On Teaching Engineering Ethics: A Challenge to the Engineering Professoriate

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1. Introduction

When the Accreditation Board for Engineering and Technology (ABET) established Evaluation Criterion 3: Outcome #f, it signaled a renewed interest in instruction in ethics at colleges of engineering in the United States.[1] Outcome #f states that "Engineering programs must demonstrate that their graduates have an understanding of professional and ethical responsibility."

Carefully reading this mandate, what do its authors want professors to teach? By "understanding" do they mean that our students are to be able to list and contrast the classical ethical systems? Are they to become *sensitive* to ethical issues? Are they to become more ethical engineers when they graduate? As members of the teaching profession we need guidance from ABET to give us enough information so that we can create the educational objects needed to construct the learning environment so students will achieve the outcomes it desires.

Teaching a student about engineering ethics is quite different from teaching a student to be an ethical engineer. Many, if not most, traditional engineering ethics courses and books on engineering ethics teach about engineering ethics by reviewing some of the traditional ethics literature from antiquity to the present day and by examining a variety of barely related case studies. Some of these textbooks take as a basis classical virtue theory [2]; others suggest that we teach engineering ethics from the point of view of *utilitarianism*, rights ethics, and duty ethics.[3] The problem is that the most candid authors admit that the choice of underlying assumptions about which ethical system to use determines what is to be taken as ethical behavior. For example, the authors who wrote the first book cited above remind us that "After this selection [of principles and methods], a specific range of right action appears . . . Different sets of principles and methods yield different ranges that often overlap only partially." This is not meant as criticism, but only to insist that if you want to develop "ethical engineers" this strategy is anti-theoretical.

Behaving ethically is—well—behavior. Using a modern learning theory known as *behaviorism* and a widely accepted view of how to judge the performance of the engineer, this paper gives theoretical prescriptions for creating ethical engineers upon graduation using specialized case studies. These cases use the norm of *best engineering practice* to encourage the engineer to *generalize* and *discriminate* his or her behavior and to act on this knowledge. The focus of this paper is on how you teach ethical behavior, given a reasonable standard of what ethical behavior is. With the renewed interest in ethics shown by ABET and the assumption that ethical engineers are what ABET wants, the responsible professor, chairman, and dean is obligated to develop sound strategies based on theory to teach it.

2. Developing ethical engineers

Designing a strategy to produce more ethical engineers is no different from designing a bridge. The engineering method applies to both. A good heuristic for use in both domains is first to define the problem we are trying to solve. What is our goal; what is our problem?

We will take as our goal, educational objective, or outcome: *when the course is completed, the student will be able to identify ethical behavior based on current best engineering practice.* We do not want them *just* to be "sensitive" to ethical problems in some unspecified sense; we do not want them *just* to be able to identify historical ethical systems; we do not want them *just* to be consistent with some vague, ill-defined definition of good or truth; and we do not want them *just* to propose alternative interpretations of engineering situations from the points-of-view of different ethicists. All of these results may be welcome as by-products of our efforts, but our central focus is on action. Ideally we want one engineer, at one moment, working on one project, to make one judgment—then the next—the next—and the next—such that a consensus of creditable engineers, managers, laypersons, judges, commentators, and whistleblowers will all label them as ethical. (We will have more to say about the important word *creditable* in what follows.)

Our ultimate goal is for engineers to behave ethically. Most already do. Unfortunately some do not and we need to avoid any erosion in the number of ethical engineers in the future. One clear example that most engineers would surely say is unethical will warn us of this danger. Following in the wake of many psychologists, psychiatrists, and lawyers who will testify on one side or the other in a legal case, there is a disappointing increase in "engineers for hire" who will say anything on any side of a technical question once they take the witness stand. The motivation for this emerging trend is perhaps the money they are paid, but more likely it is the feeling of power to decide important liability claims as at least one thoughtful judge has suggested.[1] Barring exceptions similar to this example, the general reputation of the engineer is for ethical conduct. Even the failure of a large engineering project does not, in general, seem to be interpreted by the public as a lack of engineering ethics. The public intuitively understands that it is usually the technical aspects of the problem that are causing trouble, not the ethical ones. In national polls of the most respected professions, engineers vie for the higher ranks instead of competing for the lower ones with the politicians, lawyers, and car salesmen. By and large, engineers and their judgments are viewed as somber, thoughtful, helpful, objective, and ethical. If anything, engineers are viewed as too staid.

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[1] Judge Fern M. Smith, U.S. District Court for the Northern District of California and director of the Federal Judicial Center. Private communication during the National Academy of Engineering committee meeting on Engineering Ethics.

Educational outcome determined, the way is now clear. As is true in all good design projects, let us first check the relevant theory.

3. The theory: behavioral model, theory of engineering, and technical digression

This article depends on two fundamental choices: a theory for how students learn and a theory for the appropriate standard to use to judge ethical engineering behavior. This section outlines, justifies, and gives references for further study for the choices made in these two areas. Then it differentiates between the strategy proposed here and the "stakeholder" view of professional ethics.

3.1 Behavioral Analysis

Both identifying what is ethical and acting on that knowledge are human behaviors. They are something an individual does. Theoretically if we are to claim that an individual is behaving ethically, we should be able to identify specific actions that we identify as ethical. The analysis proposed here is based on a theory of learning or modifying behavior developed by B. F. Skinner called *behaviorism*. [4]

Other learning theories exist, to be sure, and new ones come into vogue periodically. For example, we are currently seeing a surge of interest in constructivism and the various models based on cognition. Behaviorism was chosen for a variety of reasons. First, it is currently a highly respected view of behavior [5, 6, 7, 8] used to develop complex behaviors above the level of simple skill formation.[2] Second, the work of Skinner is clear, unambiguous and has been experimentally validated by an extensive body of research on many species—from the lowly *Planaria* to the human—over a very long period of time. In addition, many of these alternative theories can be subsumed into behaviorism. For example, *constructivism* which encourages students to learn on their own would be viewed by behaviorists as simply exploiting the reinforcing effect of a person solving a problem on his own. Professor Skinner is even said to have identified the *Id*, *Superego*, and *Ego* of Freud as nothing more than a set of behaviors that are seen frequently conjoined in humans because of past, common contingencies of reinforcement.

Behaviorism (or reinforcement theory as it is sometimes called) is based on the Thorndike's Law of Effect. [9] This law asserts that behavior is modified by its consequences. Therefore, to modify an engineer's behavior to make it more ethical (or to maintain the ethical behavior we now see), we must reinforce (reward) good behavior and ignore bad behavior. Theory predicts and experiment confirms that this strategy increases the probability that the individual will exhibit the desired behavior in the future.

Theoretically, then, we want an engineer to be able to identify ethical behavior and, secondly, to act on this knowledge. In the analysis to follow, we will need to use two common words *generalization* and *discrimination* in their technical, behavioral senses.[9] A specific example will help make them clear.

[2] Support for this claim comes from the well-known Professor of psychology, Dr. George Semb, at the University of Kansas and his colleges who provided the references cited. Dr. Semb does extensive research in the application of both behaviorism and cognitive psychology to learning.

The engineer must be rewarded when he or she is presented with or acts appropriately in a situation that is identified as ethical. The engineer will then *generalize* to other situations that bear some resemblance to the one now recognized. If a new situation that is similar is subsequently labeled as unethical, the student learns to *discriminate* ethical behavior from unethical behavior. For instance, all of us can distinguish between a dog and a horse. We learned this behavior so long ago that most of us have forgotten how we learned it. Our parents must have rewarded us with parental approval and said *good* when we first identified a dog. The child will try to generalize this knowledge to get the reward in future, sometimes inappropriate situations. To quote the well-known learning psychologist, Dr. Keller, [10]:

> In everyday life, examples of generalization are so common that they go unnoticed. They are most obvious, perhaps, in children, where they are often amusing. Parents smile at the child who calls out "Doggie!" at the sight of a horse, a cow, or some other four-legged creature; or they may laugh to hear a child say that soda-water "tastes like my foot's asleep."

What we are seeing is the first step in concept formation called *generalization*. The second step is to make distinctions between the dog and the horse by *discrimination*. For this step to take place, we must present examples of dogs and horses randomly and reinforce the correct response. If you want a behaving organism to learn a concept you must present a large number of exemplars with and without this concept and reward generalization and discrimination.

Note well several important characteristics of concept formation. We will need them later. (1) The samples we present when we are training must be dogs or horses. If we suddenly present a bird instead of a dog or a horse under the guise of teaching the difference between dogs and horses, the essential generalization will be weakened. (2) It will not do to only present the child with dogs. You cannot learn to distinguish between dogs and horses if you never see a horse. (3) The parent must know for herself the difference between a dog and a horse. (4) A time stamp must tell when the learning took place. The definition of a horse has changed over time. In the distant past, horses were the size of the modern dog. It would be a pity for a budding paleontologist to not recognize a horse from the past because our faulty training failed to tell her when our definition of a horse was appropriate. If our training set does not have these characteristics, the child is left flailing about trying desperately to understand what is expected of her. We will return to these characteristics later. See any good book on learning theory such as those already cited or the programmed text [11] for a more detailed look at this theory.

3.1 Best engineering practice

Our major problem is knowing what a dog is. All that needs to be done (using the word *all* somewhat cavalierly) is to determine a justifiable, but perhaps fallible, standard for ethical engineering behavior against which engineers and engineering students can normalize their behavior. The second theoretical requirement for achieving our educational objective, then, is a philosophy or theory of engineering—a theory for the appropriate standard to use to judge ethical engineering behavior.

The choice made in this article is based on the author's research over the last 37 years into the philosophy of engineering [12, 13] and an extension of it to engineering ethics. Basically this research claims that all engineering is based on heuristics and that the fundamental Rule for Judging an engineer is to

> Evaluate an engineer or the engineering design against the state-of-the-art (or set of heuristics) that define best engineering practice at the time the design was made.

We need a suite of examples for the state-of-the-art that represents *best engineering practice* as it concerns ethical and unethical behavior in specific, but very similar, cases, confident that the practicing engineer will *generalize* and *discriminate* the results to the case at hand when perplexed as to what should ethically be done next.

A single professor or even a single book is clearly not a satisfactory arbiter of ethical engineering practice. We all have hidden, and not so hidden, agendas. Individuals with a conservative bent will naturally respond to ethical questions differently from those with a more liberal one. Conservative nuclear engineers will emphasize the ethical importance of providing an assured supply of energy for human needs; liberal nuclear engineers will emphasize the unethical requirement this lays on future generations to subsidize the present generation by storing the waste product for centuries into the future. Will the professor convinced that the environment is threatened set the same ethical standard as the professor who feels that it is not? In the difficult area of defining engineering ethics, even the best intended, but isolated, individual is wanting when it comes to determining a standard of behavior for the profession.

We only improve the situation at the margin by slightly increasing the number of engineers or by using professional ethicists in the determination. Moving from one individual to five, to seven, or even to twelve and then claiming that we have found the ethical behavior of the entire profession is an extrapolation so large that any competent engineer would refuse to make it in an equivalent technical area. Involving a small number of philosophical ethicists who have only hearsay knowledge of engineering in the effort to determine a standard for engineers will only do little to improve the situation. What we need is a consensus of the largest possible number of credible engineers, engineering ethicists, ethicists, engineering professors, developers of codes of ethics, members of society, media, lawyers, and so forth to decide what can be reasonably taken as *best engineering practice*. And, most importantly, they must tell us what is to be taken as ethical and what is to be taken as unethical behavior. We can expect that there will always be honest disagreements over what is *best engineering practice* just as there are honest disagreements in most areas of human activity.

How are the credible individuals to be chosen? Heuristically, of course. When we seek the state-of-the-art in the technical domain to evaluate, say, product liability we are also required to use heuristics. We include in the evaluation engineers who have an established reputation through research, past experience, knowledge, and so forth to aid in the consensus. This model is directly transferable to the ethical determination. Over time, companies, individuals, professors, laypersons, and engineering ethicists are recognized for their knowledge and judgment. What we seek is as near a consensus as possible from as large a number of credible individuals as possible.

We are aided in our endeavor by a characteristic of the problem that is often overlooked in books on engineering ethics. Engineering ethics is a subset—a relatively small subset—of all ethics. This simple fact makes our task as professors more manageable in two regards. First, we do not (nor should not) have to teach all of ethics. For example, different religions disagree in important areas as to what constitutes ethical conduct. Although a course in ethics in the *philosophy* department must confront these differences and examine the theoretical bases of the competing claims, this is not the purpose or obligation of a course in the *engineering* department. The requirement to teach only ethical conduct with respect to engineering behavior greatly simplifies our task and counsels against too much class time allocated to the more esoteric notions of ethics. Second, surely we desire the engineer to "play down the center of the field ethically instead of running down the sidelines trying to stay in bounds." Consensus on what constitutes ethical behavior under this condition is easier to achieve than in the more controversial situations.

We can probably never say for certain that a specific engineering decision is ethical. In the best case we would like to be able to say that a representative sample of credible engineers, administrators, engineering ethicists, and members of society think that it is. In the worse case we would like to claim, for example, that a consensus of honorable engineers finds it ethical, but an equally honorable consensus of managers or engineering ethicists or members of society or professors or whoever finds it unethical for the specific reasons that are given. Either option is the only justifiable standard against which we should measure ethical behavior—the larger the sample, the more justified it is.

3.3 Technical digression

Finally, this section ends with a short technical note that may not be of interest to all readers. Some have confused what is proposed here with an emerging theory in professional ethics, specifically in business and biotechnology.[14, 15, 16] This is the "stakeholder concept" popularized by R. Edward Freeman, director of the Olsson Center for Applied Ethics at the University of Virginia.[17] Freeman includes in his list of stakeholders suppliers, customers, employees, stockholders, etc. and tries to analyze ethics in light of the conflicting claims on a company. Quite apart from the value of this theory, the philosophical basis of this paper lies elsewhere. Rather than adjudicating conflict, we seek consensus and take our lead from Wittgenstein.

Ludwig Wittgenstein is a respected contemporary (he died in 1951) language philosopher who incidentally studied mechanical engineer in Berlin and practiced engineering in Manchester, England. He specifically claims that his most famous philosophical work, *Tractatus Logico-Philosophicus*,[18] is about ethics although the concept is hardly mentioned. In his famous essay "Lecture on Ethics"[19] delivered in 1929 at Cambridge University, Wittgenstein said "the tendency of all men who ever tried to write or talk Ethics or Religion was to run against the boundaries of language," i.e. to talk or write nonsense.[3] His solution according to the Internet Encyclopedia of Philosophy [20] to "living right [and we would argue to practicing engineering ethically] involves acceptance of or agreement with the world…." Our claim is that best engineering practice determined heuristically by the largest group of heuristically chosen engineers whose credibility is heuristically chosen meets the standard set by Wittgenstein.

[3] Here Wittgenstein is using the term nonsense technically as beyond the reach of language.

4. The case method

Now that we have a standard against which we can reinforce ethical behavior, in principle, our work is done. Theoretically all behaviorism suggests we now do is wait for ethical behavior to occur and reward it. This strategy is impractical in the present situation, however, because we want to begin teaching ethical behavior in universities where students are not actually in true engineering situations, unethical behavior occurs very infrequently, and we do not have direct access to appropriate, timely rewards.

To solve these problems, the knee-jerk reaction when improvements in engineering ethics instruction is being considered is to propose one more random addition to the overflowing library of engineering case studies. In essence, the case study is being used to simulate the relevant aspects thought to be important in an actual, real engineering situation. As we will soon see, engineers have been writing cases for a very long time and are still hard at it [21, 22, 23]. Ultimately, we will propose the same educational strategy in this paper, but with a significant difference—the cases must be designed so that the reader is able to *generalize* and *discriminate* among the ethical axes of the cases. In other words, the cases we propose must make a difference in teaching ethical behavior. Now we turn our attention to the notion of case studies, and, then, we propose several characteristics of a case study that will help students distinguish between ethical and unethical behavior.

5. Historical use of case studies

Case studies have been used in engineering education for a very long time. The Engineering Case Program began at Stanford in 1964 [23]. This reference also states that [at the time] the case method of instruction [had] been very successfully used for about a century in teaching law and for about half a century in teaching business administration. Engineers of all stripes have churned out many descriptions of engineering projects and they are used in the classroom to teach engineering students engineering design. From the beginning, cases in the Stanford library were labeled according to the area of study for which they were most appropriate. One of the classifications of engineering cases has always been *legal & ethical*. I have engineering cases in the office as I write so labeled and have proposed their limited use in teaching engineering design [24].

Students undoubtedly learn from case studies and associated activities. Cases give a glimpse of how engineering design was done in a specific situation at a specific time and invite the student to emulate (or in the case of a bad design) not to emulate it.

Past uses of cases to teach the technical aspects and the ethical ones have not been equivalent, however. We expect the professor to be knowledgeable of the state-of-the-art in the technical areas and to reflect *best engineering practice* in the chosen technical area. If a case study uses the Colburn relation to calculate the heat transfer coefficient, the clear implication is that its use is consistent with the view of, say, 90% of the interested parties (in this case, the practicing engineers and engineering professors) in a similar situation. We expect professors to keep up with the literature, to attend appropriate conferences, and to perform research in the chosen field. Using case studies, a student can *generalize* and *discriminate* the appropriate technical solution strategies with confidence. She will leave satisfied that she has learned vicariously how to act when she wants to be consistent with the technical aspects in the state-of-the-art that represents *best engineering practice* in technical matters.

Typically this is not the situation when cases are used to teach engineering ethics. We cannot assert with equivalent confidence that at least 90% of the interested parties (practicing engineers, members of society, engineering ethicists, administrators, and whistleblowers) would agree on the ethical behavior taught in ethics courses. Engineering professors ordinarily do not keep up with the ethics literature, do not attend conferences on ethics, or perform research in the area of ethics. Students will leave unsatisfied when it comes to knowing how to become consistent with the ethical aspects in the state-of-the-art of *best engineering practice* in ethical areas.

This indecision and equivocation is a plausible reason for the feeling among too many students, professors, and practicing engineers that the commitment of colleges of engineering, departments of engineering, and societies of engineering to engineering ethics is, at best, superficial. In one extreme case, a competent, well-prepared, enthusiastic professor taught an ethics course that was labeled by the students as "The course from hell."—a truly ironic comment for a course in ethics.

6. Proposed use of cases

Whether or not ethics is taught "across the curriculum," in a specialized course in engineering, as a part of the design sequence, or by a combination of all of these, the theory is clear: for engineers and engineering students to *generalize* and then *discriminate* when it comes to ethics, first, we need concrete cases of both ethical and unethical behavior, or, at least, the best approximation we can find to them and, second, they need to be clearly labeled as one or the other against the best, most objective, most universal standard possible or at least the best approximation we can find to it.

Let us generalize on the theoretical characteristics of concept formation given earlier to aid us in the development of appropriate case studies.

1. **The samples we present must be dogs or horses.**

   A good case in point is the Challenger Shuttle disaster. In any conversation of engineering ethics it is just a matter of time before someone mentions this failure. The participants seem to vie with each other to be the first to bring it up. But what is the clear ethical issue? I am suspicious that the managers of this project are often abused. As you recall, in 1986, a launch by NASA of the Space Shuttle Challenger exploded soon after take-off. A large investigation of the failure by a "blue-ribbon" committee named the Rogers Commission after its chairman, took place [25]. This committee found that in essence, the engineers assigned to the project recommended that the flight be scrubbed. This advice was not followed by management. One engineer was told to "take off your hat as an engineer and put on your management hat" before you give your answer. As events unfolded, the engineers were right in their technical assessment and the flight failed. What are the ethical issues that warrant the retelling of this story, and who is qualified to assert that they are the appropriate ethical issues?

Certainly the launch of a space shuttle is a complex system with many trade-offs.

Certainly different engineers, managers, and politicians will have different criteria and different weighting coefficients between them as they produce their optima.

Certainly no engineer, manager, or politician wants failure and people killed.

Certainly we can learn from the failure of one organizational structure and create a different one for the future.

Certainly the trade-off between listening and following the advice of the engineers and considering other criteria turned out to be wrong—but was it unethical? Is there any chance we are looking at a bird while trying to learn the difference in a dog and a horse?

It is instructive at this point to pose the following strategy. Ask the nearest ethics teacher whether or not, based on the short description in any book, if they would say it is definitely unethical.

It is simply not true that all differences of opinion between management and engineers must be decided in favor of the engineers, even in matters that have a technical component. Managers and engineers operate in different optimization spaces. To deny the possibility that managers can be aware of important criteria unknown to engineers is inadmissible.

Ironically as this paper is being revised, a second shuttle failure (the Columbia) has taken place. The cause of the problem has not as yet been determined. One possibility being considered is the loss of foam insulation and its impact on the left wing of the spacecraft. In this case, the engineers studied the situation for two or three days and management followed their advice that there was no cause for concern. As we await the final verdict, should we label managers as ethical or unethical?

Cases to teach ethical behavior must raise ethical issues. If they do not, students will flail about and become justifiably confused as to what an ethical issue is. My concern is simple: based on the two page description in most descriptions of the space shuttle event, is the ethical professor prepared to say it is ethical or unethical?

2. It will not do to only present the child with dogs.

Assuming that not "following the engineer's recommendations" was one of the ethical issues, can we find other cases in which the engineer's judgment was taken and produced suboptimal results? If we do not do this, then theoretically students will learn that it is only ethical to listen to engineers irrespective of their track record in the past, the relative importance of the decision to the overall success of the project, and the probability of error in their conclusions. We need to see a horse.

3. The parent must know the difference between a dog and a horse.

To summarize and repeat what has come before: In the best situation we would like to label a case by saying that a national consensus of engineers, engineering ethicists, members of society, managers, and so forth felt at a specific time that this behavior was ethical. Lacking that, we might be interested in saying that at a specific time a consensus of nationally recognized professional engineers found this behavior to be ethical, but a consensus of credible ethicists of the same period found it to be unethical for the following reasons. What we cannot do is ask a group of students to study the case, discuss it, and reach a consensus as to whether or not it is ethical. I am reminded of the retort of a favorite professor of mine when I suggested a similar solution to a difficult sociological question as a young professor. He asked me if I thought we would get any useful information if we asked a group of six year olds the distance to the moon. Before we call NASA with crucial information for the next moon launch, we should certainly know the capabilities of the group that supplies the information. If we cannot tell the difference between a dog and a horse, how can we expect to be able to teach someone else to do so?

4. A time stamp must tell when the learning took place.

Ethical behavior has certainly changed in the past and will change in the future. A case study must be clearly labeled to tell when it was considered ethical or unethical. Our present glasses did not necessarily correct our hindsight to 20/20.

I suspect that the Challenger story is so persistently used by engineers in discussing ethics because it is self-serving and puts engineers in a good light—and that most certainly *is* unethical.

Few, if any, suites of engineering cases provide all of this information or have a defensible basis for teaching *generalization* and *discrimination*. If a case does not, it could conceivably sensitize a student to engineering issues, teach them to distinguish between rival ethical theories, teach how to interpret a situation differently depending upon different ethical views, but it most certainly does not teach a student how to behave ethically. Only a series of cases that teach a student to *generalize* and *discriminate* against some declared, albeit approximate, norm can do that. The theory is unyielding.

7. Conclusions

This paper promised progress toward defining engineering ethics, at least in the opinion of one engineer. The clear implication was that if we could define ethical behavior, we could help engineers achieve it. Retracing our steps to review the major landmarks of this paper will show how closely we have come to our goal. It will then allow us to suggest what we can do *practically* to achieve the objective of producing ethical engineers.

Theoretically, modifying behavior so a behaving organism will learn to recognize a concept requires a standard to allow her to *generalize* and *discriminate*. *Best engineering practice* provides such a standard. This standard has been used since the beginning of engineering with respect to the technical axes; we suggest that it is appropriate for use with respect to the ethical ones as well. Case studies of engineering situations carefully chosen to contain ethical issues, carefully chosen to contain ethical as well as unethical examples, carefully labeled as to who decided which are ethical and which are not, and carefully labeled with a time stamp to identify when the judgment was made offer one way, if not the only way, to teach ethical behavior. Success of this entire enterprise depends on a practical strategy for determining a good approximation to *best engineering practice.*

8. Challenge to the professoriate

The challenge of the professoriate is clear. Rather than a knee jerk reaction to develop yet another case study that is ambivalent with respect to ethics, we need a smaller number of very specific case studies designed to contrast ethical and unethical behavior. Then these cases must be examined by the largest possible number of interested parties to achieve as near a consensus as possible. This group must include practicing engineers, professors, ethicists, engineering ethicists, members of the public, whistleblowers, politicians. Only by establishing the best engineering approximation to *best engineering practice* in specific cases can we ever hope to teach students how to behave ethically when they graduate from college. That is the least we owe ABET as professors given our new mandate.

This paper is a companion piece to a paper entitled *On Defining Engineering Ethics: a Challenge to the Engineering Community* submitted to the Liberal Division of ASEE.

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