what is known:

      Such terms were in use as early as Edison's time. Since then, the "bug" has morphed into the dreaded computer virus. As many as 600 new viruses arose last year (Jacobs 2003), many of which were tailored by hackers to be slip through anti-virus programs. The loss to American businesses due to downloaded viruses last year alone has been estimated in the billions of dollars (Zeister 2003). In response, many companies are creating new anti-virus software.

    - States the "**gap**"—what is unknown or what needs to be tested. The gap is typically introduced with an adversative transition (e.g. "however" as per Section 6.5 Frequently Used Transitions):

      However, few anti-virus programs are capable of screening out one of the most dangerous viruses, the "worm."

    - States the **purpose** of the lab—the research question or hypothesis:

      The purpose of this lab, then, was to develop such an anti-worm program, dubbed "Fishhook."

    - Provides a **textual overview**—including an outline of organizational scheme or comments on something unusual or unexpected in the report which orients the reader to the lab report:

      The results of the alpha and beta testing of Fishhook are summarized, and the resultant program changes are recounted. The potential market for this program is also discussed.

- Optionally identifies the location and date of the lab experiment and acknowledges anyone outside of the professor and fellow students who participated in the lab or offered their aid.

- Is generally written in the *present* tense, though the *past* tense may be used when providing background information or historical context. (See Section 7.0 Grammatical Choices.)

Appendix D: Sample Section: Stylistic Issues: Voice

5.1 Voice

Voice indicates the relationship of the *subject* to the *verb's action*. English has both active and passive voice.

5.1.1 Active Voice

Active voice emphasizes the *performer* of the action while not emphasizing the *action performed*:

> The engineer filed the report.
>
> Dr. Rudolph Lehmann conducted the experiment in the laboratory as planned.

In these examples, the *engineer* and *Dr. Rudolph Lehmann*, as subjects performing an action, are emphasized by their placement at the beginning of their respective sentences; the subjects' actions (*filed the report* and *conducted the experiment*) are, thus, not the sentences' focus.

5.1.2 Passive Voice

Passive voice emphasizes the *action* performed by the subject, while either *not emphasizing* the subject or *eliminating* reference to the subject altogether:

> The report was filed by the engineer.
>
> The report was filed.
>
> The experiment was conducted in the laboratory as planned by Dr. Rudolph Lehmann.
>
> The experiment was conducted in the laboratory as planned.

In all four of the above sentences, the *action performed* by the subject is placed first in the sentences and is thus emphasized. In the second and fourth sentences, any reference to the subject is eliminated.

Notice that while active and passive voice can be used to express the exact same meaning, the difference between them is twofold. First, *what* active and passive voices emphasize is different. Second, active voice is *less wordy* than passive voice and is thus stylistically preferred, as passive voice uses a helping verb in addition to the main verb and an additional preposition if the action's doer is also identified (e.g., [active] "Officials *encourage* evaluations" vs. [passive] "Evaluations *are encouraged by* officials.")

However, be aware that there are times when passive voice is preferred over active voice: e.g., if one wants to focus on the action alone, as in *process analysis* or an Apparatus and Procedures section, or if one wants to describe an action without attaching a specific performer to that action (e.g., "A series of mistakes were made in the process" vs. "The research team made a series of mistakes").