Integrating Ethics into an Engineering Technology Course: 
An Interspersed Component Approach

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Abstract

The format or approach to teaching professional ethics in engineering or engineering technology can be troublesome. The issue is often how to present ethics as an important aspect of the technical profession, without hindering the learning of more technical matters. To accomplish this, institutions have employed a variety of approaches, each with its strengths and weaknesses.

Purdue University is successfully using an interspersed component approach to this challenge at one of its outreach sites. A three-week ethics component is woven into the capstone A.S. MET course. This component surveys ethical principles, reviews a professional code of ethics, teaches a structured case analysis strategy and requires student case analyses.

A number of aspects make this approach attractive. These include fitting it into an existing curriculum, connecting ethics to technical work, providing adequate case analysis time, and giving instructional flexibility. The detailed instruction component also overcomes many of the described weaknesses of other approaches.

Introduction

The call for inclusion of professional ethics instruction has resulted in a variety of curriculum structures and instructors’ credentials.[1] Among them, are:

- A free-standing ethics course (required or optional), by technical or philosophy faculty
- An ethics component within a free-standing “professionalism” course [2]
- An issue for review within a senior project/thesis [3]
- Integration of ethics throughout the curriculum [4]
- Commingling ethical issues and problems in technical courses [5]

While these approaches evolve around local constraints and preferences, they also reflect the compromises made among somewhat conflicting methods.

For instance, few technical curricula can easily incorporate a required ethics course, even though such status can highlight the importance of ethics. And yet, segregating the subject—even within a “professionalism” course—tends to separate ethics from the core aspects of technical problem-solving. Injecting ethics into a student design project can prove too little, and perhaps too late. Integrating ethics throughout the curriculum can begin to overcome this, by bringing ethical considerations into many technical courses. However, dispersion can bring dilution, undermining effectiveness. Furthermore, practicing detailed, time-consuming, ethics case analysis can distract from and interfere with learning technical concepts and problem-solving skills.
Beyond these considerations, there are the options of actual course content. The instruction could include general morality and ethical theories. It might instead simply address the ethical expectations of society or the profession. Professional ethics instruction often includes a structured means of analyzing the situation and deciding upon an action. Ethical cases can be incorporated into the instruction, to provide the students the personal challenge of responding to a dilemma. These can be short “yes or no” type cases or complex ones, requiring more detailed analysis.

A Different Component Approach

Purdue University’s School of Technology offers the first two years of many of its four-year engineering technology programs at sites across Indiana. Most A.S. graduates at these sites do not relocate or commute to distant campuses to complete a Bachelor’s degree. They instead generally proceed directly into their technical professions. Consequently, at the Richmond, Indiana site, ethics instruction was incorporated into a “host” A.S. Mechanical Engineering Technology course.

The author developed a three-week ethics component that included both a professional ethics overview and a structured case analysis strategy. The overview covered the concept of a good ethical decision, as well as ethical principles, values, and rights. For example, students considered the principles of honesty, nonmaleficence, fidelity, and autonomy; as well as the rights to privacy, knowledge, due process and others.

Key to the ethics component was the subsequent study and use of an ethics case analysis strategy. The method involved a careful review of case details, identification of stakeholders, generation of reasonable decision options, and assessment of principles violations and consequences. The process also considered compliance with ethical theories, company policies and a professional code of ethics. Students were taught to follow the strategy through an analysis of each option and finally to make a decision.

Use of the case analysis strategy proved very successful, particularly when a case reflected the complexity of an actual workplace. A specially designed worksheet [6] (Figure 1) helped the students compile the case information and spot important relationships. This careful analysis and its documentation took students hours for each case. The approach brought them through a thorough consideration of relevant ethical issues.

However, perhaps the most crucial instruction decisions involved how the ethics component was incorporated into the host course. First, the chosen host was an applications course, involving “real world,” technical problem-solving. Second, ethics was not “commingled” with technical instruction. Third, the ethics sessions were interspersed through the semester. Fourth, the ethics sessions were scheduled to accommodate the other course needs. As the course proceeded, it was the interspersed nature of the ethics component that proved to be the structure’s key aspect.
## Ethics Case Study Worksheet

<table>
<thead>
<tr>
<th>Claimants/Stakeholders</th>
<th>Decision Factors/Criteria</th>
<th>Decision Options</th>
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<td>Principles/Values</td>
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<td>Equal Consideration of Interests</td>
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<td>Privacy</td>
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<td>Free Expression</td>
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<td>Due Process</td>
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<td>Safe Workplace</td>
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<td>Property Ownership</td>
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<td>Profit Earning</td>
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<td>of Future Generations</td>
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<td>Self-Interest</td>
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<td>Justice</td>
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<td>Ethical Theories</td>
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<td>Rule-Deontology (above items)</td>
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<td>Act-Utilitarianism</td>
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<td>Egoism (violates ECI)</td>
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<td>Company Policies/Procedures</td>
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<td>NICET Code of Responsibilities</td>
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Figure 1
A Component Structure and Schedule

Using the above elements, the author developed and implemented a six-session ethics component.

The first session provided the overview of ethics concepts. Students reviewed background material on ethics principles and theories, along with the role of professional societies and codes of ethics.

The subsequent session introduced the case analysis strategy. The instructor detailed the analysis steps and briefly showed how the strategy would be applied to a sample ethics case. Before adjourning, the students received and reviewed Ethics Case #1, their first case analysis assignment.

Two weeks later, the students met for the third ethics session, where they submitted their Case #1 analyses for grading. The instructor facilitated an extended class discussion of their results and then distributed Case #2. At least one week prior to the following session, the instructor returned the graded, Case #1 analyses.

Two to three weeks separated the subsequent ethics sessions. At each, the students again submitted and discussed their case analyses and, except for the final ethics session, received a new case assignment. With the structure described (nine weeks minimum span), the six sessions included the preliminary ethics instruction and four case analyses.

The instructor decided when to begin and how to intersperse the ethics sessions within the host course. The ethics material could have begun the semester or been delayed until the host course had progressed through its introductory material. Ethics sessions could have been placed between or aligned with host topics, maintaining at least two weeks between cases.

Benefits of the Component Approach

The interspersed component approach has a number of positive attributes. These involve the relationship of ethics to other technical topics and the effectiveness of teaching both.

The interspersed component promotes ethics within the context of the technical coursework. The topic is unmistakably within a technical course, yet is given focused attention. Students return to ethical considerations again and again during the semester. This repetition in the midst of technical endeavors is one means of connecting the two activities.

Another avenue is the tailored ethical cases used. By ensuring that the cases are set in the technical workplace, with believable characters and circumstances, students see that ethical issues will be part of their professional life. Through technical case settings, students connect their roles as professionals with their roles as moral agents.

While technical and ethical issues are integrated, the associated, detailed analyses are generally complex and mostly parallel. Ethical decision-making usually involves people, policies, use of information, and/or how to proceed—not the actual execution of technical analyses. If a
particular ethics case analysis should require a computed value, the instructor can provide the numerical results or options.

True commingling of ethical and technical analyses can be counterproductive. As long as students are struggling to perform technical analyses, concurrent ethical issues can distract and hinder technical learning. Similarly, detailed ethics analyses may be derailed, if students’ technical analyses distract or provide errant case data. Just as a pianist practices a new piece with the left and right hands separately, so a student benefits by mastering each analysis technique, with minimal interference.

Perhaps most importantly, a careful analysis of a detailed ethics case requires significant time. Students benefit from the “ponder period,” during which many of their discussions and insights occur. While technical skills are usually learned sequentially or progressively, ethics analysis skills are often learned by applying similar techniques to a variety of circumstances. The feedback loop for technical learning is therefore usually shorter, and numerical. Furthermore, by spacing case studies at least two weeks apart, the instructor has time to carefully grade and return the analyses well before the next ones are due. This timely feedback is crucial, given the limited number of cases that the students can analyze in detail.

Another positive feature of the interspersed component is its flexibility. The number of ethics sessions can be adjusted for any amount of background information or quantity of case studies. Furthermore, ethics cases can be created and scheduled where they relate to or fit well around particular host topics. Also, scheduling can complement or accommodate other course activities, such as examinations or projects.

Not to be overlooked, is the simple benefit of “breaking the routine” of the course. The occasional ethics session gives the students a change of focus, if not pace. They generally enjoy the opportunity to discuss the “grayer” professional issues with which they have just wrestled in their analyses.

The Purdue Component Specifics

The sophomore-level course chosen for the interspersed ethics component was Machine Elements (MET 214), the capstone A.S. MET course. No previous ethics instruction is part of the current curriculum. At the Richmond site, the fifteen-week, three-credit class has two sessions weekly. First implemented in the spring semester of 1996, six ethics sessions (E0 through E5) were scheduled as follows:

E0: Week #3, Session 2
E1: Week #4, Session 1
E2: Week #6, Session 1
E3: Week #9, Session 1
E4: Week #11, Session 1
E5: Week #14, Session 1

The ethics sessions were scheduled to complement the host work. For instance, analysis submission days E2 through E4 were scheduled for the meetings immediately following
examinations (the previous week). These usually were points where less host course homework was due. The introductory material on ethics (E0-E1) was covered within the course’s second examination. Graded case analyses were returned at least one week before the next were due.

Specific questions regarding the ethics component were added to the students’ course evaluations. The responses have been consistently positive, with students generally relating the study to their expectations for the technical workplace. No student has expressed any negative impact on the technical portion of the course.

Conclusions

Interspersing an ethics component within a technical course has proven successful. While no approach is perfect, this format avoids many of the common difficulties. It integrates focused ethics instruction into the curriculum without diluting it over a number of courses. Both technical and ethical problem-solving techniques can proceed on optimum schedules, without interference. The instructor can tailor the sessions and schedule to individual course or campus constraints. The interspersed ethics component offers a strong alternative in ethics instruction.

Acknowledgment

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References

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