Coordinating Concepts in Engineering Communication and Project Management

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CE 4101 Project Management and Economics is a writing-intensive[1] course offered by the Civil Engineering Department at the University of Minnesota to approximately 150 students each semester. Students who take the course are introduced to project management concepts, heuristics, and algorithms and are asked to rehearse and apply them both individually and in teams. At the same time, these students are asked to seek out encounters with workplace professionals in an interview assignment and to prepare two persuasive documents common in the engineering workplace: a (problem-solution) memo and a proposal.

Sections of the course are planned and taught by a team of project management faculty and writing consultants. The writing consultants give a series of thirty-minute modular lectures five to six times over the course of the semester on process-focused rhetorical writing strategies and hold office hours where they are available to answer questions that students have about writing assignments. Student writing assignments are evaluated by writing consultants and are returned, often with extensive feedback. All of the writing assignments are pass/fail, and many students are required to revise assignments in order to receive a passing grade.

In its current format, CE 4101 fulfills several of the more challenging ABET 2000 criteria [1], including: criterion d, "an ability to function on multi-disciplinary teams"[2] and criterion g, "an ability to communicate effectively" as well as qualifying the course for writing intensive status at the university (as mentioned).More importantly, perhaps, CE 4101 introduces various types of engineering students to a rhetorically-situated and process-based approach to organizational writing and, notably, gets students to recognize the importance of such a skill by situation within and association with the discipline and by instructional teaming. These aspects of the instruction are detailed in the rest of this paper.

Process-based approach to writing

There are a variety structures in the pedagogies of technical communication, rhetoric, and composition for constructing persuasive technical documents. The lectures and assignments in CE 4101 are based on the analysis of the following rhetorically-situated points: [3]

[1] Rather than taking an upper division writing course, students at the University of Minnesota are required to accumulate a certain number of writing intensive credits by completing service or disciplinary courses so denoted.
[2] Housed in the Civil Engineering department, CE 4101 attracts a number of students from other engineering disciplines, partly because of the demand for the topic and partly because of the writing intensive designator. Many of the workgroups, therefore, are multidisciplinary.
[3] A number of the schemes in this section are derived from or influenced by Mathes and Stevenson's *Designing Technical Reports: Writing for Audiences in Organizations* [2].

- **Audience**: Who are all the people who will read your document?
- **Purpose:** Why are you writing? What do you need to tell them? Why are they reading? What information do they need from you?
- **Action:** What action do you want them to take?

If asked, engineering students, especially those who have not spent appreciable time in the workplace, typically give rather simplistic answers to the questions above. They name one or two rather general audiences (the client or administrators in New Hanover County) or one or two specific people (my boss or my project manager). They also tend to derive a generic purpose (to inform the audience of a problem or to get the audience to act).Real-world engineering documents, however, typically have a wide variety of audiences (of varying organizational situations) to whom engineers are communicating for a variety of purposes. Each of the audiences, likewise, is often being asked to take several actions.

The writing component of the course, therefore, introduces students to a systematic method for attaining a richer and more realistic description of audience, purpose, and action: students are asked to investigate their problem the way they would any other engineering problem, by carefully considering their problem in the light of several relevant questions, collecting and organizing data, and then using the interpretation of that data to inform and construct a solution.

For the sake of expediency, students are given some relevant questions as a base:[4]

1. What is the organizational context that you will be writing from? (Feel free to use internship experiences, or interview people who are working in your field to find an appropriate context, and describe it here.)
2. What is the purpose of this memo? How should this memo affect the organization if it is successful?
3. Who will be the reader(s) of this memo? What do they know about the problem? What will they gain from the problem being solved?
4. What action(s) do you expect your readers to take as a result of reading this memo? For the purposes of this class, understanding a problem differently can be considered an action.
5. What do your readers need to know in order to want to take those actions?

Through lectures and feedback, the students are coached to appropriately collect and construct answers to each of these questions. Then they are asked to use their answers to these questions to their memos and proposals.[5] The exercise is helpful to students who are not accustomed to considering, in depth, their audiences, purposes, and actions; the challenge is to help students see the value of this information which will be included in an indirect manner, and not be used word for word within the memo itself.

To help students actually use their prewriting data in the construction of their memos and proposals, the genre structure and informative components of problem-solving memos and proposals are discussed. For the problem-solution memo, for example, the structure of a

[4] In future semesters, we plan to try in class exercises where students are guided to derive questions like these.
[5] For an illustrative analysis of how two representative students responded to these questions see section 4 of [3].

problem-solution memo is discussed (the document is short, containing mostly description of the problem, etc.) and the following informative components are discussed at length:

- Problem/Purpose statement
  - What is the problem?
- Context of the problem
  - Links the issue to people
  - How do the facts affect people?
- Scope of the problem
  - To what extent does this affect people?
- Justification for the problem
  - Why is it a problem?
  - Why should it be solved now?
  - Why is it compelling (cost/benefit)?
- Link to your solution
  - How will your solution contribute to solving the problem?
  - How will people be affected by the outcomes of your solution?

In the context of a memo, these components are rather granular—sentence and paragraph level. Beyond providing structural and informative points of consideration for students in the production of documents, the problem-solution memo scheme gives the writing consultant a vocabulary for discussing the components of the students' memos during the review and revise phase and gives students a vocabulary for discussion during cooperative writing and peer review. Additionally, students' pre-writing response sheets are turned in with their problem-solution memos and the proposals. While this encourages students to take the prewriting portion of the process more seriously, it also allows the writing consultant responding to the memo or proposal to trace problems back to root misunderstandings of the audience, purpose, and action scheme revealed in students' planning. In this sense, the feedback on process (rather than just product) itself reinforces students' perceptions of the essential links between prewriting and the final product.

Mutually reinforcing associations

Connecting writing consultant responses to all points of the writing process (rather than just the product) reinforces students' perceptions of the importance of process to the writing consultant. It does less, however, to reinforce the position that the writing consultant is an integral part of the student's engineering education.

Convincing undergraduate engineering senior-level students that technical communication concepts are an essential part of engineering practice can be problematic. Tying writing assignments and instruction to workplace practice (or workplace derived evidence) and offering discipline-specific rational for communication skills and practice is probably the most effective method of making the connections between the assignments and writing in the engineering workplace explicit.

In CE 4101, the writing consultant's lectures take place during the larger project management course lectures and the writing assignments are tied explicitly to project management practice.

At the beginning of the semester, students are asked to find a practicing engineers and to interview them paying specific attention to the writing and speaking tasks that they perform on a regular basis; students are given some guidance in the form of suggested questions. This assignment, added after encountering resistance from students in early iterations of the course, seems to ground the occasional militant student who, after finding a practicing engineer and discussing his or her encounter with a group, comes to the shocking realization that a career in engineering does actually involve quite a bit of writing.

Also, the writing consultant's discussion of the assigned proposing documents is informed by the various project management documents discussed. Problem-solution memos and proposals are presented, notably, as problem-solving precursors to project charters and work breakdown structures. This not only encourages buy-in from students who are accustomed to thinking of writing as merely evidence of work, but it also helps instill the idea of writing as an important part of the larger problem-solution process.

And perhaps more subtly, the teaching team has, in recent semesters, termed the triad of audience, purpose, and action the "triple-constraint" of the document, matching what students learn as the "triple-constraint" of the project: quality, time, and cost. While this nominal association seems incidental on the surface, the correlation provides students a terminology for discussing writing in an organizational setting in terms of project managing: as a deliberate task that involves making strategic decisions.

Team teaching

In an embedded instruction setting like CE 4101, it's not enough for a writing consultant to connect his or her lectures and assignments to the disciplinary portion of the course; it's more effective if the association goes both ways. Students are more likely to internalize connections between writing in the class and workplace if they hear writing referenced by the disciplinary instructor as well. Even the most casual references help to illustrate the cohesiveness of the teaching team and reinforce the position of the writing consultant as a subject matter specialist from the student perspective.

Undoubtedly, students actively engage in the application of process and strategy in the completion of the writing assignments in CE 4101 because the writing consultant is incorporated as an integral part of the project management course, rather than being a foreign grader or an instructor of a somewhat detached skills course. Instructing in the same classroom during scheduled lecture time and making it clear that writing assignments are created cooperatively by members of a teaching team—all of whom are fully committed to writing assignments as an integral portion of the course—encourages students to consider the importance of the techniques and exercises attributed to by the writing consultant.

[1] ABET. 2004-2005 Criteria for Accrediting Engineering Programs. Accessed June 12, 2004. available: <http://www.abet.org/images/Criteria/E001%2004-05%20EAC%20Criteria%2011-20-03.pdf>
[2] Mathes, J.C. & Dwight W. Stevenson. 1991. *Designing Technical Reports: Writing for Audiences in Organizations 2nd ed*. New York: Macmillan.
[3] Kampf, Constance, et.al. 2004. "The Triple Constraint of the Document: Coordinating Concepts in Rhetoric and Project Management for Engineering Students." *IPCC Proceedings*. Minneapolis, MN.

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