

Debating the Ethics of Engineering Controversies: Encouraging First-year Teamwork on Critical Thinking

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Abstract: This paper focuses on an assignment Dr. Sarah Pfatteicher and I designed last fall in our interdisciplinary class, a first-year basic communication course with an engineering ethics component. Our debate assignment galvanized the students to work as a team in examining the ethical foundations of their own assumptions as well as the foundational assumptions of their opposing team. Their examination of the ethical positions involved in these controversies ultimately led several of the students to change their minds about such issues as whether the U.S. should continue to develop a National Missile Defense System, or whether Embryonic Stem Cell research should be more widely funded by the federal government. My paper explores the difficulties and triumphs of assignments such as these that challenge students to examine their own assumptions. I make recommendations about the further integration of ethics in engineering curricula, which may happen only if there are new and financially feasible opportunities in ethics training for interested faculty and instructors.

About five years ago I became involved in an interdisciplinary program which was at that time aimed at first-year curriculum here in the College of Engineering at University of Wisconsin-Madison; I teach a first-year required course in basic communication, and this new program offered a way to more closely link that communications course to other engineering, math, and science courses. Others from UW have published papers and given presentations on different aspects of the UW effort in this program, which we call “the Links Program.” “Links” is funded by the Foundation Coalition, which is an NSF program to encourage problem solving across the curriculum and link learning communities for freshmen. For my small part in the program, I have linked my communications course to a course on Engineering Ethics taught by one of our assistant deans, Sarah Pfatteicher, whose expertise is in the history of Codes of Ethics in engineering disciplines. Sarah and I are now embarking on our fourth semester of teaching this course together. This paper focuses on a debate assignment we designed last fall that really worked well to foster teamwork, develop critical thinking skills, and encourage analysis of the ethical assumptions that operate in arguments about science and technology.

I. What makes this assignment different, and thus worth sharing?

Courses like our EPD 155 Basic Communication course are taught all over this campus and indeed all over the nation; it is the ubiquitous “English 101” or “freshman composition” class that has been perhaps dreaded but usually survived by most college students in their first year. Because we are housed in the department of Engineering Professional Development, and our students are thus often science-oriented, we like to gear the assignments to technical topics, without losing a strong focus on argumentative and persuasive writing. From years of experience, we recognize that these students enter UW with some respectable writing skills – they can do narrative and descriptive

writing fairly well, but they are challenged when asked to do critical thinking and writing about arguments. This matters deeply, because these students, if successful in their academic careers, will go on to become practicing engineers who will have to write proposals, environmental impact statements, feasibility studies, risk analyses, and what have you. They will be making professional arguments, and they will be faced with arguments from others that they need to be able to analyze carefully. So, we practice that in various ways – and of course, one obvious way is to ask them to read, write, and talk about controversial issues in the sciences.

So far, nothing here is either surprising or innovative – my colleagues and I have been doing this for years. And there is nothing new in the idea to use a debate format to encourage first-year students to analyze those controversial issues – this kind of thing has been done for many, many years in courses on argumentation. What is indeed cool and noteworthy is that Sarah and I bring together several different pedagogical objectives in this one debate assignment: we want students to think critically about arguments in the sciences, analyze multiple perspectives, question underlying ethical assumptions, marshal reliable and diverse evidence, manage themselves as an effective team, and present themselves credibly to others. The hardest part to teach the students, I think, is helping them to really question the underlying ethical assumptions in arguments they read and make. For many students, and even some instructors, it is hard to objectively analyze long-held assumptions. Donna Kienzler makes this point in her discussion of ethics and pedagogy for technical communication instructors:

As critical thinking proponents reiterate, [the] questioning of assumptions is hard for college-age students, and only somewhat easier for older students. It is, if anything, even harder when questioning moves into ethical concerns.(1)

Though I have taught debate before to introductory composition classes, I've never really appreciated how valuable it can be to first teach fundamentals of ethics as a means of helping students get at underlying assumptions. It took some development on my part to be able to teach with ethics, and I'm still learning every time I try it.

II. Introducing ethics as a tool to analyze assumptions in debates.

Students will need some practice before they can effectively use ethics as a tool for prying apart arguments and examining their inner workings. We gave the students some fundamental reading in ethics -- relying heavily on a chapter entitled "Understanding Ethical Problems," in Charles Fleddermann's *Engineering Ethics*, which offers a clear and non-threatening introduction to ethics for first-year students(2). Then we began discussion pretty simply -- sometimes with just a few sample paragraphs that carried unstated but implied ethical assumptions that students were asked to then try to articulate and critique. As further practice, it helps to go in with engineering case studies -- many of which can now be found at various engineering ethics websites (like <http://ethics.tamu.edu>, a site explicitly for "Introducing Ethics Case Studies into Required Undergraduate Engineering Courses"). We also like to draw our own examples from local engineering ethics problems: one day I used the proposed expansion of Highway 12 from Middleton to Sauk City (Wisconsin) as a transportation problem that has generated arguments from many different positions. Students

brainstormed a whole list of possible stakeholders, like environmentalists, farmers, developers, cyclists, homeowners, commuters, apartment dwellers (looking for a new home in the suburbs) civil engineering firms, and the Wisconsin DOT. With students assuming some of these roles, I asked them to go around the room and articulate some reasons why they were for or against expansion of the highway, examining and articulating their ethical assumptions in the process.

In doing the Highway 12 exercise, students came to realize that sometimes stakeholders on entirely opposite sides of an argument can be arguing that their side holds the "greatest good for the greatest number of people"; similarly, entirely opposite sides might think that they are each best protecting the rights of the individual by their stance. Sometimes the "Eureka" moment happens here for some students, because when things go well they realize that even if they understand some of the ethical assumptions operating in their argument, that does not mean the argument is won with a clear victory. It sometimes means that they have to put further pressure on their assumptions, digging deeper, thinking harder about things like basic definitions and values. Ethics thus becomes a tool for the process of thinking more critically through an argument. They aren't always happy with that discovery, because it means nothing ends neatly and comfortably, but I think they come to understand that a lot of the most important arguments we face are fought out in that "gray area" - few things really are as black and white as they'd like to believe.

In preparation for the debate assignment, then, one can demonstrate through exercises like the Highway 12 example that students must be willing to examine multiple perspectives in a controversy. Understanding multiple perspectives requires careful research. Thus, our students were galvanized, first, to do reliable, credible research, because they began to really understand how the legitimacy and variety of their sources affected their own credibility and their ethics. They began to "follow the money," or in other words, to think more carefully about the politics of foundations that were supporting various arguments they were finding in their research. This approach led them to look a bit harder at published scientific studies – and they realized that not all experimental techniques are reliable. In short, some of them (many of them, I hope) stopped the bad habit of believing everything they see in print.

Maybe this made them more skeptical people, but that can be a good thing when what we really want is to encourage more careful critical thinking. The students not only put more pressure on the credibility of their sources; in the debate itself, they also began to think more critically about the ethical foundations of the arguments made by their peers. They started asking questions like "Who stands to gain from that argument? Who stands to lose? Does this trample on someone's rights? What exactly are the individual's rights when it comes to this issue? Is that trampling on individual rights justified, for the so-called "greater good"? If this is the "greater good," for exactly whom is it the greater good?" "What's in it for them?"

The students began asking these questions of each other in the process of debating scientific issues they had chosen through discussion and consensus: last fall, for example, we heard debates on whether the U.S. should continue to develop and fund a National Missile Defense System, and whether therapeutic stem cell research should be more widely restricted or more widely supported and funded by the federal

government. In debating these issues, students made arguments that were both technically complex and political; both socially responsible and ethical. It wasn't always polite, erudite, logical, or comfortable – a debate, I've found, is often somewhat messy and improvisational, but some real moments of clarity can emerge. Students find that there often aren't clear "winners" of a debate, and that argument like this is done as a process to achieve further understanding. This open-endedness can be perturbing for students who are as competitive and goal-oriented as most engineering students can be. But some students have admitted to me afterward that during the course of researching and preparing for the debate, they changed their minds about the issue entirely. That might be a modest sign of success. The debate process can help students understand what is at stake with some of the big questions that we see in science and technology today, and it also offers them a model for problem solving and self discovery.

III. The logistics of setting up and running the debate

Those who have taught debate before can skip this section; those interested in the minute details of running a debate may find it valuable, however.

To successfully accomplish all of the goals described in the previous section, the debate must be planned carefully, and I'm afraid this is something I learned the hard way when Sarah and I first used this debate assignment. I used the assignment again in the spring semester when I taught the course without Sarah, and I solved some problems by more carefully managing the teams and the time. With the aid of other writing instructors who became interested in the debate assignment, we have developed a fairly detailed assignment sheet that outlines everything the students will need to be doing, from deciding upon a topic, to sharing the research tasks as a team, to organizing for the debate, to practicing, to delivering it, and finally to writing a brief commentary or retrospective assessment of the debate.

The choice of debate topics we leave up to the teams -- usually a team consists of about 10 students (I simply split our class of twenty down the middle so that we will have two different debate topics). We facilitate their discussion by putting their topic ideas on the whiteboard and helping them try to reach consensus on a topic. When all are fairly happy with a decision, we warn them that they need to be willing to be on a side of the topic that they may not initially agree with, because of course we don't have a debate if everyone in the room is in favor of stem cell research. Then we ask them to negotiate with each other and divide themselves up equally into at least two opposing sides for the debate topic they have chosen. This is a task they really can accomplish on their own most of the time, and I like to leave it up to them to sort it out -- they feel more ownership over the process this way.

As a result of this strategy, some students inevitably end up on a "side" of the debate that they initially disagree with -- but I strongly believe that is actually productive for them. In some cases they never really thought hard about the reasons why anyone would hold this particular viewpoint, and through research, they may come to find that the initially unpopular perspective has some merits. They may even change their minds about the topic. In other cases, they find that they do not change

their mind at all, but they do discover better ways of articulating why they believe what they believe.

At this point, with Debate Team I, side A and B, and Debate Team II, side A and B, the classroom is divided up into little teams of about five persons each, and each team sets about researching different databases, sharing information and articles with each other, discussing strategies, organizing, and anticipating arguments of their opposition. Several class days must be budgeted for these team meetings, and it also is very helpful for the instructor to meet with each unit of five outside of class time, in the office, to sort out problems with focus. This last part is very important, because debate teams can wind up talking past each other unless the instructor has made an overt effort to be sure they are really arguing on opposing sides of the same issue. That special meeting can be used to iron out any team difficulties that may arise, too. First year students often have to work out how to be assertive enough in a team setting, and others need to work out how to listen and accommodate the ideas of others. As these teams work together to organize their debate and practice, they do form strong connections and invest fairly heavily in doing a good job -- they drill each other, playing devil's advocate, and they teach each other (inadvertently) some fine presenting and arguing skills.

During the debate itself, time must be managed about as judiciously as it is in a presidential debate. I ask each side to present a formal argument for about 15 minutes, then, each side gets four minutes each to raise questions or problems with the arguments of the other side. Following that, each side gets two minutes for rebuttals. Finally, each side gets one minute for a closing statement. It is helpful to have the teams prepare for the rebuttals and the closing statement pretty carefully ahead of time, and it is also fairly necessary to assign one student in the audience to be a moderator -- my "Jim Lehrer" type -- to warn students when their time is nearly up. After that, with the time remaining in class, the audience is encouraged to ask questions of either side.

Grading for the debate can also be tricky: I give a portion of the grade to the team's performance in the debate -- looking at things like how effectively they managed their time, how well they organized themselves, and how well they argued. Though grading an argument is a complicated task, I try to keep in mind that their argument needs to do the following things:

- articulate compelling reasons for their position
- show credible support for their reasons
- analyze the ethical assumptions operating in the arguments
- anticipate possible rebuttals, and
- conclude in an effective and memorable way.

Students are uncomfortable if their whole grade for several weeks of work comes down to a team grade, however. I can understand their discomfort, because sometimes, despite everyone's best intentions, teams don't work well. To address that issue, I give a portion of the grade to the individual's performance in the debate -- usually putting more emphasis on things like preparation, delivery, and visuals used. Finally, I assign that short retrospective evaluation of the debate, a written assignment that each student writes the week following the debate. In that short paper, students are asked to explore how the debate process affected their thinking about the topic, and to document which

argumentative strategies from both sides struck them as the most effective during the debate itself. This paper is often the most interesting product of the assignment for me.

IV. Pedagogical challenges in using ethics to examine assumptions.

I've already alluded to a few logistical difficulties in managing teams and time in a debate assignment, but these rank as minor issues for me. If they aren't handled well, some students will have complaints and the debates themselves simply won't run very smoothly. But even with problems such as these, the students will still learn some valuable lessons from the debate experience, and they'll probably forgive their instructor someday.

The problems that can keep one up at night are more complicated. The first, and ostensibly easiest to address and prevent, is a tendency in some students to turn their argument about the ethical foundations of a debate into a religious argument. Some students have a tough time differentiating between these things, even though, from the beginning of the course, we talk about the distinctions between ethics, law, and religion. Even if a class discussion produces useful distinctions, some students still insist that religion equals ethics for them, and they are the folks in an argument about stem cell research who will stick to their guns that it is "morally and ethically wrong to play God."

When faced with that classic argument, which is all the more compelling for some students because they see it repeated in our culture at large, I usually redouble my efforts to get the students to examine their underlying assumptions: In fact, in a moment of desperation I have personalized my response to that phrase by mentioning that my daughter was born two months early; she needed special care to survive her first few days of life – was I "playing God" to allow that? Were the doctors? Where do we draw the line on "playing God" when it comes to saving lives and alleviating human suffering? If what happened to me is "not the same thing at all," why not? (Alta Charo does a much more elegant job of analyzing the inherent problems of that "playing God" phrase in an essay whose title reveals her perspective: "Are we playing God, or Playing Human?"(3)) But I'll admit that it becomes clear from my questions that I don't see myself as "playing God," and that suggests that maybe those doing stem cell research are merely "playing human" as well. It is thus an implied endorsement of stem cell research.

At the time I launched my admittedly poorly considered response, I intended for my questions to prompt the students to re-examine their assumptions, but I'm afraid I only succeeded in convincing some of them that they would have to abandon their favorite argument, and that alienated them. It seemed as though I was disagreeing with their overall position against stem cell research, when I really just didn't find credible the way they were trying to support their position. I wanted to ask the right questions to get them to examine their position further. When things like that happen, some students may begin thinking that to do well in the course, their arguments have to be in line with my beliefs. Of course, I'd quit teaching if I thought I was doing that to my students. My mantra from the outset is that it doesn't matter where I stand on a particular debate; what matters is that each side of the debate does its best to forward

credible, well-supported reasons and to examine the underlying assumptions of their arguments carefully. But in prodding them to examine their assumptions and in trying to challenge them to go beyond religious arguments, I can see how students may think I'm denying the validity of their overall perspective. In short, a risk in questioning the ethical assumptions of students is that they may not fully understand your goal, which is to encourage further questioning -- not to mess with their belief systems as a whole.

Other writers have taken what appears to be an enviably straightforward approach to the common problem of student confusion over the religion / ethics distinction. Linda Elder, in an argument entitled "Critical Thinking: Teaching the Foundations of Ethical Reasoning," points to the example that some students will use the bible to support their claim that it is wrong to commit suicide, and with this piece of evidence (!) they will argue that euthanasia is "not ethically justifiable." Her answer to this is simply,

[Such students] fail to intellectually struggle with the problem. . . . They fail to see that, when in conflict, ethical concepts take priority over religious beliefs since the former are *universal* and the latter are *inherently controversial*. All *reasonable* persons give priority allegiance to ethical concepts and principles, whether or not these concepts and principles are explicitly acknowledged by any given religious group. (4, emphasis mine)

I'll have to admit that when I first read this passage, I was initially relieved – a ha! It seemed a rational dismissal of religious beliefs as inferior to the more "universal" ethics that all of us "reasonable" folks live by – I should just adopt this attitude in class, and maybe my problems with the religious arguments will go away. But on further examination, Elder's tone and the point are unconvincing. It seems rhetorically unfair for her to stake out the territory of what is "reasonable," suggesting that those for whom religion takes priority are unreasonable. And I'm not at all convinced that ethical concepts are "universal" – sometimes they seem "inherently controversial."

I'm still looking, then, for a better way of addressing this problem for students who want to make a religious argument rather than an ethical argument. In the meantime I'll continue to ask questions designed to get them to examine their assumptions, and just hope that I can do that in a manner that demonstrates that I am not out to bring them around to my own way of thinking; not at all. I want to encourage them to do stronger critical thinking of their own. Am I really doing that? Am I effectively questioning my students so that they effectively question themselves? I brood over these questions.

Richard Paul puts his finger right on these anxieties in his argument that instructors must be well trained to use an ethics pedagogy in an "educationally legitimate way"(5). For him, the danger is that we might "merely pass on to students our own moral blindness, moral distortions, and close-mindedness." He goes on, and painfully I might add, to say

Certainly many who trumpet most loudly for ethics and morality in the schools merely want students to adopt their ethical beliefs and their ethical perspectives, regardless of the fusion of insight and prejudice those

beliefs and perspectives doubtlessly represent. They take themselves to have the Truth in their pockets. (5)

Well, I try not to walk around carrying Truth with a capital T or even a lowercase t. But I've quoted Paul's concerns because I agree that teachers of ethics and critical thinking must be vigilant and scrupulously honest with themselves about which of their own assumptions are operating when they question their students. They must be willing to question themselves, too.

V. Conclusion and Recommendations.

I hope, by articulating some of the triumphs and the challenges inherent in this kind of assignment and this kind of class, I have laid the groundwork for these recommendations: first-year courses that integrate ethics and critical thinking have a clear value for the students, but they must be taught by well prepared and well supported instructors. I've been lucky in that I've worked with Sarah Pfatteicher through the Links Program; I've learned a lot from attending her classes as we team-taught together, and over the years we've developed what I think is a valuable course in ethical problem solving skills. I was also lucky to have extra financial support in the years when we did the most work developing aspects of our course; if I hadn't had that incentive, I probably wouldn't have added the extra work to my already fulltime teaching load.

I strongly suspect that there are well-intentioned faculty and instructors out there who would like to examine ethical implications of their engineering courses, but they hesitate to do so because they "lack time in the course"(a common lament with which I sympathize), or they lack the training that would give their ethics instruction some depth. I'd like to see more universities supporting instructional development in ethics across the curriculum, because the ethics component, when handled effectively, can significantly improve the value of many courses that require critical thinking. That integration of ethics into the undergraduate education just might be the most important piece of intellectual equipment we can offer our future engineers, and it is worth their time and ours to pursue it.

References

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