

A Systemic Approach to Integrating Technical Writing in the Curriculum

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Abstract

This paper presents an approach to writing education recently implemented in the Engineering Technology Department at the University of Dayton. The approach began with an overall curricular review. One of the department's concerns was employers' reports that many graduates lacked sufficient technical writing expertise. The department generally agreed that requiring a separate technical writing course and then technical reports in a few courses simply did not meet the expectations of employers. This led to a new approach to integrate writing exercises and evaluation throughout the curriculum. One basic premise from the outset was that writing cannot be limited to a few courses, but requires a thoughtful integration over a student's entire education in Engineering Technology. Blending writing formats with each course was achieved by a constructing a matrix with courses on one axis and forms of writing on the other. The matrix ensures that students will develop the writing abilities desired by the base of employers during their tenure in the department.

Background

In 1998 the University of Dayton Department of Engineering Technology was re-evaluating and re-structuring the entire curriculum. Several environmental changes drove this need including a reorganization of faculty and a drop in enrollment. The department chose to focus its offerings on engineering technology courses alone. For instance, mathematics had always been taught by a member of the department faculty, but since the two math faculty had been moved to the Department of Mathematics, the faculty adopted university math courses to fulfill these requirements. Also the chemistry course for Engineering Technology students had always been taught by chemical and environmental engineering technology faculty. Since those programs were discontinued, students would now take university courses from the chemistry department. As these changes took effect, department faculty only taught the department courses. Thus it became apparent that the department needed to look for a university course to replace the technical writing course as well.

Technical writing had been a two-credit-hour course in the curriculum for decades. It was a highly-valued course that served students well. Writing can be a weakness in graduates from many programs, and this course addressed many of the skills required of engineering technology students. The department used this course to teach the discipline-specific writing issues that are not covered in English composition and other general education courses. While the Engineering Technology curriculum required technical reports in other courses, this course specifically addressed writing as its focus. It covered such topics as abstracts, lab reports, proposals, instructions, memos, letters, descriptions, resumes, and other typical engineering writing

applications. Qualified part-time faculty had taught the course for at least the last 15 years. These instructors were handpicked by the department because they understood the focus of the course and the needs of students.

As the department met several times to discuss all the changes to the curriculum, altering the technical writing requirement was a controversial issue. Environmental factors made it clear that there would be a change away from Engineering Technology faculty teaching “English” just as it would no longer teach math or chemistry. One ‘natural’ alternative was to adopt an English course that addressed writing in addition to the two English composition course already required in the general curriculum. Another option would be to just drop the requirement from the program. Neither of these alternatives met with great reception from the department’s faculty. It was felt that a university English course would not address the particular skill set desired by employers, yet dropping the course would result in the loss of a critical component that helped to make so many of the department alumni successful.

Other engineering schools have addressed this need for good writing in the classroom. In the last few years, the profession has thoroughly examined the issue of technical writing in engineering education. Some articles present and articulate a genre approach. Others present a concept that links with personnel in the English department to help with both writing instruction and grading papers. Some have developed programs that use writing centers. While these approaches offer many advantages, the department faculty sought better solutions.

Development of a new approach

The department’s discussions of technical writing instruction led to thoughts about developing a new approach to writing in engineering. The goal was to graduate students with the writing abilities that they needed. Perhaps all of their education did not need to be contained in a 15-week, three-credit-hour format. The university had a few years of experience with “Writing Across the Curriculum,” an approach that embraces the concept of “connected learning” where a skill is developed and reinforced over a longer period of time with respect to other elements of a student’s education. Championed by a professor in the English department, the effort resulted in a thoughtful plan to implement writing as a focus throughout the total general education experience. In fact the College of Arts and Sciences had already implemented it. Perhaps the school of Engineering could apply these concepts.

“Writing in the Discipline” is an extension of this approach. Recognizing that each discipline has specific needs, “Writing in the Discipline” supports a deliberate, systematic plan to address the needs of a particular discipline. Clearly Engineering Technology graduates will assume careers with different writing demands, styles, and formats than graduates in criminal justice or education. Thus, using a “Writing in the Discipline” plan, student writing would be integrated into each course and be evaluated both for the content and writing style common to the particular discipline.

Formulating the matrix approach

The department decided that this integrated approach to writing would help the focus on writing for each course. It would also allow the student time and the necessary iterations to truly internalize the skills needed for writing the various formats in their undergraduate engineering

courses. The approach implemented was to develop a matrix to ensure coverage and integration of selected writing formats.

The matrix in *Figure 1* shows sample courses in the Mechanical Engineering Technology program in columns. The key writing elements that the faculty deems necessary are in rows. Using this matrix assures that students will experience writing assignments in courses throughout the curriculum. The writing elements shown on the matrix are a part of the syllabi for the courses listed and are included in the course regardless of the instructor.

Plan for Technical Writing in the Discipline													
	First Year Seminar	Technical Drawing & CAD	Computer Graphics Lab	Statics & Dynamics	Strength of Materials	Fluid Mechanics	Design-Machine Elements	Mechanical Measurements	Thermodynamics	Senior Project	Materials & Processes Lab	Senior Seminar	Form Totals
Memo- Design proposal		1	1		1	1	1			1			6
Memo- request for information										1			1
Thank you letter										1		1	1
Letter of transmittal							4			1			5
Lab result summary								3			1		4
Project Specifications			1	1			1			1			3
Laboratory report								3			2		5
Design Report			1		1	1	1			1			5
Emails- short	4	2	2										8
Technical description	2		6					1					9
Cover letter for resume												1	1
Resume	1											1	2
Annotated problem solving				4	4	4	8		4				16
Class totals	7	2	10	5	6	6	14	7	4	6	3	3	

Figure 1 – Sample Technical Writing Matrix for Discipline

Implementation issues and methods

As with any broad initiative, the first step to successful implementation is achieving commitment or, at least, consensus. It is not easy to suggest cutting any course from a curriculum. Resistance to this change is natural and needs to be anticipated. In this case, resistance from faculty members and resistance from the department's Industrial Advisory Committee were both present. The questions are obvious. "How, in times when communication and writing skills of graduates get so much attention, could we even consider cutting the technical writing course?" "What if professors can't teach writing?" One bonus during this process that helped push through the matrix concept was the fact that some change had to be made – the department could not continue to teach a writing course with department faculty. When status quo is not an option, a group has to move toward the selection of alternatives. This integrated approach became that selection.

The Engineering Technology Department at the University of Dayton chose the matrix approach as the key to instituting a deliberate plan to integrate writing in the curriculum. After faculty thoughtfully developed the matrix and included specific writing assignments for each course, the syllabi for each course had to change to outline the specific writing skills for student assignments. A systemic change is one that must be implemented regardless of instructor or semester. It would be very easy to say that these changes had taken place and then to let them fall away over time. Placing the format and requirement in the class syllabus gives faculty guidelines for implementing the writing assignments.

Web-based tool

Another key element to any broad change is providing support resources to allow full implementation and relieve anxiety on the part of faculty. The need for common resources for this integral approach was addressed through the use of the Internet and web-based tools. One major component of the program is a web-based resource developed in-house to provide a common tool that is available to faculty and students. The web site was developed by the technical writing instructor and is available to everyone at <http://www.engr.udayton.edu/special/writing>. The site is easily accessible from a link on the home page of the School of Engineering. It includes examples and annotations for each of the possible writing formats. The resources on the web include department-specific formats and preferences, and also more general resources with links to sites of great help to writers. Each writing format contains three pages, and a sample is shown in *Figure 2*. The elements of for each format contain:

- An overview of the basic elements of the writing
- An annotated example with engineering content
- A troubleshooting checklist that includes text design, content, and grammar considerations.

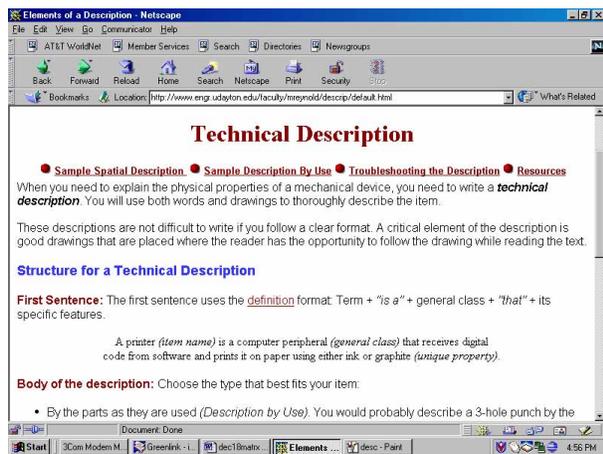


Figure 2. Sample page from the website

The web pages are a resource for both students and faculty. Additional help is provided for faculty in the evaluation section with suggestions for evaluating each of the writing formats. The evaluation criteria address such issues as grammar, readability, text design, content, and structure. The writing web site is also dynamic and easy to update. Web pages can be changed immediately as professors add materials or requirements to papers. It can also adjust to course or department changes in the matrix and even display several versions of the same format as different instructors develop their objectives for an assignment. Developing the web-based tool forced discussions about what the department faculty look for in reports and what formats are considered the best for presenting what students have learned.

The web page is also a handy tool for computer savvy students who are comfortable using the Internet as a reference base. The University of Dayton requires every student to buy a computer and have common software. All student housing is connected to the university computers and the Internet. The engineering computer labs are also loaded with current software and have high-speed Internet connections. Thus students can access the web page whether on campus or from their residences. In addition to the pages on each writing format, the web site also provides links to many other Internet sources for grammar help and links to technical writing pages at other universities. One goal when creating the page was not to recreate what already existed on-line. Students enrolled in Engineering Technology also take an "intro to computers" course that introduces the web site and incorporates some of the writing formats in assignments. The groundwork is in place so that students and faculty can easily transition into a web-based, writing support system.

Additional writing experience and support

The University of Dayton has a strong general education program. Students in Engineering Technology take two English composition courses, two history courses, four philosophy or religion courses, a social science and an arts study. This strong base of courses offers the student a tremendous opportunity to write and have writing evaluated. Writing in these courses is taken seriously, and students are able to further develop their ability to present ideas, express thoughts, compare and contrast concepts, and to persuade others. This general education is essential to the baccalaureate graduate, but it is not sufficient for the graduate from a School of Engineering.

At the university level, steps have been taken to thoughtfully implement writing developed throughout the four-year experience. In *Writing Across the Curriculum*, the university has identified writing evaluation as a thread that must be woven through the general education experience in some connected way. This experience and the fact that this effort had already met with success, offered a great foundation and additional resources for this new, departmental effort.

Support offered to faculty from the *Writing Across the Curriculum* coordinator includes training sessions for professors interested in incorporating good writing in their programs. These programs can be delivered as a formal semester-long course or as mini-courses or seminars throughout the semester. The technical writing instructor for the department will also offer sessions to faculty on how to adjust assignments and assessments toward a focus on writing.

Advantages to the matrix approach

When faculty members incorporate writing into their courses, the students get the message that writing is important and is part of what an engineer does to be successful. If each course requires a writing format in at least one major assignment and also good writing in all correspondence between the student and professor, student writing will improve. The faculty will also gain confidence in evaluating student work with a writing component added to the final grade. Since faculty members successfully completed their own engineering education with good writing skills, they will quickly find competence in teaching and evaluating good writing content.

Another advantage to the matrix approach is that the content of a writing assignment is coming from a topical area a student is familiar with and understands because of the course content. It is not a “made-up” assignment as it would be in a single technical writing course. The student will have the necessary vocabulary and understanding of the subject to write clearly and with an understanding of the need to write the paper. Papers will not be written just for a grade on a topic that may not be of particular interest.

Often the writing experience enhances the learning as students focus on the paper content and the resulting conclusion. This exercise in developing a topic and expanding it to cover what was learned often leads to a more in-depth understanding of the processes and practices of good engineering. These exercises in writing also require a discipline that helps the student get organized and present material within a structure that focuses on the reader who needs to know what was learned. This contrasts to a writing teacher who is not the typical reader of engineering writing. Providing real-world writing situations with readers who are knowledgeable about the field creates a more realistic writing environment than a stand-alone writing course is able to offer.

This approach is strongly preferred over the dual-graded model presented in much of the work on this topic. It is a mistake to try to send a message to students about the importance of all graduates to be skilled writers, and then to send the opposite message by having an outside person evaluate writing. All department faculty are presumably successful graduates. Why, then, would the faculty not be competent enough in the field of technical writing to evaluate student work with this regard? It is the faculty’s responsibility to take technical writing seriously if the students are to do the same.

Limitations of the matrix approach

The problem of how to make graduates become good communicators is not easily solved. The matrix approach is one potential solution, but it is not without its limitations.

One issue that can be raised is that of expertise. As just discussed, department faculty will evaluate writing. Certainly the person dedicated to the field of English and technical writing is more qualified to evaluate writing. While this consideration is a valid one, the authors feel that the true integration is much more valuable than this alternative and its implicit mixed message.

An additional limitation is that of course planning. It is difficult to fully address the topics needed to be covered in technical courses. To now include writing in those courses further burdens the instructor and students who will have difficulty covering the requisite topics. While this is also a valid point, the additional load should not be appreciable, and the results of years of not integrating writing are apparent in the feedback of employers, graduate schools, and graduates.

Another limitation is that some faculty members may not follow through with the writing assignment designated for their course. For the reasons discussed above and others, this attempt to integrate, may actually lead to a complete dropping of the material. There is little risk of this when an entire course is dedicated to the topic.

Additionally, change itself is a barrier to adoption. If faculty are not consulted about the type of writing that could fit into the curriculum, they won't feel a buy-in to the new approach. Most people resist change when handed a mandate instead of being asked for input.

Conclusions

Incorporating the matrix approach into the engineering curriculum begins the logical path to better student writing. This method keeps writing as an integral part of each course and is part of what is taught and evaluated. Students gain writing experiences in each course and professors become more comfortable with both the teaching of writing and using it as a natural part of the course content. Having the web page resource also supports the matrix approach for writing engineering formats. With the addition of some faculty training focused on positive attitudes toward writing as one of the engineering skills, the program will benefit students and their eventual employers. After establishing the matrix approach, the department will begin to assess whether employers find that graduates are ready to leave the university and begin careers with the ability to communicate professionally with their peers.

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