AC 2008-1616: INTEGRATING ENGINEERING ETHICS EDUCATION INTO A MULTI-DISCIPLINARY SEMINAR COURSE: MAKING THE "SOFT" OUTCOMES RELEVANT

David Cottrell, University of North Carolina at Charlotte

DR. DAVID S. COTTRELL is an Assistant Professor in the Department of Engineering Technology, University of North Carolina at Charlotte. He graduated from the United States Military Academy in 1978 and retired in 2000 after more than 22 years of service with the US Army Corps of Engineers. Studies at Texas A&M University resulted in an MS Degree in Civil Engineering in 1987 and a PhD in 1995. He is a registered Professional Engineer and has taught courses in statics, dynamics, mechanics of materials, graphic communications, engineering economy, and construction planning, scheduling, estimating, and management.

Integrating Engineering Ethics Education
into a Multi-Disciplinary Seminar Course:
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Introduction

The Department of Engineering Technology at the University of North Carolina at Charlotte (UNCC) has developed and implemented a comprehensive program leading to an academic environment of continuous improvement consistent with the ABET Technology Criteria 2000 (TC2K).[1] With the advent of TC2K, many institutions have been confronting ethics education and the mandate to implement, assess, and evaluate the student's ethical strengths. Traditionally, institutions tailor classroom instruction to incorporate in some fashion professional society's wide range of ethical codes and standards that collectively provide guidelines for practicing engineers. Some noted academicians have proposed that engineering ethics education should be more; that perhaps, it should "stimulate moral imagination, recognize ethical issues, develop analytical skills, and promote ethical obligation and professional responsibility in each student."[2] Others tend toward a more analytic approach by defining sequential intermediate steps necessary to react to a given ethical dilemma. This approach assumes the individual already has a set of acceptable moral or ethical standards and moves toward a less theoretical and more action-oriented posture to respond to the ethical condition.[3] This "Problem Response" methodology includes the following sequential steps:

1. Examine the ethical dilemma;

2. Thoroughly comprehend the possible alternatives available;

3. Investigate, compare, and evaluate the arguments for each alternative;

4. Choose the alternative you would recommend;

5. Act on your chosen alternative.

This paper describes an approach that builds on the familiar and extends to the unknown, or at least, more hypothetical. The methodology begins with the student's immediate surroundings, dealing with academic integrity within the bounds of the University. This opens the door for addressing the professional engineering framework based on well-established societal codes of ethics that define expectations for the practicing engineer. Ultimately though, the instruction strategy recognizes that an individual's personal convictions play a key role in ethical decisions and so finally, the course provides an opportunity to host open discussions on a number of contemporary, professional, societal and/or global issues including diversity matters such as race and gender.

The practical techniques addressed by this paper are designed to integrate the new ABET accreditation criteria for engineering technology (TC2K) into a junior-level seminar course. This course is structured deliberately to be a multi-disciplined environment where third-year engineering technology students can explore a number of relevant topics pertinent to their success as a student as well as a future practicing engineer. With enrollment open to electrical, mechanical, and civil engineering technology as well as construction management students, this course provides a unique, multi-disciplined atmosphere to address many aspects of engineering ethics both as a student and as a practicing engineer and creates a unique preview for the students of their future "team-oriented" relationships in the real world. Enrollment for the semester targeted by this paper was approximately seventy-five students split into three sections meeting on successive days. In particular, this paper will discuss innovative, strategic teaching initiatives for those "soft" yet essential skills that allow engineers to effectively function and grow as members of the society that they serve. These outcomes are noted below lettered appropriately as they appear in the ABET criterion:

i: an ability to understand professional, ethical and social responsibilities.

j: a respect for diversity and a knowledge of contemporary professional, societal and global issues.

The diversity resulting from the numerous engineering disciplines in the course serves well as a precursor to examining these outcomes and the associated engineering ethics from different engineering perspectives. The teaching strategy recognized that an ability to understand professional, ethical, and social responsibilities extended quite naturally into the other areas of emphasis included in Program outcomes. Presentations and class work included traditional instruction, guess speakers, group projects, extensive writing, and student presentations on selected topics. This paper will present several innovative techniques for addressing, assessing, and evaluating the outcomes noted above and provide insights into the benefits of integrating electrical, mechanical, and civil disciplines into the same learning environment.

Institutional Ethics and Formalized Expectations

Presentation of the topics dealing with integrity and ethics sprain quite naturally from academia beginning with a comprehensive presentation on the University Code of Ethics and Academic Integrity.[4] Topics covered policies, penalties, and procedures for dealing with a variety of issues in the academic realm including

- Cheating
- Fabrication or Falsification of Information
- Multiple Submission of Academic Work
- Plagiarism

- Abuse of Academic Materials
- Complicity in Academic Dishonesty:

Assigned homework required students to create written essays detailing the University expectations for ethics and academic honesty and the student's commitment to honoring the Code. Numerous rubrics[5] have been developed that provide a basis for assessment of written argumentative essays; instructors employed a variety of these templates and tailored a model for their individual section.

Academic integrity set the stage for discussion about ethical issues in a post-graduate environment dealing with professional practice as engineers. Codes from current professional societies where used initially to give the students an appreciation for the clearly stated expectations established and the associated, potential consequences for practicing engineers in various disciplines. Discussions included representative professional societies such as:

- The National Society of Professional Engineers (NSPE)[6]
- The American Society of Civil Engineers (ASCE)[7]
- The American Society of Mechanical Engineers (ASME)[8]
- The Institute of Electrical and Electronics Engineers (IEEE)[9]

Student discussion indicated an understanding of the expectations and relevance of ethical behavior and the absolute personal standards of integrity in the engineering profession. Some students expressed surprise at the consequences and penalties associated with violations. As written submittals, students created written essays detailing (1) the expectations for their particular discipline and (2) based on personal research, three examples of ethical violations currently in the news and the environmental, social, or economic consequences. Instructors reviewed a variety of templates for assessing the student's grasp of ethical issues and their ability to discern alternatives, predict consequences, and select the best choice. Each instructor tailored a model for their individual section.

Situational Ethics: Testing Personal Integrity through Workplace Scenarios

With their academic environment and professional society standards, expectations, and codes as a backdrop, the class then shifted their focus forward in time to when they would be working members in an engineering field. The various Codes of Ethics from the various societies noted earlier were posted around the room. Students were presented with seven (7) common ethics scenarios with multiple-choice responses. Each scenario dealt with a different contemporary, professional, societal and/or global issue including diversity matters such as race and gender. However, the scenarios were brought out of the typical "generic" hypothetical and set in a practical, work-related environment. The following is a brief discussion of the student responses and subsequent discussions to each of the seven scenarios including the following ethical issues:

1. Honesty and Truthfulness in the Workplace.
2. Dealing with a Lazy, Slacking Co-Worker.
3. Taking Credit for Someone Else's Work.
4. Invention Ownership.
5. Receiving Unauthorized Discounts from a Company Customer
6. Unexcused Absenteeism.
7. Sexual Harassment.

A pretest was administered to gage student awareness and perceptions to the various situational parameters and considerations. Students were issued flashcards with color-coded letters corresponding to the lettered responses for each of the scenarios. With each situation, students immediately held the appropriate letter corresponding to their initial reaction to the issue being presented. Student responses were recorded and are presented below. It should be noted that student feedback indicated that the "flashcard" concept highly instructive as it revealed perceptions throughout the classroom and provided students with immediate feedback as to whether they stood with the majority or the minority. This naturally also served well for generating discussion since students were allowed to defend their decision in each case. The discussions ensued both collectively and at times in small groups addressing each of the various scenarios. These discussions tended to be open-ended but the instructor moved about facilitating the pertinent points and to ensure the students stayed on topic.

Building on in-class presentations and discussion, students subsequently submitted at a later session a short essay detailing their perceptions covering particular aspects of the wide range of professional ethical, social, and diversity regarding their application, their validity, and their relevance to either the students' current academic circumstance or their future as a practicing engineer. The assignment was assessed for general compliance and support for the standard codes of ethics recognized within the industry. Based on in-class presentations and discussion, students demonstrated a clear awareness of the purpose and requirement for the Codes and a general acceptance of the Industry Code of Ethics and the University Code of Ethics. Student discussion indicated that they grasped the subtleties of ethical behavior and the inherent difficulty in applying rigid standards in a variety of real-world situations. Essays testified to the student awareness and their intent to follow commonly accepted ethical practices in the workplace. The following discussion presents the individual scenarios and the student responses.

Situation #1 dealt with honesty in the workplace. The scenario described a situation where the student missed a day of work because they had partied too hard the night before. Then the next day, during a meeting, their supervisor inquired why they had not been at work. The possible responses included

    A. They should explain to their supervisor that they were ill.
    B. They should explain to their supervisor that an emergency came up at home that entirely consumed them.
    C. They should tell their supervisor that they were absent for personal reasons.
    D. They should tell their supervisor that they were ill because of over-partying.

Figure 1 charts the response for each of the three sections. As can be seen, a clear consensus thought that some honesty was warranted but not full disclosure. Students thought that what happened on the weekend was not "any of his business and a partial truth was justified. However, as it was further pointed out that the partying had adversely impacted his workforce that a line had been crossed so that extra-curricular activities were now germane. Secondly, as a leader, the supervisor was also responsible for the welfare of those under him within the organization. In the limited confines of this scenario, a case could be made that perhaps the employee had a problem with drugs or alcohol that might warrant genuine concern and perhaps medical treatment. Students tended to recognize that these were possible but still were convinced that "C" was the best response.
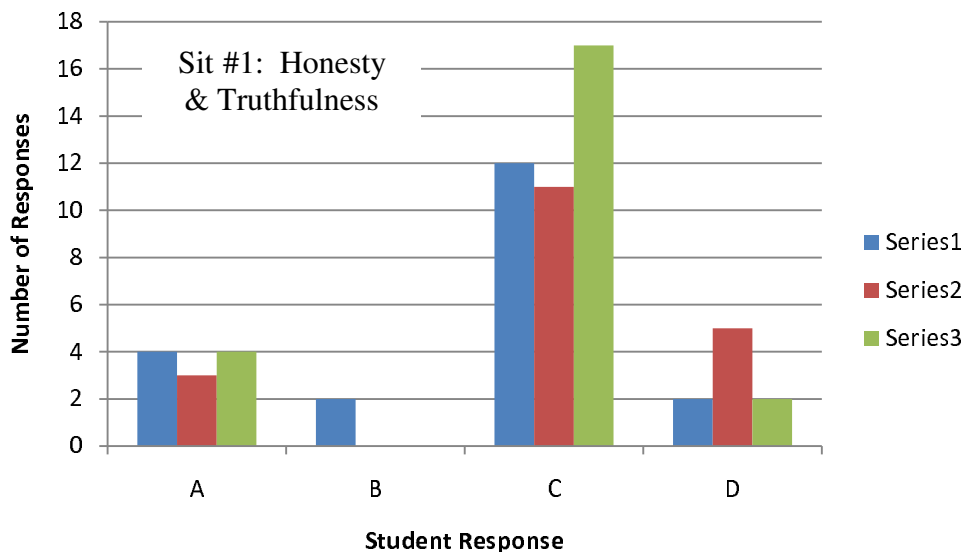

Figure 1: Student Response to Situation 1 Dealing with Honesty & Truthfulness in the Workplace.

Situation #2 indicated that for several months, one of their colleagues has been slacking off, and they were getting stuck doing their work as well as that of the colleague. Naturally, their think it is unfair. Given the situation, the students debated the following responses:

A. Recognize this as an opportunity for them to demonstrate how capable they are.
B. Go to their supervisor and complain about the unfair workload.
C. Discuss it with their colleague in an attempt to solve the problem without involving others.
D. Discuss the problem with the human resources department.

There was a majority of students who chose to pursue a solution personally with their colleague. However, the discussion also seemed to identify some possible limitations that once the inquiry was made, the colleague might respond with situations that might exceed their ability to assist in correcting the problem. Students commented that there are times when the best response is to refer someone to better trained or professional help depending on the nature of the problem. Nevertheless, if that course of action failed to resolve the situation, they almost unanimously considered the going to the supervisor was the next step.
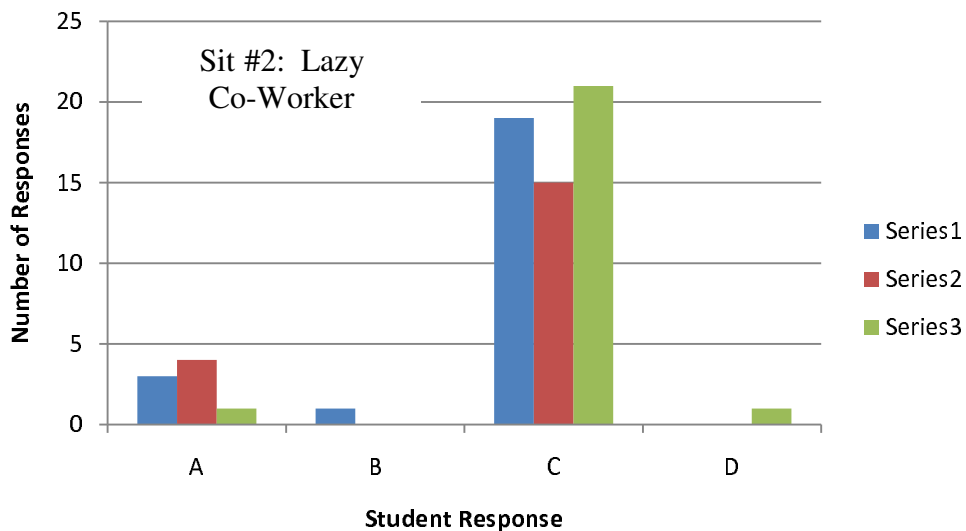

Figure 2: Student Response to Situation 2 Dealing with Co-Worker that is Slacking Off on the Job.

Situation #3 describes an occurrence during a department meeting when their supervisor takes credit for some excellent work of a colleague who is absent. The students had to select from the following responses:

A. Put the word out to fellow workers as to who really did the work.
B. Seek a private meeting with the supervisor in order to make sure the colleague gets credit, at least in the supervisor's head.
C. During the meeting with "the big boss," inadvertently let it slip that the colleague did not get the credit they deserved on a recent project.
D. Inform the colleague as to what took place and let them take whatever action they desire.

With a clear understanding of plagiarism and academic integrity, the students nevertheless did not feel compelled to call the supervisor to account. Rather, they fairly consistently thought the best course of action was to inform the injured party and allow them to push for credit where credit was due. One comment suggested though that dishonesty of this nature was a "cancer" that could quickly permeate a workplace; the colleague was not the only one injured but rather the entire team. There was also a general agreement that work was often "staffed out" within an office and the boss taking credit for the work of subordinates was not uncommon; by the same token, they agreed that one characteristic of a good leader was to recognize and appreciate the labors and productivity of the members of the team.
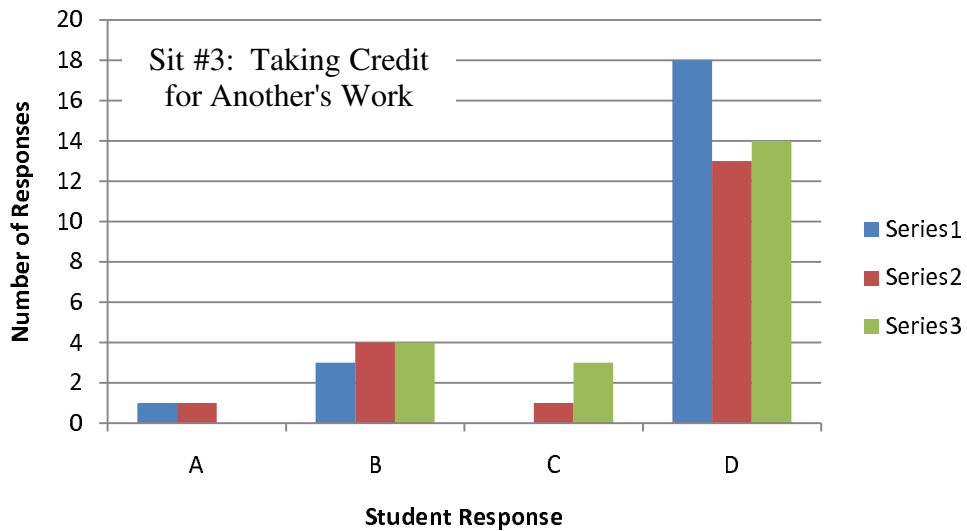

Figure 3: Student Response to Situation 3 Dealing with a Supervisor Taking Credit for the Work of a Subordinate.

Situation #4 presents a case involving an employee that while working for a particular company, they invented a device that has a potential for making them wealthy. They used the company's lab and test facilities but did the work on their own time. Students then debated the proper disposition and ownership of the invention. The options included the following:

A. Take it to the legal department for determination of ownership rights and appropriate disposition.
B. See a local attorney and have him file for a patent in their name.
C. Submit the invention for consideration for awards in the company's "ideas count" program.
D. Contact those companies who would have interest in the invention; sell it to the highest bidder.

Although a majority seem to eventually migrate to the correct response of "A," many still thought that the law in this matter was not basically fair to the employee who displayed creativity and inventiveness displayed by the employee. The law is clear that the company has at least a claim since their facilities contributed to developing the invention and that it was only fair that they receive an opportunity to be compensated. This "classic" scenario is not unheard of in academia dealing with either students or faculty and the development of either real or intellectual property.
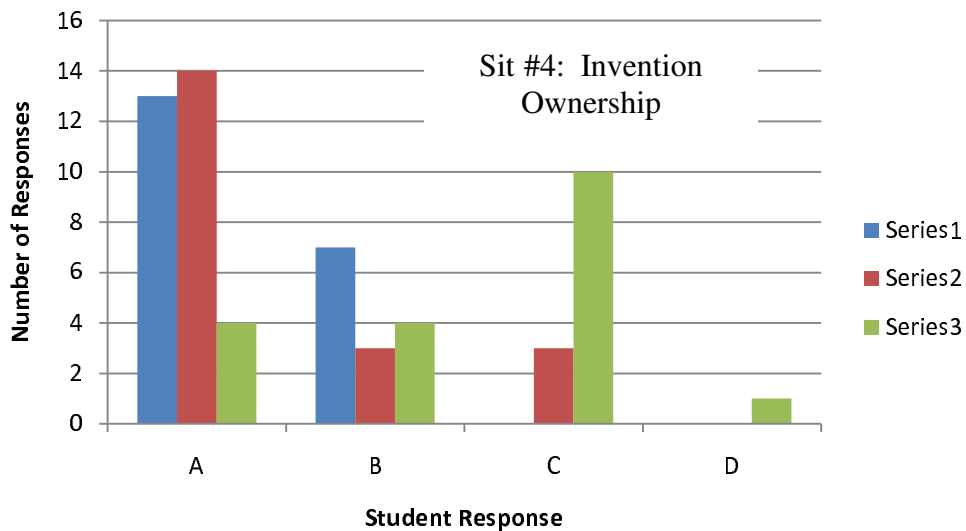

Figure 4: Student Response to Situation 4 Dealing with the Legal Disposition of an Employee's Invention Developed Using Company Lab and Facilities.

Situation #5 places the students in a company working for "Production Control." They are planning on adding a porch onto their house, so they visit a lumberyard to get ideas and a price. During the discussion, the sales manager recognizes the employee as working for a company that routinely does a large volume of business with the lumberyard. Subsequently, the salesman decides to give them a special discount. Students were challenged to consider the following responses:

A. Like finding a $20 bill on the street. take the discount, of course.
B. Explain to the sales manager that they are in production control and not purchasing at the Company.
C. Ask for clarification about whether the special discount is available to all Company employees.
D. If a deal sounds too good to be true, it probably is. Thank the salesman, but walk out.

Rather surprisingly, the students relatively consistently settled on the correct response of asking for clarification. However, the scenario provided a great forum for discussing a number of items in the news about kick-backs, graft, and bribes from businessman, lobbyists, and politicians.
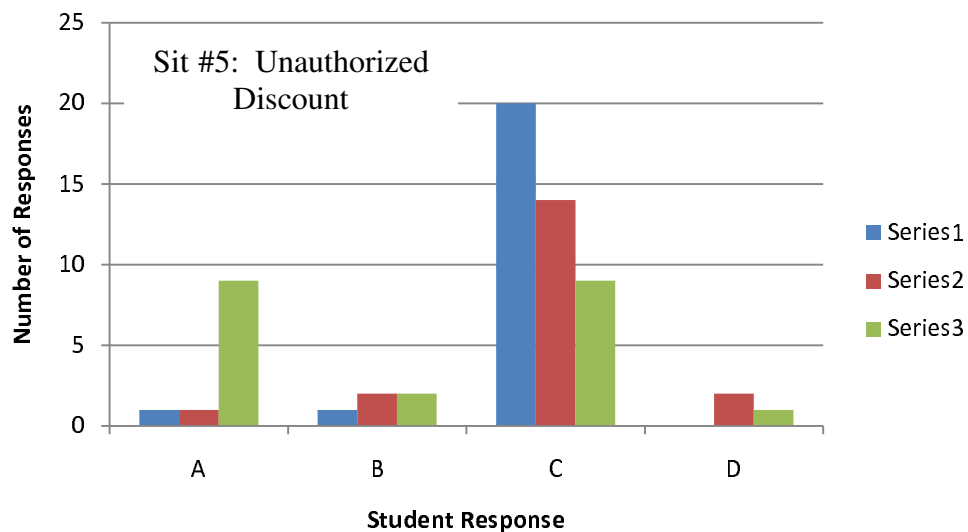

Figure 5: Student Response to Situation 5 Dealing with the Offer of an Unauthorized Discount by a Lumberyard Based on the Employee's Association with a Company that is Also a Customer.

Situation #6 describes a co-worker at a defense plant who signed up for a training course. However, the student has knowledge that he did not attend the course but was not at work either. They had to determine the best way to handle the situation based on the following responses:

A. It is not your business, so stay out of it.
B. Speak to your supervisor about the co-worker's absence.
C. Send an anonymous letter to the company's ethics office.
D. Speak to your colleague about this discrepancy and see what his explanation.

This question seem to split the general students concerning whether they should get involved. Nearly a third of the respondents were determined to confront the co-worker in an attempt to ascertain what happened. Although some were intent to hold him accountable; under an apparent air of collegiality, others expressed concern that something bad might have happened and he needed some assistance. Nevertheless, almost half thought that it was mot there business and that response "A" was the correct response.
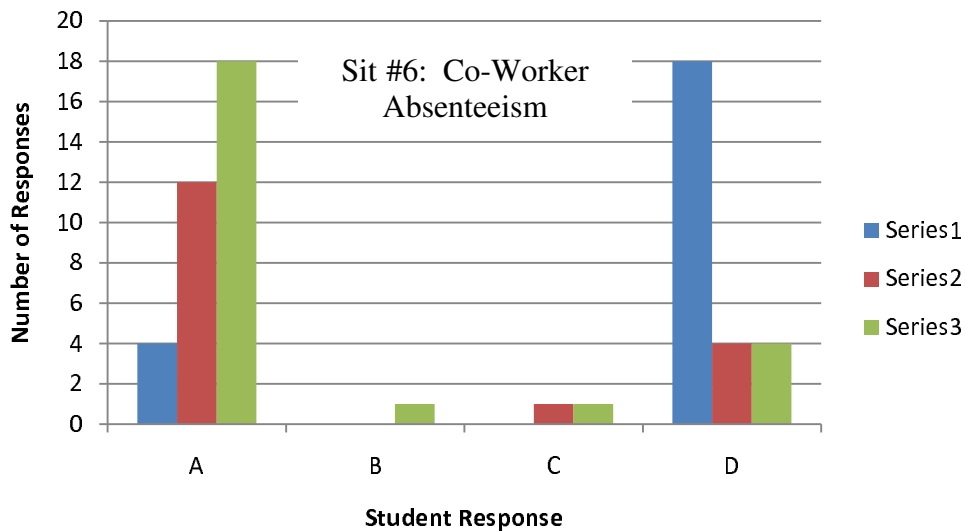

Figure 6: Student Response to Situation 6 Dealing with a Co-Worker's Unauthorized Absenteeism.

Situation #7 involves a male supervisor talking to a female employee and routinely addressing her as "Sweetie." The student has overheard him several times. The student was to assume the role of the male's boss. As the supervisor's manager, should they do anything? Students considered the following responses:

    A. No, since no one has complained.
    B. Yes, talk to the supervisor and explain that, while he may have no sexual intention, his use of "Sweetie" may cause resentment among some of the employees.
    C. Yes. Order the supervisor to call an all-hands meeting and apologize for the unintended slights.
    D. No, because there is nothing wrong with calling a female employee "Sweetie" or other endearment.

Although this scenario generated a heated discussion at to the correct definition of what constitutes sexual harassment, the overwhelming majority of the class recognized that the supervisor had indeed crossed a line and that as his manager, they had a personal responsibility to act.
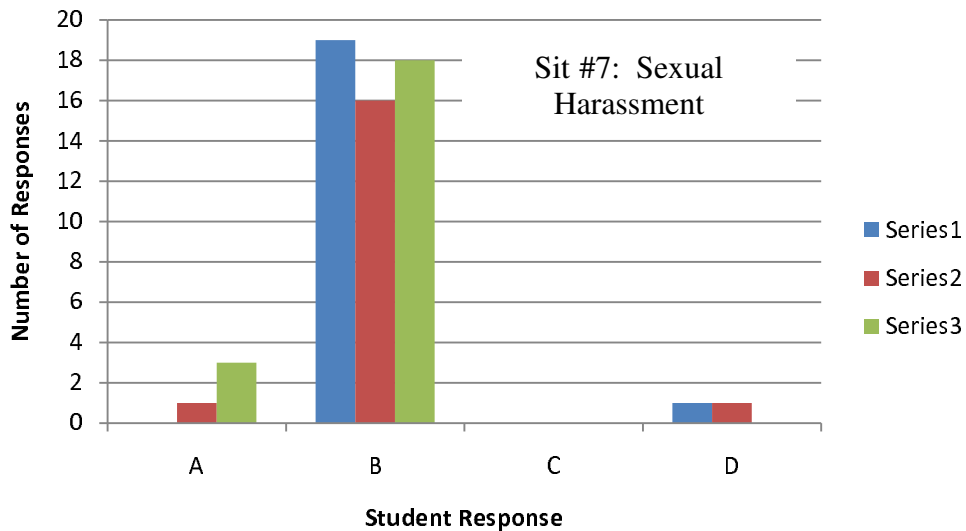

Figure 7: Student Response to Situation 7 Dealing with Sexual Harassment.

Conclusion

    Assessment and evaluation of the TC2K Criterion 2 Program Outcomes has now been in the field for six years. Nevertheless, the engineering technology

community continues to struggle at times to find appropriate opportunities, venues, and techniques to development student skills consistent with those less technical, more "soft" yet essential skills that allow engineers to effectively function and grow as members of the society that they serve. This paper demonstrates that even a general multi-disciplined junior seminar can be a viable medium for implementing process improvement initiatives supporting these critical outcomes. Certainly, this one-hour course should not represent the complete treatment of the outcomes within the curriculum, but this paper testifies to the potential that this target of opportunity provides for the faculty member who is committed to continuous improvement of a program dedicated to produce graduates with the requisite skills and abilities for success in a ever-increasing technical and complex world.

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