AC 2011-717: ENGINEERING ETHICS AND JUSTICE: HOW DO THEY RELATE?

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Abstract

Engineering professional societies have revised their ethics statements in recent years to include additional issues such as sustainability and environmental protection that were not in earlier statements. These changes reflect changes in our society and changes in how engineers see their role in society. This paper will examine the issue of justice, and how/whether it should be in engineering ethics codes.

One example of this issue was when members in the Engineering Ethics Division were requested to aid ASEE in a revision of its policy on engineering ethics education. We had substantial email discussions about how or whether to put topics such as justice in a society policy. No one argued for an unjust society. However, there was disagreement over whether or not engineers, as engineers, should have this as part of their task. Some proposed that engineers, as citizens, should be concerned with justice, but that it was not part of their task as engineers.

Even among engineers who are in agreement that promoting justice is part of their task, there may be very big disagreements as to how to define justice. Some engineers would support a top-down approach, whereby they seek to change government policy on justice issues. Many of those who would use the term "social justice" may fall into this camp. Another approach is a bottom up approach that seeks to work directly to empower poor people by using technology to improve their lives.

The author will use examples from his work in developing countries to show how engineers can use their skills with a bottom up approach to make real differences in the lives of poor people. As these people are economically empowered, their health will improve, and they will have the time and energy to work for governmental policy changes in their communities. This approach is consistent with ethics codes which typically hold paramount the health and safety of the public. It is also consistent with a virtue ethics approach to ethics. Virtue ethics emphasizes that we should seek to become good people, and good people will do what they can to help others in need.

Background

Professional societies have adopted codes of ethics for the membership to give them guidance when faced with difficult decisions. One example is the ASME Code of Ethics[1]. These codes have been revised as circumstances change over the years. For example, the ASME code was adopted in 1976 and has been revised in 1979, 1982, 1984, 1991, 1994, 1998, 2002, 2003, 2005, and 2009.

Sometimes the codes have been changed to reflect new interests or concerns of the engineering community. An example of this is the relatively recent addition of environmental and sustainability questions to the ASME code. ASME fundamental canon #8 states:

> "Engineers shall consider environmental impact and sustainable development in the performance of their professional duties."

Sometimes the changes to the code have been forced upon the societies and were not made willingly. An example of this is a change in the code of the National Society of Professional Engineers (NSPE)[2]. NSPE used to have a statement that is was unethical for professional engineers to engage in competitive bidding. However, that has been held by the federal courts to be a violation of the Sherman antitrust act. In response to this, NSPE has added in the following statement to their code[2].

> "By order of the United States District Court for the District of Columbia, former Section 11(c) of the NSPE Code of Ethics prohibiting competitive bidding, and all policy statements, opinions, rulings or other guidelines interpreting its scope, have been rescinded as unlawfully interfering with the legal right of engineers, protected under the antitrust laws, to provide price information to prospective clients; accordingly, nothing contained in the NSPE Code of Ethics, policy statements, opinions, rulings or other guidelines prohibits the submission of price quotations or competitive bids for engineering services at any time or in any amount."

However, NSPE wants everyone to know that they still do not really like competitive bidding, so they further state in their code[2].

> In order to correct misunderstandings which have been indicated in some instances since the issuance of the Supreme Court decision and the entry of the Final Judgment, it is noted that in its decision of April 25, 1978, the Supreme Court of the United States declared: "The Sherman Act does not require competitive bidding."
>
> As noted by the Supreme Court, "nothing in the judgment prevents NSPE and its members from attempting to influence governmental action . . ."

This means that NSPE is free to encourage governmental agencies to choose to not solicit competitive bids on projects.

The point the author wishes to make is that codes of conduct are not sacrosanct. They can change to reflect changes in the consensus of how engineers see the world. As shown by the example from the NSPE code, the legal and political system can also force the engineering community to change its codes.

Revising the ASEE policy on Engineering Ethics Education

This past year the Engineering Ethics Division of ASEE was asked to draft a revised statement to the ASEE ethics education policy which was adopted in 1999. This policy is shown in Appendix 1 of this paper. The chair of the division, Dr. Doug Tougaw drafted a revision to the policy and circulated it among the leaders of the division for our comments. His first draft is shown in Appendix 2 of this paper.

In general the reaction of the ethics division members to this draft was positive. Most of the people in the group accepted most of the draft without any problems. The areas of disagreement largely dealt with one phrase in Tougaw's draft. This phrase is shown below.

> ASEE believes that engineers must be equipped by their education to fulfill their ethical obligations to the public at large, to their profession, and to their clients and employers. The ethical issues that engineers may

> confront include personal ethical actions such as protecting the public health and safety, avoiding conflicts of interest, protecting trade secrets and proprietary information, handling gifts from contractors and others, and demonstrating honesty in research and testing. Even more importantly, engineers will also face ethical issues of global importance such as protecting the natural environment, promoting justice throughout the world, and ensuring that new technologies protect the fundamental rights of all humans.

The disagreements dealt with the phrase "protecting the natural environment, promoting justice throughout the world". While no one argued for engineers promoting pollution or injustice, several objected to the idea that justice and the environment were the most important aspects of an engineer behaving ethically.

One suggestion was to replace the phrase that includes justice with the following phrase[3].

> Given the increasingly global impact of technological development, engineers should be cognizant of the profound effect that their work can have on the natural environment and the lives of people throughout the world.

A third major alternative was suggested, which included the following phrase[4].

> ASEE believes that engineers must be equipped by their education to fulfill their ethical obligations to the public at large, to their profession, to their clients and employers and to the natural world. The ethical issues that engineers may confront include protecting the public health and safety, avoiding conflicts of interest, protecting trade secrets and proprietary information, handling gifts from contractors and others, demonstrating honesty in research and testing, examining the impact that their work may have in various cultural settings and on the existence and spread of violence. Given the increasingly global impact of technological development, engineers should be cognizant of the profound effect that their work can have on the natural environment and the lives of people throughout the world.

One of the problems we faced was that different people had different meanings to the same terms. Several of us (including the author) supported having a reference to promoting justice in the code, but we had very different personal definitions of justice. To some the term social justice has political implications and implies governmental intervention in many economic areas. To more conservative people (such as this author) social justice means equality of opportunity (not equality of result). We never really did resolve what justice means and that part of the phrase was dropped from our final drafts. Part of this issue is that some see justice as a top down issue which can be implemented largely by governmental action. Others see justice as a bottom up issue best addressed by helping individual poor people to better their lives.

The purpose of this paper is not to describe all of the negotiation that went on before we arrive at a final suggested text. However, this process shows some of the problems we have in developing a consensus when the group involved was very diverse.

We ended up voting on several different versions of the statement without reaching a consensus. Finally the Division Chair, Dr. Doug Tougaw suggested the following phrase[5].

> Given the increasingly global impact of their work, engineers must also be prepared to face ethical issues on a macro-scale and should be aware of the profound effect their work has on the natural environment and on the lives of people throughout the world.

While this was not everyone's first choice, there was agreement that everyone could live with

this proposal. Those who are concerned with peace and justice can certainly see the implication of those concepts in the code.

Dr. Tougaw then submitted the proposed version to the ASEE leadership. It was approved by the A.S.E.E. Board of Directors in January 2011. This final version is shown as Appendix

Virtue ethics and revisions to our ASEE code

The author has presented a virtue engineering ethics perspective at a prior ASEE conference[6]. Virtue engineering ethics is not a new concept. A virtue ethics approach has been discussed in a number of engineering ethics books. Martin and Schinzinger's book[7] has a chapter on moral frameworks for making ethics decisions. Virtue ethics is discussed as one of four common frameworks. Carolyn Whitbeck also discussed virtue ethics in her engineering ethics book[8]. Seebauer and Barry have written an entire engineering ethics books from a virtue ethics perspective[9].

At the heart of a virtue ethics perspective is the need to emulate the virtues in your own life. Seebauer and Barry[9] identify what are commonly thought of as the four classical virtues:

- Prudence
- Temperance
- Fortitude
- Justice

The author has personally adopted a virtue ethics perspective as his approach to engineering ethics and practice. It is also related to his work in the developing world. He has previously reported on his work in the developing world at the 2009ASEE conference[10]. He has done projects in Kenya[11], Honduras[10], and Rwanda[12]. We created a village level energy company in Honduras, using a micro-hydroelectric system to provide electricity to rural mountain villages[10]. The following from our 2009 paper[10] describes what we have done.

> During this first trip and a following trip the students did site survey work, design, construction and installation of a battery charging station. However, there was a failure to leave behind a completed business structure that resulted in a lack of accountability that would have ensured that the business and operational objectives of the project where continued. This resulted in a nearly complete "business" failure, in part because the technology was not really what they wanted, and that resulted in a lack of societal uptake and therefore a lack of societal acceptance of the battery charging station. Also during this trip, we did not have the vision or plans to try and spread the technology around to other towns in similar situations.
>
> While we have learned from our mistakes, this lack of foresight has ethical implications. It is not ethical to start something that cannot be sustained. The local peoples' hopes are raised as they anticipate an improved life, and then it is shattered by the failure of the project to continue to work.
>
> Our second try at developing an electrical system in Honduras has a very different base. We have learned a lot from our first try and from further research in the area, and although we have a similar purpose, this time we have a totally different set of directions, goals and methodologies. This time around we want to make the system sustainable in as many ways as possible, and we do want to spread this technology around to affect as many people as possible.

> It is important that the project improve the life of the people it was designed to serve. Equally important it must be seen as an improvement by the local people themselves. If the local population does not see this as an improvement, most people will not bother participate after the project team has left the country.

Our final conclusion was that we needed to practice the virtues of prudence and justice in involving the local community in our projects. This is consistent with the approach of William Oakes and Marybeth Lima in their excellent book on engineering service learning[13]. In chapter one of their book, they make the following recommendations concerning the interaction of an engineering service project with a local community.

- Think hard about how your problems are defined or framed
- Realize that engineering and technology decisions are value laden
- Realize that engineering itself is value laden
- In engineering, use systems thinking instead of linear thinking
- Engineering and technical systems should be democratic

There is a very real overlap with the virtues of justice and prudence and Oakes' recommendation to take into consideration the needs of the local community. Oakes perspective that the practice of engineering is value laden makes the need for the engineer to practice justice even more important.

Engineers and engineering students frequently do not seriously think about how their design might impact a community. The social implications of their designs are not one of the criteria that is used to assess its success. This is in contradiction to what ABET requires schools to teach concerning engineering design. Criterion 3(h) states that[14]:

> "Engineering programs must demonstrate that their students attain the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context."

Ignoring societal impacts is also a violation of most engineering codes of conduct. For example, the National Society of Professional Engineers (N.S.P.E.) states in their code as the first fundamental canon of engineering practice[2]:

> "Engineers shall hold paramount the safety, health, and welfare of the public."

Oakes suggests[13] that the practice of engineering service learning should be done in a democratic way. This does not mean that everyone votes on everything. It does mean that the local community gets input into the decision making process. This includes not only what projects to design but also how the design works. If the design works in a culturally offensive manner, it will not be used.

Another local involvement issue is that the project is frequently done for a local non-profit group which is acting in the name of the community. The faculty member must make sure the community itself really wants this project to be completed.

If an engineer seeks to reflect the four classic virtues in his life, he will want to make sure that the results of his work reflect justice for those for whom the work is done. This means that the local community's concerns and needs should be reflected in the engineering solution to their problem. This is a bottom up approach to ethics and engineering practice.

The final draft of the controversial statement in the proposed revised ASEE statement once again is:

> Given the increasingly global impact of their work, engineers must also be prepared to face ethical issues on a macro-scale and should be aware of the profound effect their work has on the natural environment and on the lives of people throughout the world.

This is consistent with a virtue ethics perspective that demands that the engineer involve the poor people whom he seeks to serve in the solutions to their problems. We need to seek to solve the problems they believe they have and not the problems this western engineer thinks they have. This approach is very consistent with our proposed revised statement that we should be concerned with the effect of our work on the lives of people throughout the world.

This does not yet answer the question of what is meant by the engineer pursuing justice. The virtue ethics perspective emphasizes each person living a life that reinforces the virtues in his life. This approach to ethics allows the engineer to demonstrate his ethics in the way he interacts with others. This is consistent with a bottom up approach to justice, demonstrating justice one person and one relationship at a time. This is consistent with an approach to justice that emphasizes equal opportunity more than equal results.

The final conclusion that our group came to on this issue was the above statement that the engineer should be aware of the profound effect of this work on the environment and the lives of people. This is very consistent with a virtue ethics perspective that emphasizes acts of personal justice by the engineer. It may also be consistent with the top down approach that emphasizes governmental policy and action; however that aspect of the issue is not the main point of the paper.

A virtue engineering ethics approach emphasizes the engineer practice the classical virtues, one of which is justice between individuals. A virtue engineering ethics perspective would suggest that justice be part of any engineering ethics code.

Conclusions

This paper describes some of the complexity of creating/revising an ethics statement for a diverse group such as ASEE. There will be differences in emphasis and even differences in how terms are defined. However, our work this past summer indicates that a consensus can still be reached.

Reaching such a consensus will require that some of the statements be somewhat open ended. The author's virtue ethics perspective and work in the developing world support the concept that we should have ethics statements that takes into consideration the needs of the people whom we wish to serve. This can be expressed as requiring engineers to demonstrate justice as part of their practice.

Appendix 1: ASEE 1999 Policy on engineering ethics education

ASEE Statement on Engineering Ethics Education

As the result of the accelerating pace of scientific and technological change which is rapidly transforming society and the economy, issues of ethical choice have taken on an increasing importance for all professions, and especially for engineering. In recognition of this challenge, ABET's Engineering Criteria 2000 include "an understanding of professional and ethical responsibility" among the general criteria for basic level programs in engineering. ASEE agrees that ethics education must be an essential element in the education of all engineers.

ASEE believes that, because engineering has a large and growing impact on society, engineers must be equipped by their education to fulfill their ethical obligations to the public at large, to their profession, and to their clients and employers. The ethical problems that may be confronted by engineers include such issues as conflicts of interest, threats to public health and safety or to the environment, trade secrets and proprietary information, gifts from contractors and others, honesty in research and testing, and yet other problems which will inevitably result from the application of new and revolutionary technologies.

To educate students to cope with ethical problems, the first task of the teacher is to make students aware of ethical problems and help them learn to recognize them. A second task is to help students understand that their projects affect people for good or ill, and that, as "moral agents" they need to understand and anticipate these effects. A third task is to help students see that, as moral agents, they are responsible for helping to develop solutions to the ethical problems they encounter.

ASEE believes that ethics education in engineering should endeavor to equip students with the skills to confront ethical problems and exercise their ethical responsibilities as engineers. While ethical issues can be raised in a lecture format, students also need practice solving ethical problems first-hand. Educators can employ a variety of problem-solving activities to give students experience using decision-making tools to handle ethical problems. These activities can involve role-playing, computer simulations, group projects, and engineering cases which involve both unusual and everyday situations. To provide this experience, engineering schools have found two basic ways to fit ethics instruction into their curriculum: by establishing freestanding courses in ethics, and by integrating ethics across the curriculum.

Whichever means is chosen to impart the ethics experience in the engineering curriculum, ASEE strongly shares the view that, to survive in the work world of the 21 century and to carry out responsibly their roles as agents of technological change, new engineering graduates need substantial training in recognizing and solving ethical problems.

The American Society for Engineering Education is a nonprofit association of more than 11,000 members representing colleges, corporation, and other organizations dedicated to promoting excellence in engineering education and engineering technology education. ASEE, which celebrated its centennial in 1993, plays a key role in developing and promoting policies that will enable engineering education and its allied branches of science and technology to meet the new challenges of global competition and technological change.

Approved: ASEE Board of Directors, January 31, 1999

Appendix 2: Initial draft of revised statement by Dr. Doug Tougaw

As a result of the accelerating pace of technological development and its potential to transform society and the economy, it has become increasingly important for those involved in the development of new technologies to exercise ethical decision-making skills. In recognition of this need, ABET's Engineering Criteria 2000 include "an understanding of professional and ethical responsibility" among the general criteria for basic level programs in engineering. ASEE agrees that ethics education is an essential element in the education of all engineers.

ASEE believes that engineers must be equipped by their education to fulfill their ethical obligations to the public at large, to their profession, and to their clients and employers. The ethical issues that engineers may confront include personal ethical actions such as protecting the public health and safety, avoiding conflicts of interest, protecting trade secrets and proprietary information, handling gifts from contractors and others, and demonstrating honesty in research and testing. Even more importantly, engineers will also face ethical issues of global importance such as protecting the natural environment, promoting justice throughout the world, and ensuring that new technologies protect the fundamental rights of all humans.

Educators can help students develop ethical awareness in many ways. The first is to be aware of their own professional actions and to ensure that they are modeling the behavior they hope to see their students emulate. By behaving ethically in the classroom, in their work as advisors, and in the conduct of their own research, educators can help students to see firsthand the importance of professional ethics. Educators should also help students to become more aware of ethical issues and to recognize ethical dilemmas and responsibilities when they encounter them. It is important that educators help students come to see themselves as "moral agents," to understand that their engineering work can have both positive and negative effects, and to anticipate and eliminate those negative effects whenever possible.

ASEE believes that engineering ethics education should equip students with the skills to confront ethical problems and to exercise their ethical responsibilities as engineers. This can be done in part using lecture, but active learning should be an integral part of engineering ethics education. Educators can employ a variety of problem-solving activities to give students first-hand experience using decision-making tools to solve ethical problems. These activities can include role-playing, computer simulations, group projects, and engineering cases that involve both typical and unusual situations. These learning opportunities can be provided to students either by establishing freestanding courses in engineering ethics or by integrating ethics across the curriculum. Service learning can also provide help students to understand the impact of their engineering work to help others, and it is a very effective way to teach students about engineering ethics.

Whichever means is used to include engineering ethics in the curriculum, ASEE strongly shares the view that it is an essential element in the education of all engineers. Only those who are prepared to recognize their ethical responsibilities and to effectively solve ethical problems will be able to responsibly carry out their roles as agents of technological change.

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Appendix 3: Final statement on Engineering Ethics Education approved by the ASEE Board of Directors in January 2011

ASEE Statement on Engineering Ethics Education

As a result of the accelerating pace of technological development and its potential to transform society and the economy, it has become increasingly important for those involved in the development of new technologies to exercise ethical decision-making skills. In recognition of this need, ABET's Engineering Criteria 2000 include "an understanding of professional and ethical responsibility" among the general criteria for undergraduate programs in engineering. ASEE agrees that ethics education is an essential element in the education of all engineers.

ASEE believes that engineers must be equipped by their education to fulfill their ethical obligations to the public at large, to their profession, to their clients and employers, and to the natural world. The ethical issues that engineers may confront include protecting the public health and safety, avoiding conflicts of interest, protecting trade secrets and proprietary information, handling gifts from contractors and others, demonstrating honesty in research and testing, and examining the impact that their work may have in various cultural settings. Given the increasingly global impact of their work, engineers must also be prepared to face ethical issues on a macro-scale and should be aware of the profound effect their work has on the natural environment and on the lives of people throughout the world.

Educators can encourage students to develop ethical awareness in many ways. The first is to maintain an awareness of their own professional actions and to ensure that they are modeling the behavior they hope to see their students emulate. By behaving ethically in the classroom, in their work as advisors, and in the conduct of their own research, educators can help students to see firsthand the importance of professional ethics. Educators should also help students to become more aware of ethical issues and to be capable of recognizing ethical problems and their ethical responsibilities. It is important that educators help students to see themselves as "moral agents," to understand that their engineering work can have both positive and negative effects, and to anticipate and eliminate those negative effects whenever possible.

ASEE believes that engineering ethics education should equip students with the skills to confront ethical problems and to exercise their ethical responsibilities as engineers. While lecture is useful, active learning should be an integral part of engineering ethics education. Educators can employ a variety of problem-solving activities to give students first-hand experience using decision-making tools to solve ethical problems. These activities could include role-playing,

computer simulations, group projects, and case analyses that involve both typical and unusual situations. Universities can provide these learning opportunities either by establishing freestanding courses in engineering ethics or by integrating ethics across the curriculum. Service learning can also provide students with an understanding of the impact that their engineering work has upon others, and it is a very effective way to teach students about engineering ethics.

Regardless of the methodology for integrating ethics into the curriculum, ASEE strongly believes that it is an essential element in the education of all engineers. Engineers must recognize their ethical responsibilities and be able to effectively deal with ethical issues.

The American Society for Engineering Education is a non-profit association of more than 11,000 members representing colleges, corporations, and other organizations dedicated to promoting excellence in engineering and engineering technology education. Founded in 1893, ASEE plays a key role in developing and promoting policies that will enable engineering education and its allied branches of science and technology to meet the challenges of global competition and technological change.

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