2006-1521: HOW ENGINEERING STUDENTS LEARN TO WRITE: THE SECOND YEAR OF THE ENGINEERING WRITING INITIATIVE AT THE UNIVERSITY OF TEXAS AT TYLER

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How Engineering Students Learn to Write: the Second Year of the Engineering Writing Initiative at the University of Texas at Tyler

Abstract

The Departments of Electrical Engineering and English of the University of Texas at Tyler are in the second year of a four-year longitudinal study investigating how engineering students learn to write. The Engineering Writing Initiative (EWI) seeks answers to the following questions:

- What are engineering 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?
- How can we incorporate we learn about students' attitudes, practices and skills in order to improve our instructional practice with regard to writing?

EWI is using multiple data-gathering methods (semi-annual writing prompts, individual interviews with students, written surveys of students, and student writing samples gathered in portfolios). It employs several assessment strategies (quantitative analyses of student writing samples, quantitative analyses of written surveys, and qualitative analyses of interview transcripts).

This paper is the second in a series of four planned EWI reports to ASEE. While last year's paper articulated a baseline set of data with regard to student attitudes, practices and skills, this year's report will include data demonstrating what students have learned in addition to preliminary considerations of how this study can begin to affect instructional practice in UT-Tyler Engineering courses.

Background

With some estimates suggesting that "as much as 80% of an engineer's work time is spent on communicating,"[1] significant attention has been given recently to the place of writing instruction in engineering courses. For example, in multiple publications Norback et al [2,3,4,5] have developed powerful links between classroom and industry to identify relevant writing skills and transfer them into classroom practice. Bonk, Imhoff and Cheng [6] describe a collaborative effort between a Civil and Environmental Engineering program and a Business and Technical Writing program that has resulted in the incremental integration of writing skills into engineering curricula. Ostheimer and White have developed a sophisticated assessment mechanism that, among other outcomes, "generates important program information for the faculty about the relative success of their students in reaching goals that the faculty has determined to be important." [7] And in a pithy assessment of the value of clear written communication for the engineer, Forsyth (2004) notes that "the effort involved" in careful drafting "will pay dividends." [8] The authors of this study understand the value of writing within engineering practice. The University of Texas at Tyler founded its School of Engineering (now the College of Engineering and Computer Science) in

1997, and industrial experience was required in all founding faculty, including Dr. Beams who wrote numerous laboratory reports, letters to vendors and customers, memoranda, test instructions, failure analysis reports, and other documents during 16 years in industry. Thus an emphasis on communication skills appropriate for the workplace has been a component of UT-Tyler engineering programs since their inception. With few exceptions, laboratory reports produced for UT-Tyler engineering courses require students to write as if they were practicing engineers. This is the same kind of writing assignment that Norback finds lacking in six out of ten engineering programs surveyed.[9] In particular, the style guide and template for Electrical Engineering laboratory reports are modeled on industrial experience.[10] UT-Tyler's engineering programs include communications-intensive curricula. Students begin with freshman-level Engineering Methods, a course that requires students to make oral presentations as well as to write laboratory reports, business letters, résumés, and technical research papers. Written reports and oral presentations are required in mid-level courses, and the senior-level two-semester capstone design sequence, a joint effort of Electrical Engineering and Mechanical Engineering, requires students to write project proposals, progress reports, updates, and final reports as well as make an oral presentation in each semester. Dr. Niiler, founding director of UT-Tyler's Writing Center, has extensive experience working with students from across the disciplines on subject-specific writing projects. He has contributed to the Electrical Engineering Laboratory Report style guide, and regularly provides presentations on writing skills for engineers.

Last year at this meeting the authors presented a paper detailing the findings from the first year of EWI**.** [11] Through interviews, surveys and writing prompts, the authors found that the freshman cohort of students in this study tended to "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" (p. 14). Preliminary findings of EWI also included a junior-level cohort for the sake of comparison and projection. Close analysis of these students' writing samples showed "more mature, highly-developed prose" and "an incipient understanding of writing as a means of learning, of connecting with course material and ultimately the discipline of engineering" (p. 15). These findings are best summarized in Table 1, below, which shows freshman and junior-level responses to a Likert scale survey measuring the extent to which they agreed with five statements that focused on their attitudes and work habits as writers. The consistency of these responses was high; correlation coefficients of these responses were measured and found to be positive to strong positive (0.7 to 0.9).

Table 1: Responses to a 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
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

The authors found this understanding borne out through further, more quantitative assessments of this same cohort's written documents—in particular, laboratory reports. As per the assessment rubric created for the purposes of this study, the authors determined that freshman Engineering students' writing rated particularly poorly in terms of content, mechanics, professional language, the use of tables, figures and graphs, and technical merit (p. 15). As shown in Table 2, below, junior-level students demonstrated stronger writing skills than the freshmen in all areas assessed except Content. In this area, juniors performed no better than the freshmen. (A five-point scale is used, with 5 indicating that the writing sample in question strongly conformed to the criteria, and 1 indicating no evidence of doing so).

Table 2: Evaluation of freshmen and junior laboratory reports per rubric.

Criterion	Freshmen	Juniors
Organization	4	5
Content	2	2
Mechanics	2	4
Language	1	4
Tables, Figures and Graphs	2	3
Technical Merit	2	3

The operative definitions of these criteria are as follows:

- 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 accurate.
- 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: Material is free of errors in technical matters.

For the purposes of greater context, it should be noted that these operative definitions are both similar to and extensions of assessment criteria from other academic institutions, two of which are identified below. Ostheimer and White report that the University of Arizona Department of Electrical and Computer Engineering has developed a scoring guide that includes the following:

- Organization: Structure and function of [the document] is clear and purposeful; logical sequence signaled with effective transitions.
- Development: All selections contain appropriate ideas, relevant details; no relevant information is omitted and no irrelevant information is included. Sequence of ideas helps reader understand technical content and writer's purpose.
- Expression: Language is clear, succinct, and in general will communicate equally well to technical specialists and to interested non-specialist readers.
- Mechanics: Few errors in punctuation, spelling, grammar or documentation. [12]

The UT-Tyler Scoring Guide, while equivalent to UA's in terms of Development and Mechanics, places a greater stress on workplace communications. Organization is similar in both guides; however, UT-Tyler's offers a more fully articulated emphasis on professional courtesy/contingency (ie, the required documents are to be frontloaded with significant information—description, methods and results). UA's Expression criterion is encapsulated within UT-Tyler's Professional Language criterion; again, UT-Tyler's emphasis is on workplace communication. And the UT-Tyler Scoring Guide includes the two additional categories of Tables, Figures and Graphs and Technical Merit.

Flateby details the Cognitive Level and Quality of Writing Assessment (CLAQWA) initiative at the University of South Florida. This assessment instrument includes five criteria for written communication, and has been adopted for use by general education courses and the College of Engineering. The CLAQWA includes the following criteria.

1. Assignment Parameters represent the degree to which students fulfill the requirements of the assignment presented, maintain a main idea, and consistently address the appropriate audience.
2. Structural Integrity addresses the organization revealed in papers and includes skills such as the adequacy of the opening and closing and the unity within and across paragraphs.
3. Reasoning and Focus pertains to the development of ideas and writers' thought processes in developing their ideas.
4. Language focuses on appropriate word choice, level of vocabulary, sentence construction, and comprehensibility of sentences.
5. Grammar and Mechanics represents the degree to which students observe standard English.[13]

In this example it is possible to compare UT-Tyler's Organization to USF's Assignment Parameters and Structural Integrity, and UT-Tyler's Content to USF's Reasoning and Focus. Mechanics and Language are equivalent across both institutions, with UT-Tyler's Tables, Figures and Graphs and Technical Merit not represented on the USF rubric.

Methodology

With the above baseline data established, the authors again visited with the 2004-2005 cohort of student writers, now in their sophomore year. The work of fifteen freshmen was studied during the 2004-2005 academic year; the work of nine sophomores has been reviewed to date during the

2005-2006 academic year. The authors anticipate that most of this original cohort will participate in the study as it continues during the spring 2006 semester. All results shown below should therefore be considered tentative until all data has been gathered. It should also be noted that as with other longitudinal studies (in particular, the work of Marilyn Sternglass [14]), student access is a perennial issue. Due to factors such as class and work schedules, as well as changes of address and major, it is always a challenge to locate, contact and follow up with students.

During the fall 2005 semester, the authors used the following tools to continue gathering information about student attitudes toward writing and student writing skills:

(a) A Likert-scale survey
(b) A written questionnaire,
(c) Oral interviews with students (completed in May 2005; these results are included here for the purposes of comparison),
(d) A focus-group discussion, and,
(e) A quantitative, multiple-trait assessment of writing samples.

Results of each of these methods will be described below, with discussions immediately following.

Results of Likert-scale survey

As shown in Table 3, below, there is very little change from spring to fall 2005 in student attitudes toward writing in their Engineering classes, with the exception of the statement that "writing in engineering courses helps me understand the course material." Possible reasons for this change are noted in the "Discussion" section below.

Table 3: Responses to a fall 2005 attitude survey. Figures indicate the percentage of responses rated 4 (agreement) or 5 (strong agreement) by respondents.

Statement	Spring 2005 (*n*=15)	Fall 2005 (*n*=9)
I'm an experienced writer.	60	66
Writing in Engineering courses helps me understand the course material.	53	77
I care about the writing I do in Engineering courses.	80	88
Writing plays an important role in Engineering courses.	80	88
I spend a great deal of time on writing assignments in Engineering courses.	46	62

Discussion of responses to fall 2005 attitude survey

Responses to each question were highly consistent. Variances in responses generally measured between 0.23 and 0.50, with greater variance among responses to the last two statements (1.0 and

1.1, respectively). This variance may in part be accounted for because of the wording of the prompt: the terms "important" in the first statement, and "time" in the second, have multiple connotations and therefore perhaps engender a broader range of responses. The authors also chose to replace the term "good writer" (from the first year of the study) with "experienced writer" in question one, as the term "experienced" appeared less subjective.

Most interesting were the responses to the second statement, "Writing in Engineering courses helps me understand the course material." Agreement to strong agreement with this statement rose from 53% of freshman respondents in spring 2005 to 77% of sophomore respondents in fall 2005. The authors speculate that this increase may have been anticipated by last year's study, in which a small number juniors surveyed shared their belief that writing in Engineering courses helped with their comprehension of course materials. Indeed, when asked to comment (in a written questionnaire, detailed below) on how and if writing had helped them better understand their Engineering courses, the sophomores surveyed had the following to say:

(a) "The class with writing assignments is easier to understand than the class without writing assignments."
(b) "When I am required to write, the writing forces me to dig deeper into the material and thereby learn it more effectively."
(c) "Writing helps me slow down and think about the subject matter."

Indeed, if the jump from 46% to 62% answering "agree" or "strongly agree" to the last statement (about time spent writing) is any indication, this sophomore cohort is in fact beginning to "slow down" and "think more." The authors speculate that these students have begun to understand the significant role writing plays in their course of study.

Results of written questionnaire

During the fall 2005 semester, sophomores involved in this study were asked to complete a written questionnaire, in which they elaborated on several aspects of writing within their Engineering courses, including their own writing strategies, the role writing plays in their Engineering classes, and the impact of past classroom experiences on current writing practices. The authors' intentions with this more qualitative portion of the study were, first, to attempt to understand how students communicate about writing. Sommers [15] has shown that less experienced writers (often students) understand writing as a means of showing "what is already there, already finished, already produced, ready to be communicated, and all that is necessary is a better word 'rightly worded'"(p. 47). More experienced writers, on the other hand, show a much more pronounced concern for the "form or shape" of their argument, as well as a "concern for their readership" (p. 50) and, most significantly, an understanding of writing as "an act of discovery" (p. 53) which proceeds in a nonlinear fashion. How experienced, how sophisticated, were UT-Tyler's sophomores? The authors also wanted to begin to understand the extent to which Engineering students considered writing to be an act of learning, and not simply a means of transmitting data. Sommers and Saltz [16] have shown that student writers who learn the most throughout their college careers tend to "see in writing a larger purpose than fulfilling an assignment" (p.124): again, how would the sophomore cohort measure up? Finally, the authors wanted to understand the relevance of the sophomores' past writing experiences to their current writing practices.

When asked to describe the techniques they use to write in Engineering courses, students noted that they

(a) "use lots of graphs and data and explanations";
(b) "use a standard report guideline to complete papers and reports";
(c) "research, then write, then put in well-annotated paragraphs"; and
(d) "babble along in a sequential fashion and proofread later."

When students were asked to comment on the function of writing in Engineering courses, they claimed that:

(a) "Writing allows me to better understand and professionally present a report to inform others";
(b) "Writing allows an instructor to assess a student's comprehension of a subject or observation";
(c) "Writing leads to better perception of [course] materials," and
(d) "Writing explains the theories that prove the research."

Asked to comment on the role of past writing experiences on their current writing practices, six of nine students surveyed noted that various high school and college-level writing and literature courses were instrumental in providing them with key writing skills.

Discussion of written questionnaire

The sophomore cohort, in general, falls into the category of "less-experienced writers" as defined by Sommers. Students surveyed actually say very little about writing *per se*, taking writing as a given and noting several key *features* of their writing: the way it conforms to an outline; the fact that it includes tables, figures and graphs; the fact that it is research-intensive. While there is some attention given to process in these statements (especially in the comment about "babble" and proofreading), these statements show, as Sommers suggests, an unsophisticated understanding of the way writing really works. The process of preparing a draft for submission/publication is in fact highly recursive. "Details are added, dropped, substituted or reordered according to [experienced writers'] sense of what the essay needs for emphasis and proportion," she writes.[17]

However, in terms of how writing functions in Engineering courses, the student writers surveyed showed a pronounced awareness of how writing works within a given discipline—not only as a method of transmission, but a means of learning. There is some evidence, in effect, that the sophomores see in their writing a greater purpose than simply completing an assignment for a grade. The words "perceive," "understand," and "comprehend" crop up repeatedly: these students are writing to learn, writing their way into the discipline of Engineering. The authors suggest that this point marks the beginning of what may be "normal discourse" for these students, that is, "a conversation within a community of knowledgeable peers." [18] Of course, there are those responses that closely adhere to what the authors found in the freshman cohort of 2004-2005: an understanding of writing as a means of transmitting data. As these students note, writing enables us to "give an accurate and precise account of the experiment, and provide us with the training "in the technical writing we will be required to do as part of our careers." In oral interviews conducted in May 2005, freshmen emphasized "communication of ideas," "showing [research] findings," "expanding other people's knowledge based on what you know," and "explaining what you did and how you did it." None of these statements are untrue, just incomplete.

In terms of the relevance of past writing experiences to current writing practice, it should be noted that in seven of nine responses, the student writers surveyed mentioned either or both *frequency* of writing assignments and *feedback* provided by a combination of instructors and other students. This finding is very much in keeping with the bulk of writing center scholarship over the past twenty years, and perhaps best articulated by Harris, who notes that writers are best served when their teachers "respond [to their work] as an audience or reader, to identify problems the writer may be having, and to teach the writer strategies for moving through the writing process successfully."[19]

Students were also quick to point out the value of non-engineering courses to their development as writers. "Most English classes that I've had have best prepared me to write for my Engineering classes," wrote one sophomore. Yet in a move signaling this student's imminent immersion in an established discourse community, or "group of people likely to read and act on [a] created document," [20] he adds the following: "However, since engineering classes require more technical writing, I'd say it's the Engineering Methods class that has best prepared me."

Results and discussion of focus-group discussion

A focus-group discussion conducted in December 2005 focused on participants' writing processes and how they understood the role of writing in Engineering classes. This session was an opportunity for the authors to visit with study participants in person to follow up on any aspect of the study to date.

As per the findings above, participants noted a generally linear trajectory of writing process. "I start with my introduction, then the procedure, then the results, discussion and conclusion," one student noted. Two students claimed that they waited until the "last minute," even the due date of the writing assignment, to write. But students' understanding of the role of writing in engineering courses was considerably more sophisticated. One student noted that

> Writing cements my understanding of basic theory and practice. Even if you [sic] know what you did and how you did it, unless you explain it, you don't know it. We show what we learn [by writing], but [writing] is also a form of teaching, so someone else can learn. If you can explain it in writing, you can teach it.

Results of multiple-trait assessment of writing samples

Sophomore students from the EWI cohort were asked at the end of the fall semester of 2005 to provide writing samples from coursework which were evaluated according to the criteria immediately following Table 2. These included 11 written assignments from four EWI respondents. All assignments were evaluated independently from clean, unmarked copy by both Drs. Beams and Niiler. None of the assignments reviewed were from engineering courses taught by Dr. Beams; hence both evaluators were reading these works for the first time. Evaluation criteria were those listed previously:

- Organization;
- Content;
- Mechanics;
- Language;
- Tables, Figures and Graphs;
- Technical Merit.

Scores reported for the fall 2005 work are median scores in each category. Two scores (one for each reviewer) were reported for each criterion for the fall 2005 work, with the exception that Dr. Niiler did not evaluate Technical Merit since the principles involved were outside the scope of his core competencies. These data are summarized in Fig. 1 below. Also included for comparison purposes are the evaluations of spring 2005 work evaluated by engineering faculty member Dr. Beams.

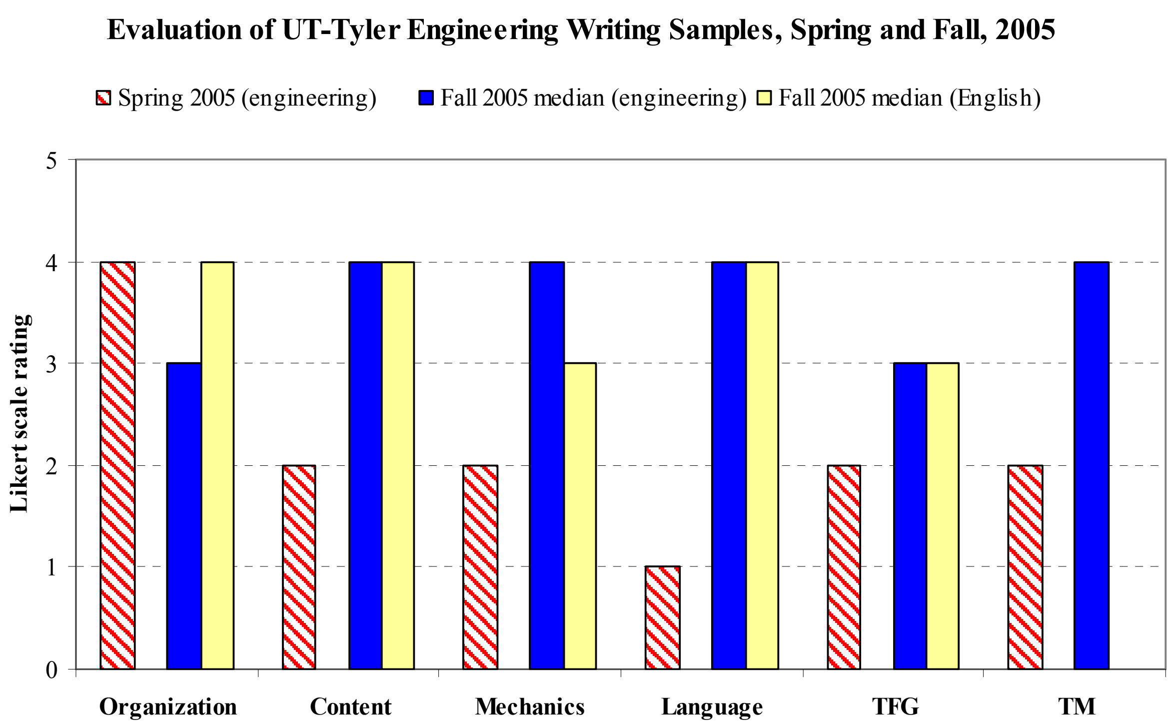

Fig. 1. Evaluation of engineering writing samples according to standardized evaluation criteria. Abbreviations “TFG” and “TM” denote “tables, figures, and graphs” and “technical merit,” respectively.

Drawing conclusions from Fig. 1 requires some degree of caution because of minor changes in experimental methodology that occurred between the evaluation of the writing samples for spring and fall of 2005. The first (and most obvious) is that evaluation of fall, 2005 writing samples involved two independent evaluators while the spring, 2005 evaluations were the work of one evaluator. The second dealt with the practices of scoring individual works vs. scoring the entire body of work as a whole. Writing samples for spring, 2005 were read *in toto* before evaluations were assigned to the body of work. Each writing sample from fall, 2005, however, was evaluated individually and the median scores in each category were computed for each evaluator. (This is the methodology that will be followed in the future). Despite this caveat, however, some observations may be drawn from Fig. 1:

- The faculty members' evaluations of the fall 2005 engineering writing were in reasonably good agreement, agreeing in 3 of 5 criteria and differing by 1 in the other two. (The correlation coefficient of the *averages* of each faculty member's ratings was 0.74).
- Improvement was noted in all categories except possibly Organization. The category showing the greatest improvement was Language. The frequency of colloquialisms noted among the 2005 samples had decreased markedly in the 2006 work, although they had by no means disappeared.
- The apparent consistency of Organization may be due to the use of standardized style guides by the engineering departments at UT-Tyler.
- The improvement in Technical Merit would be expected as students' technical knowledge expanded.

Among the more-prevalent problems of the fall 2005 writing samples were the following:

- Lack of narrative text introducing figures or graphs was found in 9 of the 11 writing samples.
- Problems with figures and graphs were found in 7 of the 11 samples. Most prevalent were cosmetic problems (e.g., use of fonts in tables or graph labels different from the font of report), but some were more substantive. For example, there were examples of misleading or incomplete figure titles (e.g., "Yield and Ultimate" and "Impact") and examples of graphs whose titles reversed the roles of the dependent and independent axes (e.g., "Mass vs. Readout" for a graph in which *mass* is the independent variable).
- Equations continued to be a source of problems. Six of the 11 reports included equations; variables were not properly identified in four of these six reports. This included instances in which units were omitted or given incorrectly (e.g., a variable representing density without units, or a variable representing force expressed in kg).
- Some reports showed inconsistency in number. Most of the texts were written in the third person, but occasional changes to the first person (and occasionally to the second person, with an attendant shift in mood from declarative to imperative) were seen. For example:
    - "For the testing of the calibrated center punch, equation (2) is also used. However, your variables are going to be different."
    - "Now the Charpy tester must be prepared. The first step is to load the pendulum. To do this, lift the pendulum up until it locks into place and the secure it with the safety latch."

- o "The materials that were being tested are illustrated in Figure 5…The first thing that my group did was to establish separate metals for each individual. James was to run all of the tests for soft steel, I was to run all of the tests for hard steel, Roy would run all of the tests for brass, leaving John to run all of the tests for aluminum."
- Awkward constructions and colloquialisms were observed in several reports:
    - o "…hard steel passed the test with very close to normal ratings while the piece of aluminum that was used wasn't very good at all and in fact left us with no presentable data."
    - o "After all of these tests were conducted, we headed back to the materials lab…"
    - o "The metals that were quenched were done so in peanut oil."
    - o "This experiment would have been more accurate if the specimens being used had no impurities, including: any spectacle (*sic*) of a substance such as pencil eraser or dirt and even the oils from our hands being present on the specimens and if each of the metals exact properties were known components."
    - o "The 8.8 was found to have done the best in the Charpy impact test to spite (*sic*) its average yield strength and below average hardness."
- There was a rather obvious lapse into subjectivism in one report: "Overall this was a rather interesting experiment which I learned quite a bit from and enjoyed very much."
- Some technical shortcomings were noted, but only one report contained a completely-false technical statement: "A linear variable differential transformer, LVDT, changes resistance with extension of the slider."

Despite this catalog of problems, however, the overall quality of this cohort's writing as sophomores is noticeably improved compared with its writing as freshmen where problems, particularly with regard to colloquialisms, were pervasive. Room for improvement, however, remains, as the average scores in each of the categories represents rather lukewarm agreement with the evaluation criteria previously outlined. It is hoped such improvement will be manifest when works from these students' junior years are evaluated.

Conclusions

Development of the writing skills of this cohort of engineering students is noted as they move from the freshman to sophomore year. The most notable findings may be summarized as follows:

- There is a tangible improvement of their writing skills, particularly in regard to the use of professional language, has been noted, although there is much room for improvement (particularly in regard to the use of tables, figures, and graphs).
- By virtue of *how students describe their own writing processes*, we can understand that all improvements aside, they are still "inexperienced" writers who tend to underestimate the complexity of writing tasks. This lack of experience is borne out through a close examination of student writing, which reveals that the problems members of the sophomore cohort have with their writing in Engineering courses are problems shared by other inexperienced writers in other disciplines. For example, while student writers across the disciplines as observed by Dr. Niiler in the UT-Tyler Writing Center are not required to employ *tables, figures and graphs* in their written work, they are required to

integrate and document secondary sources into their research papers. These students often place extended quoted material directly into the body of an essay with little to no regard for context. EWI student writers made the same error: assuming, like students outside the field working with secondary sources, that tables, figures and graphs would "speak for themselves." Problems with colloquial *language*, *errors of fact*, and *mechanics* are also shared across the disciplines.

- As shown in the Discussion of the Written Questionnaire section, above, Engineering students view as vital to their growth as writers frequent *opportunities to write* and frequent *feedback on their writing.*

However inexperienced, the sophomore EWI cohort has a heightened sense of the value of writing to the engineering curriculum. Despite moves that occasionally betray their inexperience (the eleventh-hour draft, for example), they see writing less as a documentary task and more as a valuable component of the learning process. They are becoming participants in what Norback, White, and others have termed "discourse communities," or groups of readers conversant within a specific professional field. As such, students—even at the sophomore level—should have ample opportunities for "situated learning" experiences within "high functional contexts." [20] Norback repeatedly stresses the need for students to be trained to write within specific discourse communities using workplace materials.[21] Further, given that students see writing courses outside the major as significant, relevant, and supportive of the craft of learning to write, these students should be encouraged—schedules permitting, of course—to take writing-intensive courses outside the major.

As data from the 2005-2006 academic year continue to be gathered and analyzed, the authors will conduct additional interviews, assess more writing samples, and lead more focus-group discussions. The authors would like to account for the documented improvements in student writing, in addition to considering more concrete means of addressing the quality of writing instruction in Engineering classes.

Bibliography

1. Ostheimer, Martha W., and Edward .M. White. "Portfolio assessment in an American Engineering College." *Assessing Writing*, v 10 (2005): 62.
2. Norback, Judith Shaul, and Jill R. Hardin. "Integrating Workforce Communication Into Senior Design Tutorial." *IEEE Transactions on Professional Communication,* v 48 n 4 (December 2005): 413-426.
3. Norback, Judith Shaul; Lisa D. McNair; Michael J. Laughter; Garlie A. Forehand; and Beverly Sutley-Fish. "Teaching Workplace Communication in Industrial and Technical Engineering." *Proceedings of the 2004 American Society for Engineering Education Annual Conference and Exposition*, June 2004.
4. Norback, Judith Shaul; Joel S. Sokol; Garlie A. Forehand; and Beverly Sutley-Fish. "Using a Communication Lab to Integrate Workplace Communication into Senior Design." *Proceedings of the 2004 American Society for Engineering Education Annual Conference and Exposition*, June 2004.
5. Norback, Judith Shaul; Garlie A. Forehand; Stephanie A. Jernigan; and Alexander B. Quinn. "Teaching Workplace Communication in Senior Design." *Proceedings of the 2002 American Society for Engineering Education Annual Conference and Exposition*, June 2002.

6. Bonk, Robert J.; Imhoff, Paul T.; and Cheng, Alexander H.-D. "Integrating Written Communication within the Engineering Curricula." *Journal of Professional Issues in Engineering Education and Practice* (October 2002); 152-159.
7. Ostheimer and White, 72.
8. Forsyth, Patrick. "Writing to inform—and impress." *IEE Engineering Management* (August/September 2004): 40-41.
9. Norback, Judith Shaul, and Jill R. Hardin. "Integrating Workforce Communication Into Senior Design Tutorial": 413.
10. D. M. Beams and Lucas P. Niiler, *Improving Technical Writing through Published Standards: The University of Texas at Tyler Electrical Engineering Laboratory Style Guide.* Proceedings of the 2004 Annual Conference of the American Society for Engineering Education, Salt Lake City, UT, June 20–23, 2004.

11. Beams, David M., and Lucas P. Niiler. "Preliminary Findings of the Engineering Writing Initiative at the University of Texas at Tyler: A Longitudinal Study of How Engineering Students Learn to Write." Proceedings of the 2005 Annual Conference of the American Society for Engineering Education, Portland, OR, June 12–15, 2005.
12. Ostheimer and White, 65-66.
13. Flateby, Teresa L. "Maximizing Campus Responsibility for the Writing Assessment Process." *About Campus* (January-February 2005): 23-24.
14. Sternglass, Marilyn S. *Time to Know Them: A Longitudinal Study of Writing and Learning at the College Level*. Mahwah, NJ: Lawrence Erlbaum Associates, 1997.
15. Sommers, Nancy. "Revision Strategies of Student Writers and Experienced Adult Writers." *College Composition and Communication* v31 n4 (December 1980): 378-88. Rpt. in *Cross-Talk in Comp Theory: A Reader.* Ed. Victor Villanueva, Jr. Urbana, IL: NCTE Press, 1997. 43-54.
16. Sommers, Nancy, and Laura Saltz. "The Novice as Expert: Writing the Freshman Year." *College Composition and Communication* v56 n1 (September 2004). 124-149.
17. Sommers, Nancy. "Revision Strategies of Student Writers and Experienced Adult Writers," 124.
18. Bruffee, Kenneth A. "Collaborative Learning and the Conversation of Mankind." *College English* v46 n7 (November 1984): 635-52. Rpt. in *Cross-Talk in Comp Theory: A Reader.* Ed. Victor Villanueva, Jr. Urbana, IL: NCTE Press, 1997. 393-414.
19. Harris, Muriel. *Teaching One-to-One: The Writing Conference.* Urbana, IL: NCTE Press, 1986.
20, 21. Norback, Judith Shaul, and Jill R. Hardin. "Integrating Workforce Communication Into Senior Design Tutorial," 414.