Collaborative Partnerships: Writing in the Engineering Classroom
(Using Undergraduate Course Assistants from the English Department to Improve the Writing Skills of Engineering Students)

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Abstract - Teaching effective communication skills to engineering students, especially first year students in large classes, can be a time-consuming, labor-intensive endeavor. This paper describes an instructional system that employs undergraduate course assistants (UCA’s) from the liberal arts college, typically the English department, to promote effective written communication skills of freshman engineering students. The paper presents information from an interactive session held at FIE 2004 and a case study of a program that has been used successfully at our university and which can serve as a template to create a similar learning experience in other institutions. The key component of this system is the training program for the UCA’s. It has been observed that, by incorporating the use of UCA’s into the engineering classroom, especially in Freshman Programs, the written communication skills of engineering students can be improved without increasing the workload of the primary instructor.

Index Terms – Communication, course assistants, freshman programs, writing.

INTRODUCTION

Surveys show that effective communication skills, verbal and written, are two of the most important skills required by employers of graduating engineers. [1] This is recognized by the Accreditation Board of Engineering Technology (ABET) accreditation Item 3g: an ability to communicate effectively. [2] The consistent and high quality review of students’ written work (formative assessment) is key to developing effective written communication skills among engineering students. Attempts to improve writing skills of undergraduate engineering students are ongoing. As one recent paper title indicated: “Writing and Undergraduate Engineers – A Continuing Problem.” [3] Improving the communication and writing skills of engineers is being recognized as a problem that must be approached throughout the four year curriculum, not simply in freshman composition classes or final capstone projects.

Most engineering students are weak in written and oral communication skills. This program will provide the much-needed assistance and will focus on the development of these skills. After electronic submission of essays by engineering students, the course assistants will read and assign a score to the essays. Using this system, a pool of course assistants trained as described in this project can be employed to review written assignments across the engineering curriculum.

Engineering faculty members are reluctant to give assignments that involve writing and speaking because of the labor intensive evaluating and grading nature of these assignments. This problem is complicated by the use of engineering graduate students who are rarely trained to respond to student writing. This program will provide a mechanism to allow the engineering faculty to incorporate writing assignments into their curriculum by using fully trained course assistants with a strong communications background to evaluate student writers and assist them with the goal of making communication an integral part of the engineering curriculum.

One method of addressing these problems is a program involving Undergraduate Course Assistants (UCA’s) that has been used by the authors for more than ten years to help improve the writing skills of engineering students. The program involves recruiting and training of UCA’s and expansion of the program from freshman year courses to upper level courses.

At FIE 2004 in Savannah, GA an interactive session was held to discuss the problems that face engineering educators who teach writing. [4] The goals of this interactive session were to provide participants an opportunity to discuss:

1. the importance of the interrelationships of writing, thinking, and problem solving and the importance and benefits of incorporating more writing into the engineering classroom;
2. a model to use UCA’s in their engineering classrooms and/or institutions; and
3. a training model for UCA’s to insure consistent and reliable responses to engineering students’ writing.

The session was divided into blocks that included interactive discussions, small group work and presentations by the session organizers.

Participants formed small groups, brainstormed and participated in an active discussion about their use of writing in the classroom and/or why they do not use writing in the classroom. Responses were collected and listed.

Following this work in small groups, the presenters described the method of using Undergraduate Course Assistants. Various methods for developing writing and critical thinking skills in the engineering curriculum have been used at Binghamton University for the past ten years. Peer assessment incorporating UCA’s from the English Department, mostly seniors and juniors, to review technical papers written by undergraduate engineering students is a valuable technique to accomplish this review. However, the key to the employment of UCA’s is the consistency of evaluation methods between individual reviewers. The inclusion of UCA’s in the classroom and as part of the evaluation of written work can encourage engineering professors to assign written reports in many upper level courses. This will reinforce the writing skills of engineering students that were developed in freshman composition courses.

Next, the model that shows the different roles of UCA’s in the classroom was demonstrated. A training model that insures consistency in UCA responses to student writing and other student learning issues was discussed. An organizational system for employing UCA’s in the Freshman Engineering Program was presented. This organizational system has also been used in a sophomore Materials Science course and Senior Design courses at Binghamton University (SUNY).

RESULTS OF FIE 2004 INTERACTIVE SESSION

The participants in the workshop in Savannah compiled a list of fifteen problems associated with teaching writing to college students, specifically first-year engineering students. The list of fifteen items is given here, not in a rank order, but grouped by categories that were assigned after the session:

Category I – Problems Associated with Students Skills and Attitudes

1. Literacy
2. Research skills
3. Student carelessness – grammar, spelling
4. Terminology (i.e., vocabulary)
5. Slang – inappropriate wording
6. Prose – technical writing
7. Form/Content
8. Academic integrity (plagiarism)
9. Resistance to writing: it is “not engineering”

Category II – Problems Associated with Faculty Skills and Attitudes

10. Assignment development for (to simulate) “on the job” skills
11. Lack of critical “on the job” experience of instructors
12. Time “lag” between freshman composition and senior project
13. Grading time required (Instruction)
14. No formal training in writing or composition of instructors in advanced engineering courses
15. Graders’ in engineering courses lack of writing skills, or their first language is not English (e.g., TA’s, graduate students)

Among the nine problems listed in Category I, only one (#9 – resistance to writing) is specific to engineering. The other eight problems would likely be identified for students in introductory writing courses in any discipline.

Participants agreed that one of the primary challenges to teaching writing in the engineering classroom is this resistance to writing by use of “on the job” skills and scenarios. Mention was made of resumes, memos, and activity reports. Also mentioned was the preparation of documentation, user’s manuals, and operating procedures.

It was pointed out that often students do not receive any writing assignments between their freshman composition sequence and their capstone design project report. This contributes to their attitude of resistance to writing.

The reinforcement of writing skills through writing assignments in several advanced engineering courses in the second and third years is another method of overcoming this time “lag.” The final three problems (#13 to #15) reflect the time-consuming and labor-intensive endeavor that is involved in formative assessment of writing assignments. These were noted as major reasons that writing assignments were not made in engineering courses in the second and third years of the curriculum.

The use of undergraduate course assistants as reviewers of student work can be an effective tool to enable engineering professors to insert writing assignments into otherwise technical courses. UCA’s are primarily composition and rhetoric students majoring in English or education majors who intend to specialize in English. They are prepared to analyze and review compositions, thus freeing the instructor or teaching assistants from this time-consuming task.

UNDERGRADUATE COURSE ASSISTANTS

Undergraduate course assistants are recruited in two ways. First, with assistance from the English Department at BU, English and Rhetoric students are solicited through the use of
an English Department computer listserv. Secondly, students from other disciplines learn about this program as a result of “word-of-mouth.” Engineering students with strong writing skills can also work as UCA’s.

A brief description of the position, requirements, and responsibilities is sent to all appropriate student groups. Emphasis is placed on juniors and seniors who have an interest in teaching, writing instruction, and the intersection of science and writing and who can work as a UCA for a minimum of two semesters. To eliminate students who might not be serious about the position, a formal application procedure is followed. A letter that outlines their background, and why they are interested in this position, along with a resume is requested.

Because the benefits of participating in this program are many, the English Department works with us to provide the mechanism for students to receive credit over several semesters. In the first semester as a UCA, students receive academic credit for the work. After the first semester, students have the option to receive pay or a combination of two credits and pay.

If a UCA is receiving credit or pay, they are asked to keep a journal. The journal catalogues their experiences working in the classroom and outside of the classroom tutoring students. Each UCA submits a brief narrative report of each tutoring session. If a UCA is receiving credit for the experience, they are asked to write a paper at the end of the semester that incorporates material from their journals, the UCA weekly training program, and learning theory to which they have been introduced. UCA’s are given copies of the class text book, all teaching materials, and some semesters we have purchased and supplied copies of William J. McKeachie’s Teaching Tips: Strategies, Research, and Theory For College and University Teachers.[5]

This process satisfies all academic requirements set forth by the University and English Department for students who receive credit for either an Independent Study course or the Practicum in College Teaching course. Students who have participated in the program have found that the fact that a Practicum in College Teaching appears on their transcript is very useful when they are searching for jobs.

At the end of every semester, the instructor prepares a formal written evaluation. A copy is given to each UCA. It is clear that this experience is invaluable to English and Rhetoric majors, and in many cases guides them toward a career choice. In addition, course assistants majoring in English frequently do not know what careers to select when they graduate. After working with engineering students in this program, approximately 30% of the English undergraduate course assistants go on to graduate school in teaching. Others pursue careers in technical writing.

**UCA’s in the Freshman Program**

At BU, all entering engineering students are enrolled in a common curriculum during the first year. Included in this curriculum is a set of courses (WTSN 103/104/111/112, 8 semester-hours total credit) that includes written and oral communication instruction. Course assistants are successfully used in this freshman sequence. Approximately ten course assistants per semester, mostly from the English Department, have successfully been employed over nine years by two of the instructors in the freshman engineering courses at Binghamton University.

Undergraduate course assistants have the opportunity to receive two or four credits for their work. The credit is granted through the English Department. Two credits of Practicum in College Teaching is granted for their work in the classroom during the semester and two credits of Independent Study for their work with students outside of the classroom. They have the option of taking four credits of Independent Study instead of splitting the credits between the Practicum and the Independent Study. The same option is repeated for the second semester. If course assistants are hired in their junior year and agree to stay for two years, they have the option of receiving pay during the second year. Our experience has been, that all course assistants stay for as long as they are able.

The significance of this work is, if instructors incorporate writing assignments into upper level courses, it will greatly improve the written communication skills of science and engineering students. ABET has stressed that graduating engineers must possess the ability to communicate with non-technical members of their organizations to increase efficiency and reduce organizational conflict. Ultimately, increasing the communication skills of technical personnel will improve communication with the public about technical issues that are socially significant.

**Program for Training UCA’s**

Course Assistants often begin the semester with a period of acclimation and training which slowly allows them to be comfortable with the material and scope of our Introduction to Engineering course. Each UCA is required to attend a weekly one-hour training program. On specific occasions the training program could last two hours.

UCA’s are also required to assist the instructor during class. Due to the size of the freshman Technical Communications sections, there are two UCA’s per section of 34 students. In the fall and spring of 2004/5, there are eight sections of Technical Communications; we employed 16 UCA’s.

It is often difficult to coordinate a time for training sessions that can be attended by every UCA. Because of this scheduling problem during the 2004/5 academic year two instructors each ran a training program at a different time and day.

In the fall semester the first three sessions of the training program are designed to acclimate the UCA to the engineering discipline and working with freshman engineering students. A typical session will walk the UCA’s through the two hour planned class curriculum. Time is allotted for questions, answers and discussion. Together, we find a place within the curriculum where the UCA can begin to be involved with...
students in the classroom. This process builds from passive to more active participation as the UCA’s become comfortable with the class. A typical beginning strategy might be to have the UCA’s demonstrate a concept on the blackboard and/or elicit information from students that then goes on the board. These scenarios increase in responsibility based on the UCA’s ability and level of comfort in the classroom. All UCA’s, at some point, give a brief presentation to the class. A typical presentation might occur after the UCA’s have evaluated a written assignment. They can then address the common writing errors they found in the papers and present these to the class.

Consistency in “grading” is an area of concern that arises when employing sixteen course assistants. A formal procedure is in place to minimize any discrepancies in the reviews of writing samples. When students submit each writing assignment, UCA’s go through a process of “norming” a paper during that week’s training program. Two levels of student papers are selected for review: a poorly written paper and an average paper. We begin with the poorly written paper. Each UCA reads and responds to the paper based on a specifically developed rubric that reflects the criteria of the assignment. When all UCA’s have finished reviewing the selected paper, we compare evaluations. This includes (a) grades, (b) problems found and (c) feedback comments they write to the student whose paper they have read and evaluated. It is at this point in the process that UCA’s become fully engaged. They are now faced with evaluating student writing and they are anxious to comment appropriately. If there is time, and the UCA’s feel it is needed, the average paper can also be evaluated. UCA’s are usually insecure at the beginning of the process. This sets the groundwork for intensive instruction on how to respond to student writing. The best instruction comes from the “norming” of the papers in a group setting. UCA’s learn from each other’s comments, especially when they have evaluated the same paper differently. Eventually, usually during the spring semester, UCA’s are more intuitive about evaluating student work and the “norming” results become more equal. At this point we are able to make the grading rubrics less structured. We then move to assignment criteria and comments. By the middle of the first semester, the training sessions become quite lively and in some cases are based on the UCA’s agenda.

The training program is an integral part of the success of using UCA’s in the classroom and as evaluators of written work. While we have not included training for UCA’s on specific science, mathematics or engineering subjects related to the papers that they review, this is a training area that we would like to investigate. Training UCA’s on introductory topics such as scientific notation and systems of dimensions will be included in the future. Our training program has evolved over ten years and changes as the curriculum and needs of freshman engineering students change.

**Effective use of UCA’s in Upper-level Courses**

In the discipline-specific engineering curriculums in the subsequent years, no other formal writing courses are required of the engineering students. The next significant writing assignment is in the Senior Capstone Design course.

The success of the UCA program is demonstrated by the fact that UCA’s are now used to review written assignments in the Senior Capstone Design course. In the fall of 2002 and spring of 2003 engineering ethics research papers were assigned in the Capstone Senior Design course. These papers were evaluated by UCA’s. In addition, during 2004/5, literature review papers and book reports were evaluated by UCA’s.

To provide more reinforcement for writing skills, and to encourage writing across the curriculum, the authors have initiated a cooperative program to include a writing component in second and third year engineering courses which will reinforce the formal writing presented in the first year. The first attempt at this was made for research papers that were assigned during the spring 2003 semester in the Introduction to Materials Science course that is required of most students in the second year. In this assignment, each student selects a material from a list prepared by the instructor. Only one student can work on a single topic; each material has two topics. One topic is structure and properties and the other is processing and applications. The students must then submit a draft research paper for review by a UCA of format, style, organization and grammar. This annotated paper is returned to the student as the basis for preparation of the final paper. The final paper is reviewed by the engineering teaching assistants for content and correctness. It has been found that it is helpful to make the students re-submit the paper graded by the UCA with the final paper. The grading for the assignment is 50% for the first draft and 50% for the final report. If the corrections to the draft were not made, a higher score cannot be assigned the final paper. The undergraduate course assistants’ work frees the engineering teaching assistants from much of the work correcting grammar and spelling. The scenario outlined here is being proposed for adoption in two other courses in which large writing assignments seem appropriate. One is Engineering Project Management and the other is Engineering Design. These courses are both offered in the third year.

**Conclusion**

The use of undergraduate course assistants to review student writing assignments has been found to be an effective way of providing feedback to engineering students in both first-year composition courses and upper-level technical courses. UCA’s can relieve the instructor from much time-consuming review of written assignments. The employment of English majors as UCA’s creates a source of graders who are well prepared to provide students with comments and criticism about their writing. The training that is provided for the UCA’s further enhances their ability to help improve student writing skills. The student’s ability to communicate effectively is improved by the use of UCA’s in the classroom and for grading.
REFERENCES


