The Student Consultant: Enhancing Communication Skills in the Undergraduate Laboratory

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I. Introduction

The ability to effectively communicate is an ever more frequently echoed requirement for the graduating engineering student. Industries and accreditation agencies both send the clear message that the need for communication skills rivals that for technical skills in the engineering workplace. For most undergraduates, developing oral communication skills most often involves making several formal or semi-formal presentations over the course of the undergraduate program, usually as traditional technical presentations with visual aids and a passive audience. The ability to make effective technical presentations is without doubt a key skill for today's engineer, but there are many circumstances in the workplace where effective communication at a less formal level is no less important. Examples of these situations include working with technicians or operators in a manufacturing setting, explaining technical topics to a non-technical audience, and training of new employees. In all of these settings, interactive one-on-one or small group communications must be effectively established. For some individuals, this form of communication comes much more naturally than the formal presentation, but for others it does not. The student consulting exercise described here is directed at helping students develop effective technical communication skills in interactive, small group environments.

II. Background

The Unit Operations Laboratory course (CHE 316) at Michigan State University is taught in the Spring semester of each year. Each section of the course can accommodate up to thirty students; these students work in assigned groups of three for the entire semester. Each group completes five laboratory experiments, spending two and one-half weeks (five lab periods) on each experiment. Typically, at the beginning of the first of the five lab periods students are informed which experiment they have been assigned to and are given a general objective for the experiment. They spend the first period in the lab formulating an experimental plan, learning about the equipment from talking with the instructor and teaching assistant, and watching a videotape of a prior group's efforts on the experiment[1]. They then prepare a "prereport" that describes their plan and gives a thorough description of equipment operation, safety considerations, and methods for analyzing the experimental data. The instructor must approve this prereport before students are actually allowed to conduct their experimental work. Once students complete their experimental work, they have about two weeks to prepare the final report for the laboratory assignment.

III. Implementation

The student consultant exercise has two major purposes: 1) to develop interactive, small group communication skills in undergraduate students, and 2) to help students become familiar with the operation, theory, and safety considerations of their laboratory experiments. The exercise is conducted during the first three-hour lab period of an assignment, typically for the last three experiments assigned during the semester. One student from a group who previously completed a particular experiment serves as the consultant to another group currently assigned that experiment. All groups in the laboratory section participate simultaneously, both providing a consultant and hosting a consultant.

At the beginning of the laboratory period, the instructor makes the experiment assignments and directs the student groups to their equipment. During the first hour of the period, students read the information available on the experiment, look over the equipment, and then prepare a list of specific questions. These questions are submitted to the instructor for approval; the intent of preparing questions is to help the students focus on understanding the experiment as rapidly as possible.

The consulting exercise then follows, and takes approximately forty-five minutes. The consultant presents information and discusses the experiment with the group in the laboratory at their equipment station. The exercise is interactive, with time for discussion and questions during and following the consultant presentations. The consultant has the following specific responsibilities:

1. Describe the experimental equipment;
2. "Walk" the group through startup, operation, and shutdown of the equipment;
3. Carefully describe and discuss safety considerations and any differences in actual operation from that described in the lab manual;
4. Review the underlying theory associated with the experiment;
5. Answer questions prepared by students.

The topics discussed are directed at helping student groups prepare to conduct the experiment they have been assigned. Consultants are clearly instructed not to transfer any actual experimental data, results, discussion, or conclusions that their group developed while completing the experiment.

Each of the three students in a group serves as the consultant once during the semester. During the consulting exercise, that student is absent from the group and, following the exercise, must be brought up to date on the information provided by the consultant. This forces the other two group members who interacted with the consultant to reiterate much of the information, typically enhancing the entire group's understanding of the experiment.

Implementation of the student consulting exercise requires care in scheduling experimental assignments for the groups in the course, as it is necessary to have all groups provide consultants for three experiments. Typically, the experimental schedule for entire semester is developed at the beginning of the semester.

IV. Assessment

Student performance as a consultant is evaluated in two ways. First, the instructor and teaching assistant circulate through the laboratory during the consulting exercise, observing the presentations and interactions between consultants and groups. The attempt is made to maintain a low profile during the session. Following the consulting exercise, the instructor can visit with groups and ask one or two key questions about equipment operation or safety to ensure that the consultant addressed the important aspects of the experiment.

The second evaluation is provided by students in each group. Students evaluate their consultant twice: once immediately following the consulting exercise, where both presentation and technical content are evaluated. An evaluation form is used which asks students to evaluate clarity of presentation, understanding of material, ability to answer questions, and completeness. The second evaluation is done after the group has completed the lab experiment, and evaluates only the technical portion of the consultant's presentation. This second evaluation was added after the first year, because some groups found that the consultant omitted key information about the experiment that made the experiment difficult to complete successfully. It is not possible for the students to truly assess the consultant's technical presentation until they have completed the experiment.

The consulting exercise and a formal presentation constitute the oral communications aspect of the laboratory course. Together, these count for 100 points out of a course total of 800, or about 12% of the student's grade.

V. Benefits and Pitfalls

Student feedback on the consulting exercise has been generally positive. Many like the idea of being an "expert" and having the opportunity to explain and teach technical material related to an experiment. They claim to enjoy and benefit from the informal, yet still somewhat structured communications exercise. The group members like having student consultants explain information, as they can relate well to their peers. The only negative experiences, which happened early on, were complaints that consultants were not giving accurate information about the operation of laboratory equipment, and that by the time students became familiar enough with the equipment to realize this it was too late to go back and successfully complete the experiment. We thus instituted the second evaluation step to encourage more responsible presentation by the consultant.

Instituting the consulting exercise relieves the lab instructor of the burden of repeatedly answering simple questions about the operation of lab equipment. Students in the course collectively receive a much more thorough introduction to their experiment than is possible from the instructor alone, and thus learning is enhanced. However, the instructor must be certain to carefully review the students' prereports, particularly for safety considerations and equipment operating procedures, prior to allowing them to actually conduct experiments. This ensures safe operation of the lab, and avoids the problem of consultants misdirecting students in operating equipment. This additional scrutiny of prereports has generally led to higher quality reports in the course.

VI. Conclusions

The student consulting exercise is a useful tool for enhancing communication skills of undergraduates in the unit operations laboratory, for enhancing their understanding of laboratory equipment operation, and for improving the overall atmosphere of collegiality in the laboratory classroom.

Bibliogeography

1. Miller, D.J.; "The Video Laboratory Report: Enhancing Communication Skills in the Undergraduate Laboratory," *Proc. ASEE Annual Meeting*, Anaheim, California, June, 1995.

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