Revisiting Writing Across the Curriculum:
Overcoming Faculty Reluctance to Integrating Writing into the Engineering Curriculum

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ABSTRACT

While Writing Across the Curriculum as a movement on US college campuses dates back to the mid-1970s, sustainable implementation of WAC principles in STEM classrooms has been elusive. STEM tend to cite two reasons for not incorporating more writing into their courses: 1) They believe they lack the expertise to provide effective feedback on student writing; and 2) they are rewarded more for their research efforts than pedagogy, so they focus much of their time on research activities. Recognizing, however, that their students often lack solid technical writing skills, STEM faculty are often open to incorporating more writing into their courses if they have the assistance of someone they perceive as an "expert" in writing. This paper focuses on such an approach taken in a mechanical engineering department at a small Midwestern engineering school, whereby faculty members worked with the department's designated technical communications advisor, who assessed the writing and provided feedback, to develop relevant assignments that not only allowed students to practice their writing but also enhance their learning of the material presented in a mechanical vibrations class. While students initially expressed reluctance, they understood the need for the extra work and urged the department to continue the experiment. The faculty also appreciated having another tool to assess student learning and engagement with the material. The teaching team concluded that this approach was effective, but resource-intensive, requiring the department to maintain a designated "expert" to assist faculty seeking to provide writing instruction in their courses.

Introduction

I am the technical communications advisor and Senior Design Administrative Associate for the Mechanical Engineering-Engineering Mechanics Department at Michigan Technological University. You got all that? Yes, at Michigan Tech, we relish the long and complicated version,

whether it be job or department titles or, in our case today, the path that Writing Across the Curriculum has taken on our campus and in our department. I thought it important to point out that I am a university staff member rather than faculty because my position provides the department with a bit more flexibility than if my primary role was to lead a class day-to-day. It does, however, also present some interesting challenges when it comes to sustaining pedagogical innovations such as WAC, or its offspring Writing in the Disciplines, which more accurately describes my work.

My interest in WAC/WID began about four years ago when our Senior Design Program advisors decided the department needed to address deficiencies in student writing. Our two-semester Senior Design Program is led by a faculty director with a group of eight faculty advisors, who oversea about five teams per academic year, and one technical communications advisor, myself, who meets with all thirty-plus teams. The advisors discussed ways to add technical writing opportunities in second and third-year core ME courses. Around this time, I also began work on a master's degree in rhetoric and technical communication and quickly realized that what we were discussing was highly reminiscent of the WAC movement, which itself was heavily influenced by a small group of MTU faculty, especially Toby Fulwiler and Art Young, two pioneers in the field. Now, it's important to note that WAC momentum fizzed out on our campus around 1991 when external funding ended and administrative priorities changed after both Fulwiler and Young left the university.

So what follows is a description of the re-emergence of a WID-based approach to improving our undergraduate students' communication skills via several classes, with a particular focus on the efforts to get, and keep, faculty engaged in those efforts. I'll conclude with the future direction these efforts might take and some general thoughts on issues that are perhaps unique to a small STEM-focused university with shrinking resources for undergraduate education.

The Problem and One Possible Solution

Dorothy Winsor, in her book *Writing Like an Engineer*, discusses the myth, widely held by students and faculty alike, that engineers cannot write. She and countless other researchers over the past two decades have proven that engineers can indeed write, that what they lack is not ability but the opportunity to practice communicating in their chosen professional discourse community early in their academic careers. As David Russell states in *Writing in the Academic Disciplines*, what faculty consider poor writing is often the work of a student struggling to develop skills in that particular rhetorical community. That student is attempting to learn and use the terminology and persuasive modes correctly, with little or no formal rhetorical instruction from the faculty (17). This issue of rhetorical expertise, while not explicitly discussed by the Senior Design Program Advisors, was nonetheless their main concern. While they complained about poor grammar, punctuation, and sentence structure, they were most concerned that too many students graduating with a BSME did not "write like engineers."

Typical criticisms included an inability to:

- Properly cite references and, in many cases, to understand the purpose of references.

- Format a large document using Word including pages numbers, tables of contents, proper structure of tables and figures, and use of graphics standard to engineering practice.

- Differentiate between various audiences for types of technical documents and tailor documents to the task, i.e. lab reports to document experiments versus project proposals to present plans to sponsors (ME-EM Senior Design Topical Advisor meetings Academic Year 2008).

- And finally, to effectively use technical terms, instead using imprecise language (qualitative terms such as "a few," "many" or "some" rather than quantitative terms used to describe numeric results), lengthy sentences that confused the reader, and

paragraphs or even entire sections that presented no real information. This last was especially disconcerting when the advisor <u>knew</u> the team had solid information to report.

We all realized that while we were providing a fair amount of guidance in Senior Design, it was too late to really benefit the students. That guidance had to begin earlier. In Fall 2009, we implemented an additional engineering design course required in the third-year as a prerequisite to Senior Design. This course placed strong emphasis on audience analysis; but, after just one semester it became apparent that more effort was needed to acclimate students to writing as engineers. I described the concept of Writing Across the Curriculum to the advisory team and quickly found a volunteer willing to give it a try if I evaluated the writing assignments for his double section of Mechanical Vibrations of about 80 students in the Spring 2010 semester. Course instructor Dr. James De Clerck developed the nature of the five assignments and reviewed each student's work but left the actual grading to me. The assignments were spaced two to three weeks apart during a 14-week semester and were worth 20 points each, with the intent they would involve more expressive writing, as defined by Britton, as opposed to the purely transactional writing of design and lab reports. The first assignment was to discuss what they remembered from their courses in linear algebra and differential equations and how they would apply their knowledge in this course. The next three assignments were responses to articles related either to the field of vibrations or engineering in general. The fifth assignment was to incorporate my feedback into their pieces (to show they had indeed taken note of the feedback) and to write a paragraph or two relating their thoughts about the pilot program and indicating whether it should be continued in future sections of Mechanical Vibrations.

Grading was broken into two parts – ten points for grammar, punctuation, and style and ten points for content. This format was selected based on input from faculty and industry via the department's External Advisory Board, which indicated that students graduating from the

program should be able to write documents in standard American English and be able to read, interpret, and reflect upon technical articles.   Because Mechanical Vibrations is required of all MEEM majors and is generally considered one of the more challenging by students and faculty alike, the points structure was kept small enough to have a positive impact on the grade (half a letter grade) but not negatively impact the grade if the student struggled. The lowest grade on any single assignment was fourteen points out of twenty. Most grades fell in the range of sixteen to eighteen points, with several students regularly earning nineteen and twenty points. Those who chose not to do any of the assignments, however, (and there were a few) saw their grades reduced by half a letter grade.

The most interesting part of the project was not the graded results; rather it was the feedback from the students which ranged from extreme dislike to enjoyment. What came as a surprise to both Dr. De Clerck and myself was that the majority of students indicated that while they may not have liked the articles themselves or the extra work involved in an already difficult course, they believed the program should be continued because they felt they had not received enough writing instruction in their previous courses.

Since this was our first foray into WID, we made some mistakes that we have since addressed. First, students received no guidance in terms of expectations other than, *"Write and submit your response to questions and articles provided. Responses should be based on your thoughts and opinions supported by outside references."* For many students, some articles were simply too technical for them to understand so they had a tough time formulating what faculty might deem a knowledgeable response. Second, the assignments were formulaic in that they simply required students to read the articles and respond rather than do any analysis or critique of the information presented – "critical thinking." Additionally, assessing the value of the exercise was difficult in the sense that we had no concrete goals other than the vague notion of "improving student writing." In two subsequent semesters, we have revised the selection of articles to include less technical surveys of the field of mechanical engineering. We have also

created more precise questions to help students jump-start the critical-thinking process and develop a more in-depth understanding of the material they are reading. Additionally, we now provide more instructional guidance at the beginning so students have a better idea of what we are trying to achieve.

The most important success, though, has come in the form of other faculty, whom I call "early adapters" who, once they heard about our experiment and the results, have wanted to do something similar in their classes – *as long as I would be the one doing the evaluating*. For example, one emeritus faculty who returns to campus each fall to teach a few classes was interested in continuing this model for his sections of Mechanical Vibrations. Unfortunately, due to a shift in human resources, I was not able to assist him, and he did not feel comfortable taking on the task of selecting articles and grading the results on his own.

However, another faculty member, when informed about our experiment in Mechanical Vibrations, was enthusiastic and developed his own semester-long project for the Spring 2011 semester of Dynamic Systems and Controls, a fourth-year course. The project incorporated several short written reports that required students to apply their newly-developed knowledge of systems and controls to a real-world problem, in this case finding ways for the state of Hawaii to address the high cost of fossil fuel use, largely due to its isolation. Again, I evaluated the written portion of the projects. Following completion of the semester, Dr. Parker expressed disappointment in the quality of student work, both in terms of the proposed solutions and overall readability. He was concerned that students did not put enough thought into the project, which he had intended to be a fun way to apply the concepts they were learning in class.

This past spring, a third faculty member asked that I help him develop a brief literature review assignment for his senior elective course Introduction to Internal Combustion Engines. About a third of the class was made up of graduate students or seniors who intended to go to grad school. He selected the list of about twelve topics related to lessons discussed in class that the students could research while I wrote the actual assignment description. Using at least

three credible sources, the students were asked to summarize, evaluate, and compare and contrast those sources. The students turned in a draft to me mid-semester. I then evaluated the drafts based on structure and content and provided feedback on their writing and then, at the end of the semester, students turned in a final version of the paper and the original that I reviewed to Dr. Miers for his evaluation of the technical merits of the paper and whether they incorporated my feedback.

Dr. Miers found that, in general, the students did a good job of incorporating my feedback and developing much more focused and relevant papers when forced to go through the revision process. He was also surprised at the higher scores on the final exam, although it's not clear if this increase is a result of the literature review assignment or some other factor since this is only the second time Dr. Miers has taught the class.

Continued Resistance and Other Issues

After listening to all this you might be thinking, "this isn't WAC, at least not as was originally envisioned." You're right. What we are doing in the MEEM does not follow the typical WAC model that David Russell describes:

> (f)aculty development workshops, a faculty-wide supervisory committee, a writing lab with a writing specialist as coordinator, student tutors, department responsibility for students' writing proficiency, a system of student writing portfolios, and external funding (Writing in the Academic Disciplines, 283).

Michigan Tech is a very different school in 2012 than it was when WAC was first introduced to our campus. Now, our faculty are under tremendous pressure to conduct relevant, lucrative research. While teaching is certainly still important, anything that takes time away from research, such as WAC seminars, grading the papers of 40 to 80 students, and then assessing the value of such efforts would be resisted. Instead, most faculty in my department, many of whom are highly-respected in their fields of research are still so uncomfortable with the thought of teaching writing that they are willing to relinquish that role to a staff member with a master's

degree and a strong publication history in fiction and non-fiction, but not engineering. Based on comments made during committee meetings, faculty would still rather see an ME class focusing on technical writing as it pertains directly to the field. While you've just heard about three professors who have incorporated more writing into their lesson plans, I should add that all of them are native English speakers who have published a great deal in their respective fields of research, yet they rely on my help for evaluating their students' writing.

So, yes, we have taken a back-door approach. The department provides a staff resource to help faculty achieve program learning outcomes in fields outside their comfort zone. Obviously, one issue with this model is the lack of departmental financial and human resources. I am, after all, just one person, assigned to work with nearly 1,100 undergraduate students, 300 graduate students, and 45 faculty.

Because of those limitations, part of my job is to use all of the tools I have at my disposal to help undergraduate students become more effective writers. I've worked with our university's Multiliteracies Center to develop more concise assignments in our classes. I've also brought in outside guest lecturers including a Humanities instructor to talk about communicating across cultures as we have a sizeable undergraduate international population, mostly from China. And, lastly, I am working with our three lab course coordinators to develop a training program for the lab GTAs, many of whom are international students, so they can evaluate the clarity of writing in student lab reports more effectively. This project is generating a lot of excitement in the department because the lab reports are the students' first experiences with technical writing and, therefore, provide a great learning opportunity – if they receive consistent, effective feedback on their writing.

Opportunities for Further Research

As we go forward, there are two areas that could use more research, both within my department and, I believe, in the WAC/WID movement in general.

First, considering American universities' more aggressive recruitment of international undergraduate students, particularly from China and India (Fischer 2009), it would be interesting to explore WID as it pertains to students for whom English is a Second Language. For example:

1. Does WID help ESL students improve their English language skills (as opposed to those ESL students not participating in WID programs)?
2. What methods of writing assessment best reflect ESL students' knowledge base in the American classroom?

Second, we still do not have any clearly defined goals beyond "improving student technical writing, mainly because we do not have an effective means of assessment. We rely too much on anecdotal evidence for assessment because we do not have effective quantitative or even qualitative tools. Currently, we send surveys to employers of our co-operative education students, seeking assessment of the student's abilities in a variety of areas including technical communication. We also survey graduates three to five years after they complete their BSME work, asking how well they think the MEEM curriculum prepared them based on ABET guidelines. It's too soon for the graduates survey to show results, but the co-op employer survey continues to show that students need more instruction in technical communication in their first and second-year courses. While the surveys have their place, we need an effective tool to assess student technical writing abilities in the first year and then again in the fourth-year as they near completion of their capstone projects.

Conclusion

Today I've shown one alternative to the traditional WAC model and some of its challenges. Perhaps one theme that runs through this effort to reinstate some type of WAC/WID program within the MEEM is collaboration. As a staff member with a non-technical background, I have been able to build bridges between MTU's Humanities Department and my department,

adapting composition theory to the needs of the engineering curriculum. I have also been able to bring together faculty from different fields within our department and engage them in discussions on their role as mentors to undergraduate engineering students, making transparent the rhetorical aspects of the mechanical engineering discourse community, as opposed to just being teachers of engineering theory and principles. While nothing we are doing is particularly innovative, concepts such as rhetorical analysis and formal revision are new to the ME-EM curriculum, and, anecdotally, are helping students develop a more thorough understanding of what it means to "write like an engineer."

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