Abstract. At the Colorado School of Mines we are currently developing a writing-across-the-curriculum program for our students, all of whom are engineering or applied science majors. The program consists of three major facets: a writing-intensive first year course; two writing-intensive EPICS (design) courses in the first and second year; and four writing-intensive courses in the major. All of these WAC efforts are strongly supported by a Writing Center staffed by a Writing Program Administrator and two full-time writing lecturers.

Introduction

What does it really mean to have a writing-across-the-curriculum (WAC) program at an engineering school? In this paper I will describe and analyze the process currently underway at the Colorado School of Mines to implement a successful WAC program. In our program, each student takes a writing-intensive first-year course in which the basics of technical writing are introduced. Then students practice and develop their writing skills in our two course EPICS (Engineering Practices Introductory Course Sequence) program. Finally, each student is required to take four writing-intensive courses in the major, two in the junior year and two in the senior year. The first two components of our WAC program are in place; the third piece, the writing-intensive courses in the major, is being developed now. We are currently exploring the answers to such questions as:

- How do we decide which courses to designate as “writing intensive”?
- What does “writing intensive” mean and how do we decide on guidelines?
- How do we prepare engineering faculty to become writing instructors?
- How much faculty and class time and how many resources will it take to implement WAC?
- Who oversees the WAC program? How will we know if it’s working?

WAC Program Overview

Two years ago, as part of an overall review and revision of the undergraduate curriculum at the Colorado School of Mines, we concluded that the School’s current writing program would not allow us to meet one of the goals of CSM’s Profile of the Future Graduate: “Graduates must have the skills to communicate information, concepts and ideas effectively orally, in writing, and graphically.” The goal of graduating engineers with effective communication skills is also found in the ABET Criteria 2000 [1]. We agreed with George Heilmeier, corporate executive at Bellcore, that “communication skills are extremely important. Unfortunately, both written and oral skills are often ignored in engineering schools, so today we have many engineers with excellent ideas and a strong case to make, but they don’t know how to make that case. If you can’t make the case, no matter how good the science and technology may be, you’re not going to see your ideas reach fruition” [2]. In considering the inadequacies of our current writing program, we pledged to develop:

- An enhanced Writing Center staffed by a qualified Writing Program Administrator and other writing experts.
- A writing-intensive first-year course.
- A revised two-semester EPICS program focusing on technical writing and speaking.
- Four writing-intensive classes in each major.

In addition, we have been collaborating with the Jefferson County R-1 school district to develop language arts standards for CSM students and the assessment tools to measure them. This district, in which CSM is located, is the single largest supplier of our undergraduate students. We are collaborating with them to create a seamless set of writing standards for students from ninth grade through college as well as to share successful strategies for the teaching and evaluation of writing.

Fortunately, a great deal of information about successful WAC models exists today [3, 4, 5]. We explored a variety of possibilities before choosing our model which focuses on building a state-of-the-art writing center to support a strong writing-intensive first-year course followed by a series of courses in design and in the major.
The CSM Writing Center

The Writing Center at CSM was minimally, though enthusiastically, staffed and housed in a 6 foot x 10 foot office before our WAC efforts began. We had three major goals for the Writing Center, which we view as a key component of an effective writing-across-the-curriculum program:

- Hire effective staff.
- Upgrade equipment and campus space.
- Design a “writing resources” web site.

As a result of a national search, we were able to hire three full-time writing experts—a Writing Program Administrator, Jon A. Leydens, and two full-time lecturers with writing expertise, Catherine Flynn and Suzanne Northcote. These three staff the Writing Center in addition to developing instructional materials for and teaching the writing-intensive freshman course, developing helpful materials for faculty, and conducting workshops on writing instruction.

With the aid of both internal and external funding, we have relocated the Writing Center to our computing center, centrally located on campus, and have installed a dedicated electronic classroom complete with 20 computers and a projection system. In its first semester, the number of students requesting assistance from the Writing Center more than doubled.

The third goal, developing a writing program website, is progressing; the website should be available as a campus resource during fall semester 1998.

The First Year Writing-Intensive Course

CSM has not traditionally offered a freshman composition course; writing instruction has been done in EPICS classes. However, over the past several years, as a result of faculty attrition, the writing portion of EPICS lost its focus, resulting in sometimes uneven instruction and lack of opportunities for some students to practice their writing. These shortcomings were made clear through our school-wide assessment program.

As a result, we began to explore alternative methods by which we could deliver more writing instruction. Betty Bamberg, in a recent article, describes four alternative models of first-year composition: the writing-intensive course, the freshman writing seminar, writing links and adjuncts, and specifying the content. At CSM, under the leadership of Dr. Arthur Sacks, director of the Division of Liberal Arts and International Studies, we chose the first option, the writing intensive course. As described by Bamberg, such a course “integrates writing instruction into a broad range of existing content courses,” and is “one of the most widely adopted curricular structures in Writing Across the Curriculum programs.” The variation we selected “integrates writing into an existing course but does so by attaching a separate writing ‘component’ using the lecture/discussion structure” [6]. Our new first-year, four-credit writing-intensive course, Nature and Human Values (NHV), was approved by the CSM Undergraduate Council and offered as a full-scale pilot course during 1997-1998. In the fall semester, NHV was offered in two modes: 1) two large lecture sections (approximately 120 students each, two 50-minute lectures per week) followed by a 2-hour recitation section focused on writing limited to twenty students and taught by writing experts; or 2) three 20-student combined lecture/recitation sections.

While the major goal of the course is to help students explore perspectives on the meaning, implications and global context of CSM’s mission of “stewardship of the earth,” the NHV course also focuses on helping students improve their writing skills, especially in technical writing [7, 8, 9]. Assessment of the pilot versions of the course indicate that the students believe they have been well introduced to the technical writing concepts and practices they will be using in their careers [10].

The Revised EPICS Courses

The EPICS sequence has been in place at CSM for nearly two decades [11, 12] but in the curriculum revision process, EPICS has been redesigned to focus on what feedback has told us it traditionally does best—teach students the design process and allow them to practice it by working in teams to solve problems for real “clients” from outside the School using appropriate computer software. With the guidance of EPICS director Dr. Robert Knecht, the goals of the new EPICS I course have been defined as:

- To analyze a problem, decide on a solution and communicate the chosen solution;
- To use computer packages as problem-solving tools;
- To build team and interpersonal skills through practice and faculty mentoring;
- To prepare communications documents which address the needs of the client and use evidence to argue for the chosen solution.

The last goal is most closely connected with our WAC objectives. We have worked to enhance the communication instruction and practice in EPICS by establishing a close working relationship between the Writing Center and the EPICS program so that EPICS can call on Writing Center staff for help in designing writing assignments and in delivering instruction. In addition, we have been careful to assure consistency of instruction between NHV and EPICS, even selecting common textbooks. Finally, we invited staff from the Colorado Writing Project to conduct several summer workshops for the faculty teaching EPICS and
NHV to develop common goals, definitions, and strategies for teaching writing.

Both NHV and EPICS I were delivered to the entire first-year class during the 1997-98 academic year. They were also assessed carefully and are being revised in response to feedback from students, other faculty, and advisory boards. However, on the whole, the writing component of both was favorably evaluated.

**Writing-Intensive Courses in the Major**

We believe that we are well on our way to achieving our first three goals—an enhanced Writing Center with professional staff, a writing-intensive first year course, and a strengthened writing component in EPICS. Our current challenge is developing the writing intensive courses in the major, courses which are to be implemented beginning in academic year 1999-2000. To begin the process, a working group was formed in January 1997 with representation from across campus to make recommendations to the Undergraduate Council, our curriculum-approving body, regarding WAC. Members of the working group came from the departments/divisions of Liberal Arts and International Studies, Geology and Geological Engineering, Engineering Physics, EPICS, Metallurgical and Materials Engineering, and Engineering. The working group prepared a list of recommendations to the Undergraduate Council that were approved in the fall of 1997. The working group’s primary assumption was that the teaching and evaluation of writing is a responsibility which much be shared by all CSM faculty with support from a variety of resources including the Writing Center.

The working group recommended that a permanent WAC Committee be appointed consisting of the Writing Program Administrator and five other faculty from engineering and science departments. This request was approved and the WAC Committee has begun the process of making policy recommendations to the Council. The Writing Program Administrator has also invited each department to name a WAC liaison, some of whom also serve on the policy-making WAC Committee. The purpose of the liaisons is to serve in an advisory role, to assist in implementation and communications between the department they represent and the WAC committee.

The WAC Committee is currently developing policy in the following four key areas as recommended by the Working Group:

- Writing program goals
- Writing program assessment
- Resources
- Guidelines and oversight for writing-intensive courses.

**Writing Program Goals**

The WAC working group stated that CSM as an institution needs to set clear writing goals for our students. The committee has recommended that these goals be articulated as performance standards, like those being developed by many states for elementary and secondary students. Our partner K-12 district, Jefferson County, has provided us invaluable help in beginning to articulate our standards. The working group also recommended that CSM develop a set of School-wide standards which departments can then add to or even raise. The setting of standards is a touchy issue and some departments are reluctant to accept this recommendation. However, the WAC Committee is working hard to make the entire process a “bottom up” one and to involve faculty in setting the standards. As a first step, we have recommended asking departments to select papers from their students that they consider “excellent,” “good,” and “unacceptable” and to bring these to a “norming” session for a preliminary discussion on standards.

**Writing Program Assessment**

Once we have a clear set of goals and/or standards in place for the writing program, we need to develop a plan to assess how well our students are meeting these standards. The working group discussed a number of approaches (pre- and post-timed essays, portfolios, pencil-and-paper tests) but did not collect enough information to make a strong recommendation. However, we want to develop an assessment plan that relies as much as possible on authentic assessments and that measures growth over our students’ entire career at CSM, not simply from the beginning to the end of a single semester.

**Resources for WAC**

Adequate support is essential for the WAC program to succeed. Resources must be provided to establish and maintain all aspects of the program including assessment and faculty development. It is important that we find ways to encourage faculty in the disciplines who are willing to develop, teach, and revise writing-intensive courses. Such support may take the form of faculty development opportunities (expenses paid for workshops, conferences, etc.), smaller classes, a further enhanced Writing Center, or grading help to name some possibilities.

We have offered several faculty development opportunities over the past two years including writing workshops, a special session of the Colorado Writing Project, a two-day WAC workshop led by Susan McLeod of Washington State University, and small stipends to faculty who are working to develop WAC courses. All of these activities have been supported by CSM and by a grant from
the Colorado Commission on Higher Education obtained by Barbara Olds, Arthur Sacks, and Jon Leydens.

Guidelines for Writing Intensive Courses

The working group also developed a preliminary set of guidelines for WAC courses and the WAC Committee is currently exploring these and other options, learning what guidelines other institutions use, and preparing recommendations for the Undergraduate Council. We are struggling with the conflicting values of wanting programs to be able to define their own WAC guidelines and the need for some “teeth” and standardization for the WAC program. Our initial recommendations are presented below.

1) Our starting point is that the WAC Committee will review all new course proposals for writing-intensive courses in the majors before forwarding them to the Undergraduate Council for approval. Initially, each department/division will submit a plan for how it intends to deliver the four required writing-intensive courses in the major (two in the junior year and two in the senior year). Under this plan, the department/division should explain how it will guarantee that each student takes four writing-intensive courses, how it will ensure that each student has an opportunity to write in a variety of formats appropriate to the discipline over the four-course sequence (abstracts, research papers, memos, resumes, short reports, long reports, lab reports, proposals, etc.), and how students will be given opportunities for substantial revision. The working group also recommended that each student should write at least one substantial paper or report in the major (approximately 10 pages) which includes a research component, citations, and a bibliography in a format generally accepted in the discipline. In addition, it was recommended that students be given the opportunity to produce both individual and group writing projects.

The working group also recommended that faculty be encouraged to include at least four separate writing assignments and a careful plan to provide feedback for students during the writing process in each writing-intensive course. Assignments should be given in writing and assessment criteria should be made explicit to help students reach the course goals. Assignments should foster learning of course content and provide repeated opportunities for students to think about course content. Writing assignments should definitely be factored into students’ course grades.

The working group was reluctant to recommend a set number of pages to be required in order for a class to be considered writing intensive. Instead they argued for a “substantial” amount, as defined by the professor and the department; this amount may include some revision and may include preliminary and exploratory writing.

Above all, the working group argued that two points should be kept in mind when designing writing-intensive courses:

1. Preparation. Clear and explicit guidelines, including assessment criteria, should be provided for all assignments to help prepare students for the writing process.
2. Guidance. Written feedback on drafts and final papers, class discussion, instruction in writing, use of the Writing Center, and individual conferencing all help students improve their writing skills. Student writers can also benefit from guidelines for self-evaluation of their writing and from peer review sessions during class time.

During the spring of 1998, the WAC Committee, under the leadership of Jon A. Leydens, developed a draft mission statement for the writing-across-the-curriculum program [13]. According to this draft, WAC exists at CSM for four major reasons:

1. Because the ability of our graduates to communicate their ideas during their career at CSM and thereafter is a key institutional value;
2. Because communication skills are teachable and require consistent practice if they are to be developed;
3. Because writing fosters learning and critical thinking in the content of any discipline; and
4. Because writing facilitates students’ entrance into their discipline’s “discourse community” and allows them to become familiar with the techniques and writing conventions common to their specific discipline.

These reasons will be kept before the faculty as we continue to develop and implement the WAC program.

Conclusion

In conclusion, at the Colorado School of Mines we believe that a well-designed and carefully implemented WAC program can be extremely beneficial in helping our engineering students obtain the writing skills they need to succeed in their careers. We believe that we have already made substantial progress by upgrading our Writing Center and writing program staff, by implementing a new writing-intensive freshman course, and by refocusing the writing component in our EPICS sequence. Our remaining challenge, which we are well on our way to meeting, is to develop and implement the writing-intensive courses in the majors. We anticipate that reaching consensus on this component will be the most difficult component of our WAC program, but our conversations are already well underway and we expect their outcome to be a genuine, coherent, vertical integration of writing throughout our curriculum.
References


