Preliminary Findings of the Engineering Writing Initiative at the University of Texas at Tyler: A Longitudinal Study of How Engineering Students Learn to Write

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Abstract

The Departments of Electrical Engineering and English of the University of Texas at Tyler have launched a longitudinal study to investigate how engineering students learn to write technically and how to facilitate that learning in the course of the undergraduate curriculum. This study, known as the Engineering Writing Initiative (EWI) seeks answers to the following questions:

- How do the writing skills of engineering students develop during the course of their studies?
- What are these students' attitudes, practices and skills with regard to writing, and how do those attitudes, practices and skills develop over time?
- Does writing in engineering courses help students become more involved with those courses and understand and apply the ideas of those courses?
- Do improved writing skills help students become stronger engineers?
- How can we incorporate we learn about students' attitudes, practices and skills in order to improve our instructional practice with regard to writing?

The EWI will use multiple data-gathering methods (semi-annual writing prompts, focus-group and individual interviews with students and faculty, written surveys of students and faculty, and student writing samples gathered in portfolios). It will employ several assessment strategies (quantitative analyses of student writing samples, quantitative analyses of written surveys, and qualitative analyses of interview transcripts).

This paper sets forth the goals, structure, and methods of the EWI and will present findings from its first year. The current draft includes findings from the inaugural semester of the study; this draft will be updated to include results from the entire academic year during the Spring 2005 semester.

Background

Last year at this meeting the authors presented a paper describing the University of Texas at Tyler Electrical Engineering Laboratory Style Guide and assessing its impact on the writing of upper-division EE students (http://www.asee.org/acPapers/2004-457_Final.pdf). The Style Guide is a document drafted to help junior and senior-level electrical engineering students write stronger, more coherent laboratory reports. The authors' research suggested that the Style Guide was "an effective template," in that students learned from it to create documents with better formatting, tables and figures, as well as a stronger scientific idiom. Yet it was also concluded that the same document was an "ineffective teacher," as students did not learn much in the way of formal grammar and composition from the Style Guide. The Style Guide could not "ask the student if in fact he or she has explained a foreign concept clearly and adequately," nor could it "help the student with pronoun-antecedent agreement." While the Style Guide was valuable, it was clearly not a comprehensive solution. Moreover, use of the Style Guide is not mandatory in all EE laboratory classes, and the ME program does not have an equivalent document.

Despite the fact that the Style Guide might have been considered a qualified success, numerous questions remained unanswered. Correlations, rather than causal relationships, could be posited between student use of the Style Guide and better formatting, tables, figures, and use of professional scientific language: what might actually cause stronger student writing, particularly in the areas of grammar and composition? Student writing was assessed by quantitative methods alone: what might qualitative methods also reveal? The findings of the study, further, concentrated only on outcomes rather than on the ways in which student writing was actually generated. What could be learned if the entire writing process were examined? Finally, the 2004 study comprised only a single snapshot of a single cohort of upper-division EE students. What might be revealed by a study of a larger cohort of EE and ME students—not only those enrolled in upper-division courses, but also those in lower-division classes? The time is right to begin asking such questions as part of a longitudinal study of student writers and their writing in the University's Engineering program.

Such studies are not without precedent—Nancy Sommers and Laura Saltz at Harvard[1], Marilyn Sternglass at the City College of New York[2], and Lee Ann Carroll at Pepperdine[3] have completed similar work, but without focusing specifically on the writing skills of engineering students. Nonetheless, these prior studies have significant implications for the current study. Sommers' four-year study of student writers from across the disciplines notes that "students who make the greatest gains as writers throughout college (1) initially accept their status as novices and (2) see in writing a larger purpose than fulfilling an assignment" (p. 124). Carroll suggests that writing proficiency develops throughout the course of a student's academic career as students assume new tasks—new roles—as writers, and not in a single freshman course sequence. Sternglass' study of at-risk students enrolled at CCNY, with its provocative framework of richly detailed case studies, offers a strong example in qualitative methodology. These researchers' findings are intriguing—in them it is possible to see the limits of first-year students' knowledge of written conventions and limits of their understanding of the role writing plays in their learning. Sommers and Saltz, Sternglass and Carroll also demonstrate the value and efficacy of employing both quantitative and qualitative research methodology within a longitudinal framework: by doing so, it is possible to learn about the students themselves, and how their personal and educational backgrounds affect their understandings of themselves as writers.

The UT-Tyler College of Engineering and Computer Science (CECS) has a current enrollment of approximately 161 students, including 65 freshmen (24 Electrical Engineering, 41 Mechanical Engineering); 26 sophomores (7 EE, 19 ME); 33 juniors (18 EE, 15 ME); and 37 seniors (20 EE, 17 ME). The program is now in its eighth year and received ABET accreditation in 2001. This report comprises the preliminary, baseline results of the UT-Tyler Engineering Writing Initiative—a first annual report. In developing a framework for the EWI, the authors have begun studying approximately 36% of students currently enrolled as majors UT-Tyler's College of Engineering. Some assessment has been done with students who are currently juniors in electrical engineering, but the primary focus throughout this ongoing study will be a cohort of students who are currently enrolled as freshmen.

Methodology

The authors set out to construct a baseline set of engineering students' writing skills and attitudes toward writing through timed writing prompts, close rhetorical analysis of the timed writing prompts, and close rhetorical analysis of student-authored writing assignments. In this draft of this report the authors share findings from a preliminary review of the writing prompts and student-authored writing assignments. Results of follow-up focus-group discussions and interviews will follow in a subsequent draft. The authors visited in fall 2004 and spring 2005 with 43 freshmen in an introductory course in Engineering Methods (ENGR 1200) and 15 juniors in Electronic Circuits Analysis I Laboratory (EENG 3106). While not the primary emphasis of this study, the junior cohort was included at this stage of the EWI for the purpose of comparing upper and lower-division students and predicting future behaviors of lower-division students. Each student was asked to write for 30 minutes on the following three questions:

A. Why are you majoring in engineering?

B. What knowledge and skills do you anticipate developing during your course of study as an engineer?

C. What role do you anticipate writing will play in your course of study?

These questions were chosen because they can be asked repeatedly throughout the study; answers will demonstrate the extent to which students understand themselves both as engineers and as writers.

Results of preliminary written survey—freshman students

Figure 1 below summarizes the freshman responses to the question why they had chosen engineering as a discipline. The total number of responses (47) exceeds the number of respondents (43) because some students gave more than one response. The categories of the responses were drawn from the writing prompts themselves; the respondents were not *a priori* given these categories.

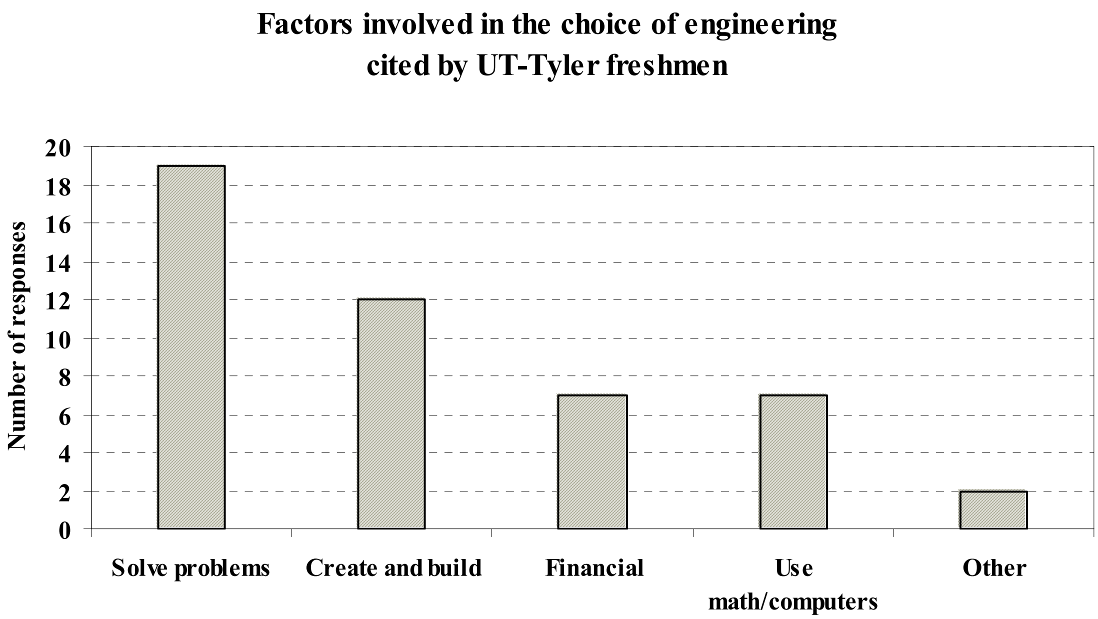

Fig. 1: Self-reported factors involved in freshmen students' choice of engineering as a major.

Figure 1 clearly demonstrates that the majority of students planning careers in engineering were attracted by the challenges of problem-solving and the exercise of creativity.

Figure 2 shows the distribution of the 69 freshman responses to the question of the knowledge and skills that they expected to develop in their undergraduate studies. The categories were again developed from the responses. These students listed a broad range of skills and knowledge they expected to develop; the "soft" skills of teamwork and communication received surprisingly-high responses. Since this was a mixed group consisting of both EE and ME students, the split responses concerning discipline-specific knowledge (e.g., circuits for EEs, mechanical principles for MEs) is understandable. What is striking (although not unanticipated) from Fig. 2, however, is the low number of responses (3) for writing as a skill to be developed by undergraduate engineers. It is apparent that writing is seen by freshman engineering students as peripheral at best to their chosen discipline.

Figure 3 summarizes freshman responses to the role they expect writing to play in their undergraduate studies. Total responses again outnumbered respondents. Figure 3 demonstrates clearly that freshmen see writing as a utilitarian skill that plays principally an *ex post facto* role in the engineering design process.

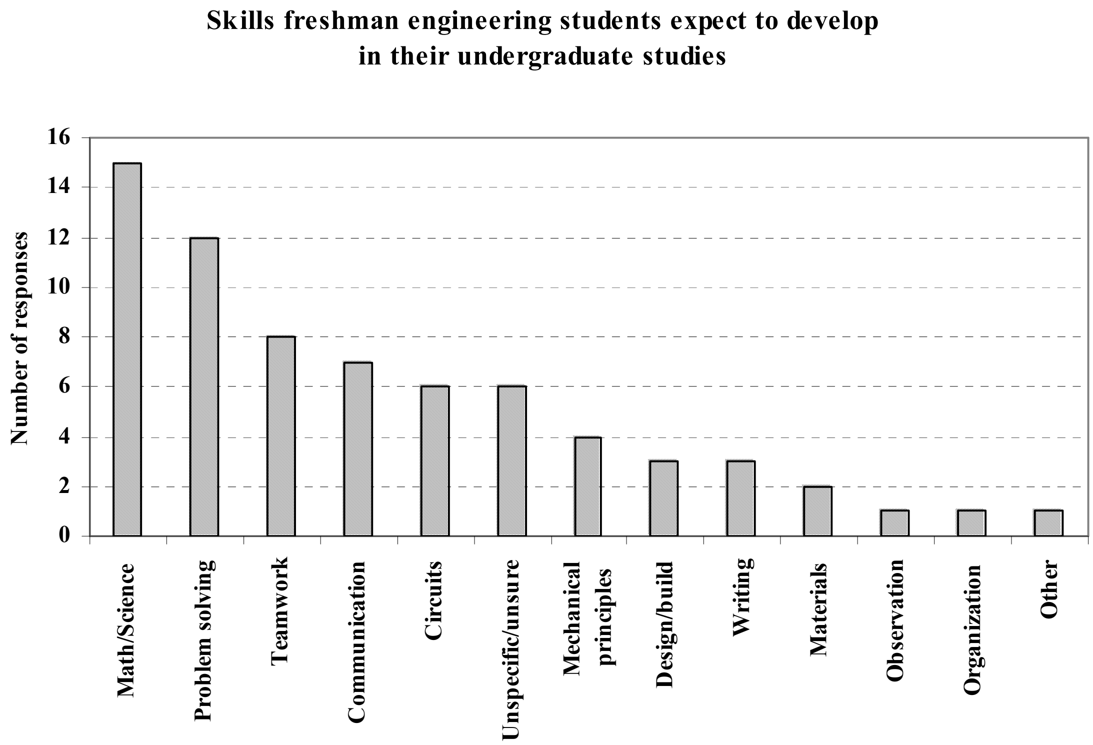

Figure 2. Skills freshmen students anticipate developing during their undergraduate studies

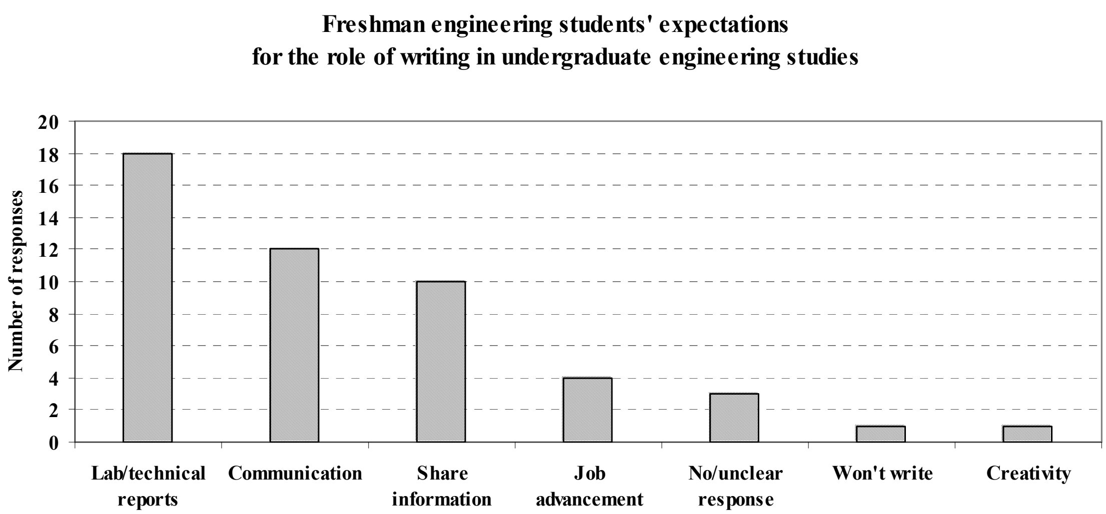

Fig. 3. Freshman perceptions of the role of writing in undergraduate engineering studies

Results of preliminary written survey—junior EE students

Figure 4 summarizes the reasons given by 15 EE juniors for pursuing an engineering degree. A total of 25 responses was recorded since some respondents gave more than one response.

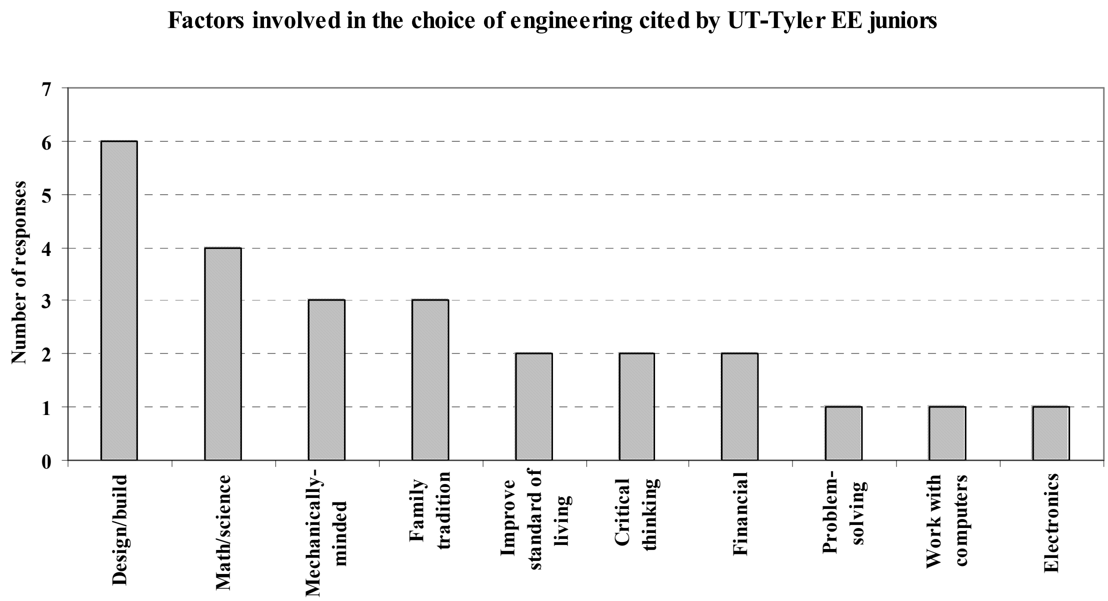

Fig. 4: EE juniors' reported motivations for studying engineering

Direct comparison with the freshmen of Fig. 1 shows some overlap in their reasons for majoring in engineering and some striking differences. For example, designing (or creating) and building systems was a prominent motivation for both juniors and freshmen. However, 19 freshmen responses listed problem solving as a motivation for studying engineering; only one junior response cited problem solving. However, this is only a point survey and they represent two different cohorts; whether the perceptions of this year's freshmen will change by the time they are juniors is a question that will be answered in two years. It is somewhat curious to note that three EE respondents were drawn toward engineering because they were "mechanically-minded" but chose electrical engineering as a major.

Figure 5 summarizes the 24 responses by the juniors to the question of their expectations of the skills they expected to develop during their undergraduate studies. Skills related to mathematics, basic science, and engineering design were understandably prominent in their responses. Writing as a separate item did not appear in their responses, although "communication" was cited twice. It is somewhat discouraging that communication—particularly written communication—is not more-highly rated. The meaning of the response "determination" is not entirely clear.

Figure 6 below summarizes the EE juniors' responses to the question of what role they expected writing to play in their courses of study. The results mirror those of the freshmen; the juniors see writing skills not as ends in themselves but as means to other ends, and they expect to use writing skills in an *ex post facto* manner.

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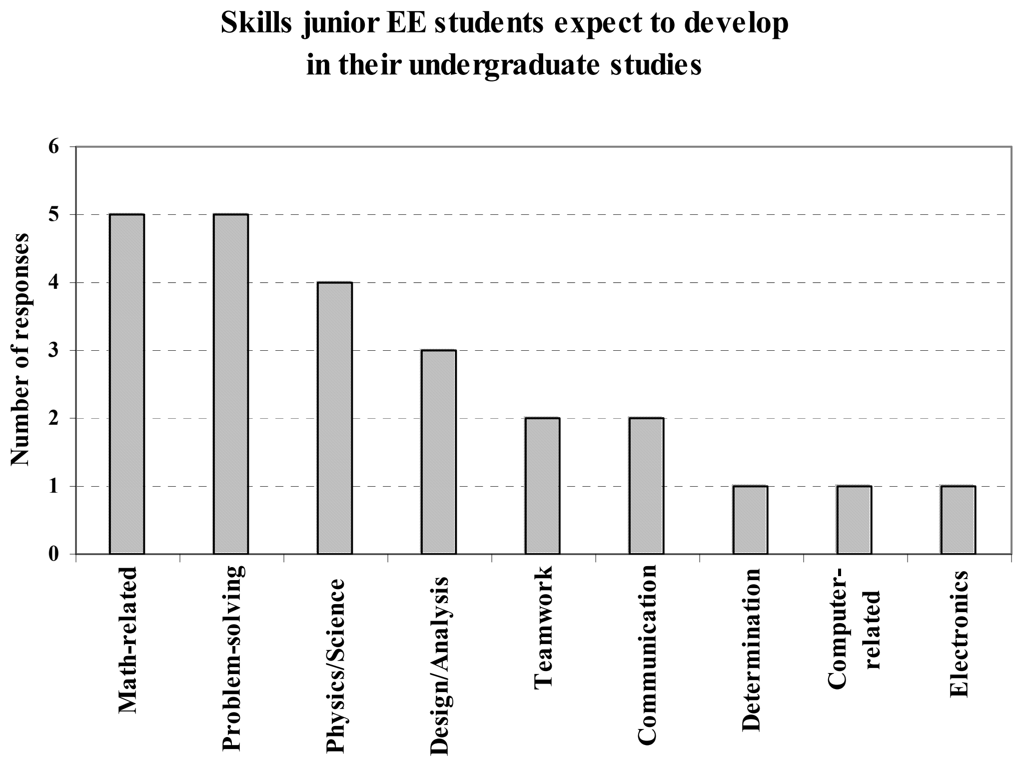

Fig. 5: Junior EE students' expectations of skills they would develop in their undergraduate studies.

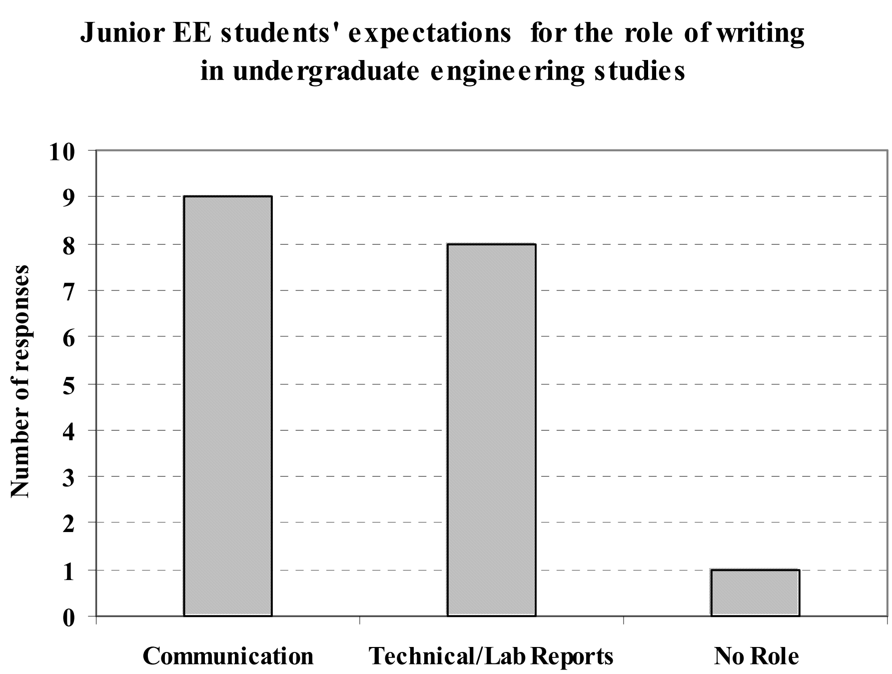

Fig. 6: Junior electrical engineering students' anticipations of the role of writing in their studies

Discussion of preliminary written survey

From a quantitative standpoint, results of the freshman responses show in a general sense that these students major in engineering because they are interested in solving problems (19 responses), as well as creating and building (12 responses). They predict, accordingly, that they will develop problem-solving skills (12 responses), but very few (3) actually predict that they will "create and build" during their course of study. Interestingly, a total of 15 respondents predict that they will develop some form of communication and teamwork skills during their course of study. It should be noted that the vast majority (22) see it as vital to communicating and sharing information, while a sizeable cohort (18) see it as vital to drafting lab and technical reports. No freshman students surveyed to date view writing as a means of solving problems.

Junior engineering students offer twice as many reasons for majoring as do freshmen (ten as opposed to five), listing "design and building" first and foremost (five out of 25 responses). Problem-solving comes much lower on this list than it does with the freshmen—only one of the 25 responses indicates this. Interestingly, five juniors predict problem-solving as a skill they will learn, in addition to math (five responses) and science (four responses). Design and building comes a little lower down the list, with three responses; communication has two. As with the freshmen, though, the vast majority of junior-level students (17 out of 18) indicate that "communication" and "technical and lab reports" will be the primary roles for writing during their courses of study.

A close rhetorical analysis of the language freshmen use to describe writing reveals that they understand it primarily as a means of conveying information, particularly in the form of formal reports. This finding is borne out by the language the freshman used to describe the role of writing in their responses to the essay prompts. The term "clear communication" showed up repeatedly, in addition to terminology suggesting the transactional nature of professional writing. One student wrote that his writing as an engineer should "clearly communicate [his] ideas in an appropriate manner"; other students used the terms "convey," "present," "describe," "display," and "put out information" to suggest this kind of communication. The idea of accountability was also very much an issue for these students, who referred to "standards" that need to be met, "requirements" that should be fulfilled, and even the presence of others—such as professors, bosses, and "supervisors"—whose opinions of their work matter very much. One freshman wrote, "Being able to word things properly will get me more respect from others." Another said, "Writing will be important when dealing with experiments, reports, and owners of corporations.". "Writing…could help me get that job I want," wrote a third. And one respondent wrote this gem: "People read what you have written, and if it looks like a 'bubba' wrote it, someone will think of you the same way."

The language juniors use demonstrates a more nuanced and arguably more sophisticated understanding of the role of writing in engineering. Certainly several juniors retained much of the same rhetorical emphasis as the freshmen, yet—perhaps due to much more experience with drafting lab reports—demonstrated an even greater emphasis on accountability. "Writing is important for an engineer," one wrote; "above all when turning in a report to your boss…it has be fluent and correct engineering style (*sic*)." Another noted that "explaining something you did [and] putting it on paper in clear English…does play a major role." Several juniors elaborated on this "major role," suggesting that in fact writing is not only a means of transmission of knowledge, but also a way of making meaning, of learning. "The technical papers we write give me a better understanding of what is going on in the course," wrote one junior. "Technical writing helps me better understand the project or lab that I am working on." Finally, another junior explicitly linked the process of writing to the process of solving problems: "If you cannot write well, it's going to be hard for society to understand the solution to the problem [you're working on], and hence the problem will not be solved." These preliminary findings certainly corroborate Sommers' recent work (2004, p. 130), which shows that of 422 students surveyed at the end of their freshman year, 73% saw writing as "important" or "very important" when understanding and applying ideas related to a course.

Results of survey of student attitudes toward writing

Findings of the preliminary written survey were in some respects corroborated by a second survey administered to a sample of 15 freshmen and 11 juniors during the spring 2005 semester. The survey asked respondents to indicate on a scale of 1 (strong disagreement) through 5 (strong agreement) the extent to which they agreed with six statements concerning their attitudes toward writing, their beliefs about themselves as writers, and their work habits as writers. Each of the six statements was presented twice, once as a positive statement and once as a negative statement. Correlation coefficients measuring the consistency of responses were calculated and found to be positive to strong positive (a range from 0.7 to 0.9). This indicates that individuals' responses were generally self-consistent and thereby valid. Survey results are shown below.

Table 1: Positive responses to spring 2005 attitude survey. Figures indicate the percentage of responses rated 4 (agreement) or 5 (strong agreement) by respondents.

Statement	Freshmen (*n*=15)	Juniors (*n*=11)
I'm a good writer.	60	45
The writing in engineering courses helps me understand the course material.	53	45
It does not bother me to write for engineering courses.	53	63
I care about the writing I do in engineering courses.	80	90
Writing plays an important role in engineering courses.	80	90
I spend a great deal of time writing in my engineering courses.	46	81

Discussion of preliminary attitude survey

The most striking difference between the numerical surveys is students' responses to the sixth statement, "I spend a great deal of time writing in my Engineering courses." Only 46% of freshmen surveyed agreed or strongly agreed with this statement, while 81% of juniors surveyed agreed or strongly agreed with it. This may be due to several factors, including the volume of written work juniors are responsible for; yet the researchers speculate that perhaps by their junior year engineering students are more likely to have grasped the significant role writing plays in their academic success, and are therefore more willing to devote more time to it. This corroborates the researchers' findings from the preliminary written survey, in which juniors demonstrated a more nuanced and sophisticated view of the role of writing in their coursework.

Juniors also indicate stronger agreement than freshmen with the statements, "It does not bother me to write for Engineering courses" (63% to 53%); "I care about the writing I do in Engineering courses" (90% to 80%); and "I think writing plays an important role in my Engineering courses" (90% to 80%). These responses are also in keeping with what the researchers know from the preliminary written survey about this cohort's understanding of and attitudes toward writing. Interestingly, freshmen show higher rates of agreement than juniors with the statements "I think I'm a good writer" (60% to 45%) and "The writing in Engineering courses helps me understand the course material" (53% to 45%). One hypothesis for the juniors' apparent loss of confidence in their writing abilities is their being challenged to write to a standard higher than their prior experience or expectations. These responses warrant further investigation,

Preliminary findings—analysis of freshman technical writing

All engineering freshmen at the University of Texas at Tyler are required to take ENGR 1200, a course that combines an introduction to the profession of engineering with an introduction to engineering ethics, a semester team-based design project, and experience in technical communication through an engineering-related research paper, business letters, memoranda, and written reports of laboratory exercises. (Transfer students who have not had equivalent experience in these topics are required to take a similar course).

Among the findings of review of this work are the following:

- Technical findings

1. Errors of fact: Seven of 28 laboratory reports reviewed contained errors of fact. Examples of these include confusion of quantities of one type with another (e.g., "One ohm is equal to the current which will flow when a voltage of one volt is applied") or equipment function (e.g., "The Strobe (*sic*) relayed the information of the speed to which the beam was shaking up and down to the Function Generator (*sic*)").
2. Summary: the summaries of 9 of the 28 laboratory reports were judged to not adequately convey what was accomplished in the experiment.
3. Equations: equations were usually appropriate to the experiment, but the meanings of variables were frequently unclear. For instance, several reports of an experiment on the principle of superposition in electric circuits contained statements similar to the following taken *verbatim* from one report:

"A function is considered linier (*sic*) in X if equation (1) is true.

$$F(X_1+X_2) = F(X_1)+F(X_2) \tag{1}$$

where $F(X_1+X_2)$ is the sum of both power inputs, and $F(X_1)+F(X_2)$ is the sum of both power input (*sic*) separately."

4. Experimental procedure: none of the reports contained sufficient detail in the experimental procedure to permit the experiment to be reproduced. Important details were frequently omitted.
5. Figures: electrical schematics were generally correct although they were generally of low quality. Mechanical drawings were generally rudimentary; none were drawn to scale, and most lacked dimensions.
6. Results: results were generally in accord with the expectations of the experiment, although the rules of significant figures were routinely violated
7. Discussion: discussion of results was sketchy and often recapitulated results instead of citing factors that could have affected the experimental outcome. Conjectures as to effects that might have altered the experimental outcome were not substantiated. For example, a report on linear superposition in an electric circuit stated that "due to the mix up of the circuit positions and the weather causing the fuses in the proto board to blow, the results of this lab where (*sic*) taken from only one multimeter."
8. Conclusions: conclusions were often sketchy or off-subject.

- Style, format, and organization

1. Suspected plagiarism: Several students submitted technical research papers of markedly better quality than their laboratory reports. For example, one student's research paper contained the following passage:

   > "Continuing progress in airfoil design is likely in the next few years, due in part to advances in viscous computational capabilities. One example of an emerging area in airfoil design is the constructive use of separation."

   This may be compared with this student's laboratory report on linear superposition in electric circuits:

   > "Although the results turned out somewhat accurate they were not at 0% difference, which was the overall goal of the experiment. The reason for this was because the electricity was drifting therefore creating inaccurate results. Another factor was that the alligator clips were slightly touching each other and that can cause the electricity to migrate slightly."

   The apparent contrast in the quality of writing and the level of technical sophistication leads to the suspicion that the research paper contained significant plagiarism.
2. Colloquialisms: all laboratory reports and most technical papers contained language that was conversational and colloquial rather than professional. For example, the summary of one student's research paper contained the following:

   > "Every person would hate to think of what the world would be like without these great men and their inventions…Everybody would have to wash our clothes by hand and

dry them on a line – scary to think about. The world should very happy (*sic*) and thankful to these scientists who gave us electricity."

3. Format of tables and graphs: tables and graphs were generated by Excel and invariably used default formatting. In many cases, data were presented in both tabular form and graphical form. Tabular data often lacked units of measurement (e.g., V, μA).
4. Format of equations: equation formatting was generally acceptable when Equation Editor was used. Equations created as text with a word processor were of poor quality..
5. Spelling, grammar, and punctuation: spelling, grammar, and punctuation were generally acceptable despite some notable counterexamples. However, lack of parallelism in number was often noted.
6. Logical organization: problems with logical organization were frequent. For example, one student's research paper on pioneers in electricity stated in its abstract that "electricity did not begin when Benjamin Franklin flew his kite during a thunderstorm," but a subsequent paragraph devoted to the achievements of Franklin states that "contrary to popular opinion, Benjamin Franklin probably did not tie a key to a kite and fly it in a lightning storm."

This review of freshman engineering writing reveals widespread problems. Among the writing samples reviewed, there were no laboratory reports that approached professional quality. It is true that the authors of these samples were freshmen and that improvement should be expected before graduation. However, the problems noted in this review appear to be endemic, deeply rooted, and more profound than can be addressed by mandating that students follow a written style guide.

Preliminary findings—analysis of junior technical writing

Junior EE students in EENG 3106 were required to write three formal laboratory reports in the fall semester of 2004 in following the requirements of the EE Laboratory Report Style Guide. Each report was submitted in draft form and returned with a written evaluation. Evaluation was conducted both on technical merits (correct theory, reasonableness of results, technically-sound discussion and conclusions) and style, format, and organization (mechanics of spelling, equation format, word choice, page layout, and logical organization). The final reports were re-evaluated according to the same criteria. Each criterion was scored on a scale of 0–4 where 0 represents missing or absolutely unacceptable work and 4 represents a professional-quality laboratory report.

The technical evaluation criteria were as follows:

- How well does the introduction describe the experiment?
- How well is necessary theory explained?
- How are equations and mathematics used?
- How complete is the experimental procedure?
- How complete are the results and how well are they supported?
- How comprehensive was the discussion?
- How comprehensive were the conclusions?

Figure 7 shows the composite results of technical evaluation of 21 draft reports and 18 final reports.

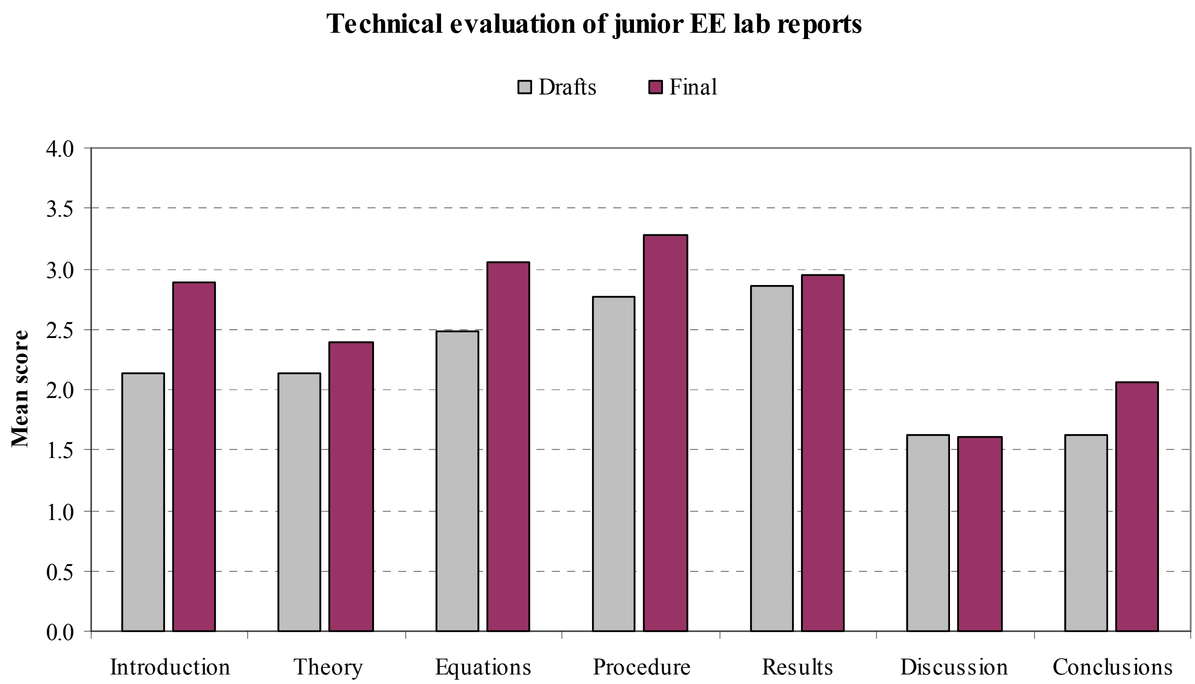

Fig. 7. Results of technical evaluation of junior EE lab reports from EENG 3106.

It can be seen from Fig. 7 that the process of editing and revision does produce improvements, but even the best category of the final reports (completeness and technical accuracy of the laboratory procedure) rises only to the level of marginally acceptable. The area in which scores were lowest was "Discussion," in which students are to write about the implications and limitations of the experiment as well as other effects that may have influenced the experimental results. This may reflect a lack of comprehension of the experiment on the part of the students. The juniors, like the freshmen, seemed quick to attribute discrepant results to human error or to resistor tolerances without a supporting rationale.

The criteria for evaluation of style, format, and organization were as follows:

- How well is the introduction written?
- How well is the theory written?
- How well were equations and mathematics presented?
- How effectively were figures used? (This criterion includes both clarity of the figures and the quality of the information they convey).
- How well is the experimental procedure written?
- How well presented are the results?
- How well written was the discussion?
- How well written were the conclusions?

The evaluation of style, format, and organization was meant to be as orthogonal to the technical evaluation as possible. For example, the “Theory” section may be technically sound but badly written. Figure 8 below gives a graphical interpretation of the results for 21 draft and 18 final reports.

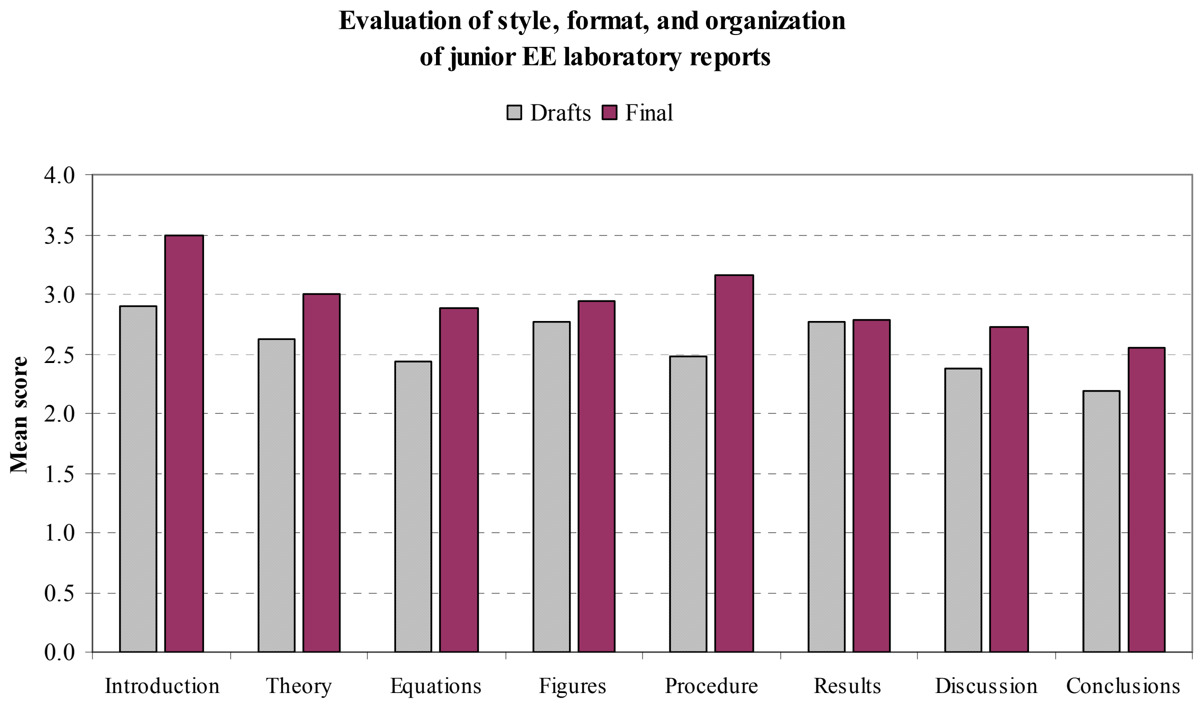

Fig. 8. Evaluation of junior EE laboratory reports for style, format, and organization.

Improvements were made in all categories through the editing and revision process, but even so, the quality of the reports is still in the marginally-acceptable range.

The evaluation criteria for the junior work were customized to the style of laboratory report mandated by the EE Laboratory Report Style Guide, while the freshman work was not written to its requirements. This complicates the comparison of the two. However, certain observations could be drawn from comparing the two bodies of work:

- Errors of fact were less frequent in the juniors’ work than the freshmen’s work.
- Graphs and tables in draft reports were usually formatted according to the default settings of Microsoft Excel. Draft reports frequently presented results as raw data in tabular form or as both a table of raw data and a graph.
- Juniors were less likely to present results without narrative text.
- Discussion and conclusions appeared equally troublesome for freshmen and juniors.

A unified rubric for future evaluations

The work that will be evaluated in the course of the EWI will be of disparate types and come from multiple sources. The necessity of a unified evaluation rubric and a common scoring method became apparent in the evaluation of freshman vs. junior work. The following rubric has been developed and will be used for future evaluations. A scale of 1 (representing complete disagreement) to 5 (representing complete agreement) will be used. This scale is consistent with that used in student surveys.

- Organization: Written material is organized appropriately into discrete units—for example, title page, project description, methods and materials, results, discussion, conclusion, and references.
- Content: Written material is presented in paragraphs, each of which is focused on one topic. Written material is also coherent, with strong transitions between ideas. Written material is well-developed, in that the writer fully explains, describes, summarizes and/or analyzes, as needed. Finally, equations are relevant and necessary to the development of the written material, with all variables clearly defined.
- Mechanics: Written material adheres to all relevant conventions of grammar, punctuation and spelling. Equations are formatted correctly; fonts are uniform; scientific notion is used appropriately.
- Language: Professional language is employed. Slang, colloquialisms, first person, second person, and the imperative mood are avoided. Primary emphasis is on a replicable process or experiment, not a personal account of an activity.
- Tables, figures, and graphs: All tables, figures and graphs are well-formatted, comprehensible, and used appropriately.
- Technical merit: Materials are technically coherent, consistent, and accurate.

The freshman and junior works cited above were re-evaluated in terms of this new rubric. The results are presented in Table 2 below.

Table 2: Evaluation of freshman and junior writing documents according to the unified rubric.

	Freshmen	Juniors
Organization	4	5
Content	2	2
Mechanics	2	4
Language	1	4
Tables, figures, graphs	2	3
Technical merit	2	3

Both the freshmen and junior scored quite well on organization since both groups used a standardized template for laboratory reports. Neither group fared well in content; this was a particular problem in junior laboratory reports where writers would change subjects without any form of transition. The freshmen were particularly low in language because of the universal use of colloquialisms. The freshmen's use of tables, figures, and graphs was also unsophisticated, particularly because of disregard of the rules of significant figures.

Conclusion

This preliminary assessment of timed freshman and junior-level writing prompts and freshman-level lab reports reveals that freshman writers understand the act of writing as an ancillary, even *ex post facto* activity, a skill that while required by their instructors is secondary to their primary function as engineers. Close review of their lab reports certainly affirms this belief. These documents—as is the case with documents examined in the authors' 2004 study—show a marked ignorance or disregard of written conventions valued by engineers, including technical findings, style, format, organization, and development. Why might this be so? While further research (focus-group and one-to-one interviews) must be conducted in this regard, there appears to be a correlation between freshman attitudes and freshman writing skills. If in fact freshman engineers do not take writing seriously or see it as an integral skill that must be developed during their course of studies, it is perhaps no wonder they write so poorly. Yet many of these same freshmen sound very much aware of several key functions of writing as engineers: they note that "lab and technical reports," "communication," and the "[sharing] of information" will be the primary ways in which they use writing in their careers. No one would seriously doubt this to be true. Perhaps, however, the tasks of compiling lab reports, drafting professional documents, and writing business memos are much more complex and time-consuming than most freshmen realize.

The junior-level cohort—which is, again, included here for the purpose of comparison and projection—offers a few predictions of how the freshman-level cohort's attitudes and skills may develop in the coming years. Certainly the juniors wrote more mature, highly-developed prose in response to the timed writing prompt. A small number of these responses, as discussed above, demonstrate a keen awareness of audience as well as an incipient understanding of writing as a means of learning, of connecting with course material and ultimately the discipline of engineering. Again, as mentioned above, these findings bear out Sommers and Saltz's (2004) recent work, in which students across the curriculum noted stronger connections to and comprehension of course material in courses in which they were required to write extensively. Perhaps some freshmen will show that they, like Sommers and Saltz's cohort, understand writing as not only a means of dispersing information but also of thinking through and understanding that information.

To date, then, the EWI raises serious questions about not only the quality of student writing but students' perceptions of the act of writing. If the junior-level cohort is any indication, there appears to be a very slight trajectory from lower to upper-division students in terms of writing ability and the perception of writing as a rich, multifaceted, complex act. Might ability and perception be intrinsically linked—and if so, what might the impact be on classroom instruction? If in fact writing skills improve as the perception of writing as a complex, thought-provoking skill also develops, do students become stronger engineers as a result? The authors will continue to consider these questions as the EWI continues.

References

[1] Sommers, Nancy, and Laura Saltz. "The Novice as Expert: Writing the Freshman Year." *College Composition and Communication* 56 (1). September 2004. 124-149.

[2] Sternglass, Marilyn S. *Time to Know Them: A Longitudinal Study of Writing and Learning at the College Level*. Mahwah, NJ: Lawrence Erlbaum Associates, 1997.

[3] Carroll, Lee Ann. *Rehearsing New Roles: How College Students Develop as Writers*. Carbondale, IL: Southern Illinois University Press, 2002.

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