Poster Presentation

Integrating and Editing Information Electronically in Science and Engineering Research Papers

Katherine Nelson Tanizawa
Waseda University

Writing for technical purposes is a crucial yet challenging skill for science and engineering students to master. Being able to express oneself with precision and accuracy is of utmost importance in such exact sciences. By learning and understanding techniques for editing, revising, and integrating information, students can confidently refine their research papers to meet the highest standards of publication. Frequently, during editing and revising of research papers, advice and comments given to students remain unread or perhaps read and ignored. Furthermore, although teachers add, change, or line out in the drafts using track changes, students often fail to integrate corrections or improvements. Moreover, incorrect amalgamation of the suggestions is common. Possible reasons for these oversights may be the result of students' limitations with the English language, or perhaps a lack of thorough understanding of how to use the track changes function. Clearly, a comprehensive explanation early in the writing process involving how to edit documents using Microsoft Word based on feedback in the track changes remarks might prove very beneficial and time efficient.

Today's students are using electronic means more and more to complete academic research papers for school assignments. Computers, word processing software, and the Internet are ubiquitous tools. They afford many benefits for not only students but also educators in efficiency of time and rapidity of feedback. Furthermore, instructors can use such tools to measure and monitor students' progress by referring to previous versions of their work edited using the track changes function of Microsoft Word.

However, limitations in the student's ability to edit electronically using track changes disrupt efficiency and hinder progress. Specifically, when allowed

multiple draft revisions, some students fail to utilize the opportunity to make in-text or layout adjustments. Others may only partially integrate advice and suggestions. I examined student performance in my technical writing courses when they were allowed multiple draft revisions and use of the track changes editing function. In particular, I noticed discrepancies between students who capitalised on the opportunity for multiple submissions and feedback and those who did not. In addition, I noticed tendencies of students to ignore or incorrectly integrate comments and suggestions, which can be essential for producing refined research papers.

The nature of this study is to examine the behaviours of a small group of science and engineering students and their integration of editing suggestions into subsequent drafts using track changes. By understanding the degree to which track changes' comments and suggestions are, or are not, noticed and incorporated, I hope to raise awareness among writing instructors so that perhaps students can learn proper usage of this useful tool. Specifically, I hope students become aware of how to read comments and accept changes inserted by instructors using the track changes mode. This study is limited in scope, but by examining a convenient editing tool and its effectiveness when used by students, I hope to assist educators in helping to improve overall technical writing skills of students.

Methods

Participants

Waseda University science and engineering students (36 undergraduate students, 28 graduate students) participated by virtue of having taken my technical writing courses and having signed a consent form allowing use of their work. They were fluent Japanese speakers taking Technical Writing (undergraduate students) or Advanced Technical Reading and Writing (graduate students). None of the participants were individually selected nor compensated for allowing their work to be evaluated for the study. All participants were allowed, yet not required, to submit two drafts for comments and advice prior to submission of the final research paper.

Materials and Procedure

Students were given a one-term assignment to design and carry out a short research project in their respective fields. Some examples of these include the following: a study on two-dimensional solid structure of poly (3-hexylthiophene) blend films by Raman spectroscopy; MPEG video watermarking for streaming using faster fingerprinting; and sampling system of soil on Mars utilizing mechanical vibration.

The task was to write up the findings in a research paper of 1600-2000 words, including an abstract of 75-150 words, using a single-column format following guidelines of their textbook (Anthony, 2013), which stipulates using the Institute of Electrical and Electronics Engineers (IEEE) style. References were not included in total word length, and no firm word-length limits existed; however, papers under 1,100 words risked the possibility of unfavourable evaluations.

Submissions were as Microsoft Word (.doc, .docx) files to allow my review and in-text comments, suggestions, and corrections. They were told to provide three submissions: two optional complete drafts on which comments and advice were given, and one final version. Each draft received comments, corrections, or suggestions written with track changes. However, if a subsequent submission revealed that all or a majority of the advice had been ignored and improvements were missing, I noted no additional errors and returned the draft with comments instructing the student to review and incorporate prior suggestions.

Throughout the writing process, students received support and instruction regarding language and layout of research papers. This included in-class help and textbook exercises, as well as electronic (E-mail, track changes) feedback to ensure excellence and accuracy in their work. To instill proper organisation of text and data even further, students received a four-page worksheet (Appendix) midway through the term at the layout-discussion stage of the writing process. The worksheet was based on guidelines in their textbook (Anthony, 2013) to complete in class with a partner. The purpose of the supplement was to simplify the complex English layout guidelines into an easily usable form that could be quickly referenced. The handout contained labels with layout details pertinent

to technical research papers such as indentations, line spacing, and font styles.

Results and Discussion

Integration

An example from one final paper submission illustrates the failure to properly synthesize information learned from the course (Figure 1). Surprisingly, despite explanations in English both in class and via track changes of how to utilize capitalization in titles and represent the affiliations, errors of these types appeared in much of the students' work.

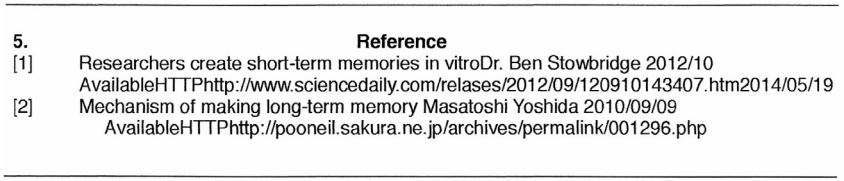
Alignment

The in-class exercises and worksheet seemed to be inadequate for ensuring that layout conventions be incorporated correctly into the students' papers.

Despite having access to myriad resources, students submitted papers with alignments varying from section to section. For example, one contained a left-aligned abstract while the remaining sections were flush left-right. This could be the result of the student writing the sections at different times, resulting in inconsistent type settings.

Another area with many inconsistencies was the reference section. Predominantly, errors appeared in the reference header's capitalization, the numbering of the section, or the misalignment of text margins. Text within citations was unevenly aligned, or set to a distance other than the 7.5-mm indentation stipulated (Figure 3). Less common, though evident, were errors regarding the order of information contained in the individual references with students sometimes failing to follow IEEE citation standards.

Figure 1. Author's affiliation shown using incorrect capitalization in three words: Science, Bioscience, Waseda. (The name and E-mail address have been changed to respect the student's privacy.).



5. Reference

[1] Researchers create short-term memories in vitroDr. Ben Stowbridge 2012/10 AvailableHTTPhttp://www.sciencedaily.com/relases/2012/09/120910143407.htm2014/05/19

[2] Mechanism of making long-term memory Masatoshi Yoshida 2010/09/09 AvailableHTTPhttp://pooneil.sakura.ne.jp/archives/permalink/001296.php

Figure 2. Sample from research paper showing lack of adhering to IEEE citation standards for order of information (Anthony, 2013).

Submissions and Grades

Grades were based on two main categories: Layout (55%) and Language (45%). Language was further subdivided into two more categories: micro (27%), covering flow/style/grammar and spelling; and macro (18%), covering audience/purpose/organization. A close examination of term-end submissions and grades shows that research paper final scores were improved on average by as much as 31% for undergraduates and 35% for graduate students who took full advantage of all three submissions, including two feedback opportunities. In general, 44.8% of the graduate students took advantage of submitting three versions (Figure 3). Of those students, 100% integrated track changes feedback into subsequent versions (Figure 4), whereas that was not the case for undergraduate students. Although 30.6% of undergraduates submitted the allowed three versions (Figure 4), approximately 10% (seven papers) were near-duplicates with virtually no revisions incorporated. So, the total of fully amalgamated papers was just 13.9% for undergraduates (Figure 4).

It is clear that receiving and incorporating editing advice and adhering to stipulated guidelines is advantageous to some degree. Term paper final grades were markedly higher for students who utilised both feedback opportunities leading to more polished final products (Figure 5, Figure 6).

Conclusion

In conclusion, proper research paper layout remains a challenge for this limited sample comprised of non-native English speaking students in Japan. Reasons why the students did not make the changes are unknown. Especially puzzling is why undergraduates with three revisions did not fix their mistakes. Perhaps conducting an anonymous survey would reveal whether the students were too

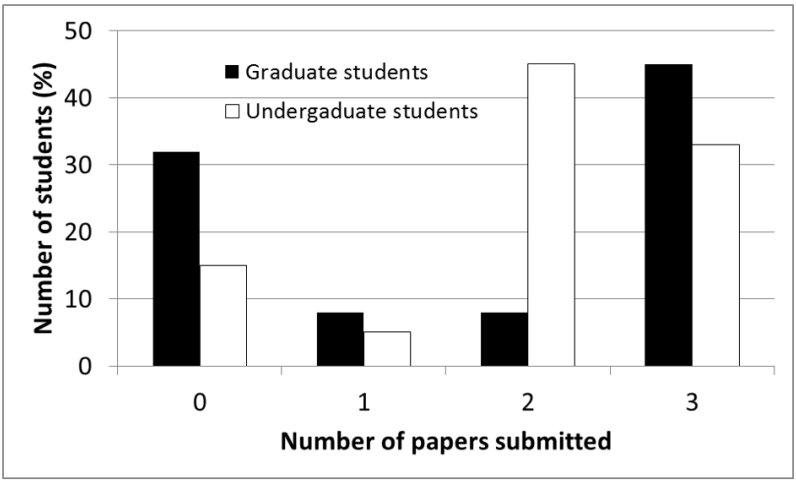


Figure 3. Percent of graduate and undergraduate students and the number of research paper versions submitted.

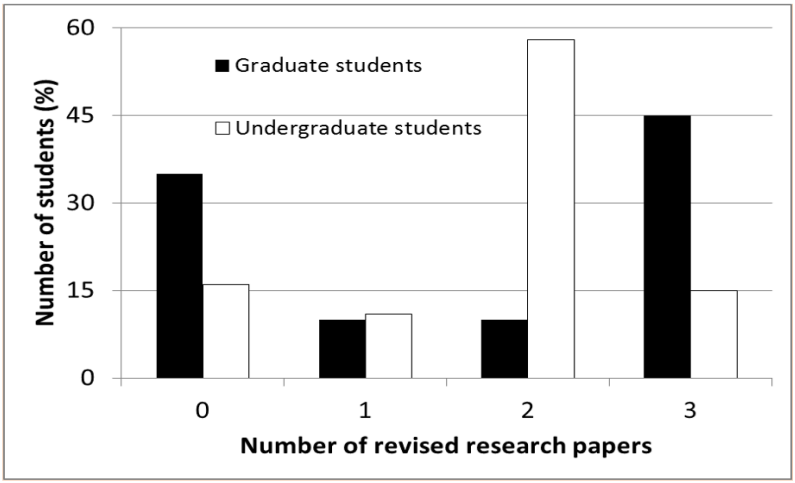


Figure 4. Percent of graduate and undergraduate students and the number of research paper versions submitted which had been revised.

lazy to make the recommended changes, or too busy with their class schedules or club activities. The students may even have thought that what they had written was "good enough" because perhaps their science teachers never ask for more than one draft of anything. Future efforts to find innovative means of reinforcing

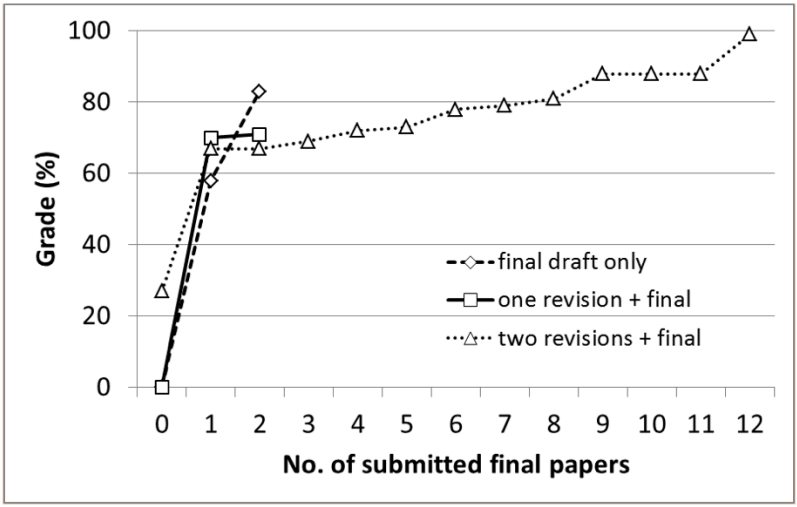


Figure 5. Graduate students' final research paper grades delineated by each paper submitted.

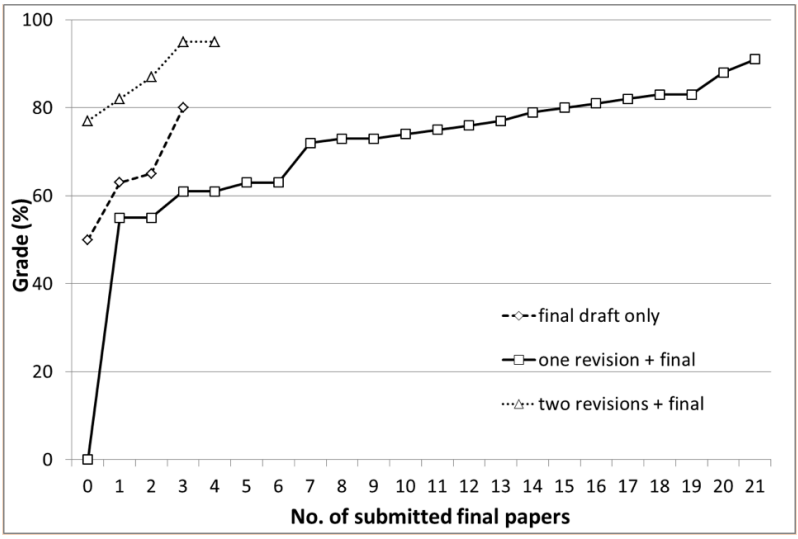


Figure 6. Undergraduate students' final research paper grades delineated by each paper submitted..

and ensuring adherence to technical writing protocol will likely improve student researchers' opportunities for publication. Additionally, it might also result in higher course grades.

The results of this study are limited due to the sample size, and further

research is required to clarify and resolve discrepancies in students' use of track changes. However, in the near term, one strategy that instructors could implement is confirming students' knowledge of using the track changes mode early in the writing process. Instructors could pinpoint areas of editorial weakness by requiring regular short assignments submitted electronically. After returning these with editorial comments and suggestions inserted via track changes, the instructor could then allow students to submit revisions. This would allow instructors' confirmation of students' editorial knowledge prior to having them submit a longer manuscript.

Clearly, the integration of instructor feedback and suggestions into successive drafts will reap benefits resulting in higher overall quality of students' work and a greater likelihood for research paper publication. Furthermore, if writing efficiency can be improved, perhaps even more content can be covered in class, or more in-depth study of other areas can occur. In other words, it is likely that the course's progression would become more efficient, resulting in opportunities to more fully maximise learning.

References

Anthony, L., (2013). Appendix B: Guide to authors. *Writing up research in science and engineering - Foundations* (pp. 127-130). Tokyo, Japan: Waseda University.

Author Bio

Katherine Nelson Tanizawa *(now* ***Katherine Nelson Crawford****) received her BA in human biology in 1985 and her MA in education in 1987, both from Stanford University. She is an adjunct faculty member in the Center for English Language Education (CELESE) at Waseda University. Her research interests include pragmatics, discourse analysis and forensic linguistics. kathycrawford@alumni.stanford.edu*

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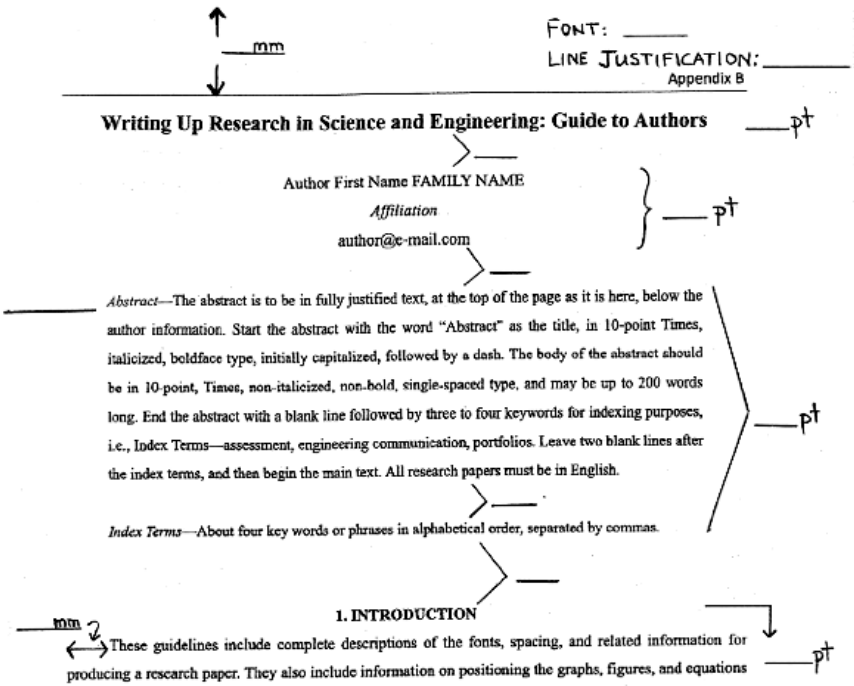
Appendix

Research paper layout worksheets to assist document setup by science and engineering students (Anthony, 2013)



4. AUTHOR NAME(S) AND AFFILIATION(S)

Author name and affiliation are to be centered beneath the title and printed in Times 11-point, non-boldface type. Affiliations are centered below the author name in italicized, non-boldface type. Include an e-mail address if possible. Follow the author information by one blank line and then start the abstract.

5. TYPE-STYLE AND FONTS

Wherever Times is specified, Times Roman, or New Times Roman may be used. If neither is available on your word processor, please use a font that is closest in appearance to Times that you have access to. Please avoid using bit-mapped fonts. True-Type 1 fonts are preferred.

6. MAIN TEXT

Type your main text in 10.5-point Times, single-spaced. Do not use double-spacing. All paragraphs should be indented 7.5 mm. Be sure your text is fully justified—that is, flush left and flush right. Please do not place any additional blank lines between paragraphs.

Figure and table captions should be in 9-point Times, non-boldface type. Capitalize only the first letter of the first word of each figure caption and table title. Figures and tables must be numbered separately. For example: "Figure 1. Database contexts," "Table I. Input data." Figure captions are to be centered below the figures. Table titles are to be centered above the tables.

Position figures and tables at the tops and bottoms of columns and centered. Try to avoid placing them in the middle of columns. Avoid placing figures and tables before their first mention in the text. Use GIF or JPEG formatting for embedded figures and images. The contents of the tables should be in 10.5-point Times. Table headers should be in bold.

TABLE I. Type sizes for tables.

Header One	Header Two	Header Three
column data	column data	column data
column data	column data	column data

Figure axis labels are often a source of confusion. Try to use words rather than symbols. As an example, write the quantity "Magnetization," or "Magnetization, M," not just "M." Put units in parentheses. Do not label axes only with units. In the example, write "Magnetization (A/m)" not just "A/m." Do not label axes with a ratio of quantities and units. For example, write "Temperature (K)," not "Temperature/K." Use SI units. Multipliers can be especially confusing. Write "Magnetization (kA/m)" or "Magnetization (103 A/m)." Do not write "Magnetization (A/m) x 1000" because the reader would not know whether the top axis label in Fig. 1 meant 15 000 A/m of 0.015 A/m.

Figure 1. Use this caption style for describing figures.

Number equations consecutively with equation numbers in parentheses flush with the right margin, as in (1) below. To make your equations more compact, you may use the solidus (/), the exponential function (ex), or appropriate exponents. Italicize Roman symbols for quantities and variables, but not Greek symbols. Use parentheses to avoid ambiguities in denominators. Punctuate equations with commas or periods when they are part of a sentence, as in

$$a + b = c. \tag{1}$$

Be sure that the symbols in your equation have been defined before the equation appears or immediately following it. Use "(1)," not "Eq. (1)" or "equation (1)," except at the beginning of a sentence: "Equation (1) is ..."

Use a zero before decimal points: "0.25," not ".25." Use "cm3," not "cc." Do not mix complete spellings and abbreviations of units: "Wb2/m2" or "webers per square meter," not "webers/m2." Spell units when they appear in text: "...a few henries," not "...a few H." Do not add any kind of pagination anywhere in the paper.

The next part of this template describes the different orders of headings that can be used, and their placement within the body of the paper.

7. FIRST-ORDER HEADINGS

First-order headings should be centered, and numbered. Write the heading using a Times 10.5-point boldface type. Capitalize all letters of the heading. Add one blank line before the heading and no blank lines after.

7.1 Second-order headings

As in this heading, second-order headings should be Times 10.5-point boldface, initially capitalized, flush left, with one blank line before the heading and no blank lines after.

REFERENCES

The References section must begin two lines below the main text using the same margins as the body. It should adopt the same font type as first order headings, but it is not a numbered section of the report. List and number all bibliographical references in 10.5-point Times, single-spaced, at the end of your paper, with

Appendix B

no blank lines between each reference. Number references consecutively in the text, and enclose the citation number in square brackets (for example, [1]).

[1] Jones, C.D., A.B. Smith, and E.F. Roberts, Book Title, Publisher, Location, Date.

[2] Author, A.J., J.S. Author, and S.J. Author. My Article's Title. Journal or Book Title. 34: 345-365, 1999

[3] "Space Shuttle Challenger Disaster," [Online Document], April 4, 2009, cited April 4, 2009. Available HTTP: http://en.wikipedia.org/wiki/Space_Shuttle_Challenger_disaster