AC 2012-3416: ENGINEERING ETHICS, ENVIRONMENTAL JUSTICE, AND ENVIRONMENTAL IMPACT ANALYSIS: A SYNERGISTIC APPROACH TO IMPROVING STUDENT LEARNING

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Engineering Ethics, Environmental Justice and Environmental Impact Analysis: A Synergistic Approach to Improving Student Learning

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Abstract

Engineering ethics is being taught to Environmental Engineering students in context with the broader aspects of environmental justice issues. The content regarding engineering ethics and environmental justice issues is presented in case studies as part of a required environmental engineering course titled Environmental Impact Analysis. The case studies also present the implementation of Environmental Impact Analysis (EIA) via the National Environmental Policy Act (NEPA). Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations", was accompanied by specific guidance from the president regarding recognizing the importance of procedures under NEPA for identifying and addressing environmental justice concerns. In this regard case studies that facilitate the interpretation of NEPA naturally extend to engineering ethics and environmental justice issues. Traditionally, engineering ethics have been taught only in terms of micro-ethics – the individual ethical decision-making of the engineering professional. However engineers are more and more expected to be moral agents responsible for helping to develop solutions to societal ethical problems. Unfortunately, macroethics problems don't fit neatly into traditional engineering education and the unavoidable fact that there are no concise "right answer" that can be imposed by the individual engineer challenges the typical engineering student's worldview. In this regard we need to change the way engineers think about ethics and a change in pedagogy is needed. Furthermore, an element of critical pedagogy is indicated to correct the worldview of engineers regarding ethics. Critical reflection is key to significant shifts of frames of reference. In this context the goal of encouraging students to view engineering ethics through the lens of environmental justice issues is motivated by transformation learning theory. During the first half of the semester lectures covered NEPA and EIA in the conventional manner and research papers were assigned for EIA case studies. Beginning at midterm the relationship of environmental justice issues to NEPA and EIA were introduced and subsequent case study assignments also involved environmental justice issues. For these case studies, the student's role played the various stakeholders on both sides of the case study issues. Anecdotally the impact of the intervention was immediately reflected by an increased level of class participation and discussion of ethical dilemmas posed by the case studies. To assess the impact on student outcomes regarding engineering ethics a survey was administered at the end of the semester regarding the engineering ethics content of the student's previous technical engineering courses. For comparison purposes the survey included several questions similar to questions from a survey at Stanford University over a three year period. Relative to the Stanford results, the survey indicated a dramatic increase in the interest and awareness of the EIA course students regarding the role of engineering ethics in society. The survey results excluding the impact of the EIA course are very similar to the Stanford results and indicate that almost all the students expect to face ethical issues during their careers, but less than one-third say they have discussed an ethical issue in any of their technical engineering courses.

1.0 Introduction

The ethical and societal aspects of engineering practice are the subjects of several ABET 2000 outcomes. ABET 2000 criterion 3(f) states that "Engineering programs must demonstrate that their graduates have an understanding of professional and ethical responsibility." Criterion 3(h) states – "Engineering programs must demonstrate that their graduates have the broad education necessary to understand the impact of engineering solutions in a global and societal context." And, Criterion 4 requires that program graduates have design *experience*…that includes most of the following considerations: economic, environmental, sustainability, manufacturability, ethical, health and safety, social, and political" [1, 2]. Notwithstanding ABET requirements, a recent survey indicates that 80% of engineering graduates attend schools that have no ethics-related course requirements. Even at schools that have courses with ethics-related content, the courses are usually in philosophy or religion and have no specific engineering ethics component [3]. Notwithstanding these deficiencies, the American Society for Engineering Education's **(**ASEE**)** Statement on Engineering Ethics Education sets a high bar for engineering educators. It states [4]:

"*…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…"*

These directives on inclusion of ethics in engineering education have garnered a great deal of interest in formulating exactly what elements of ethics belong in the engineer's ethics education. Traditionally, engineering ethics have been taught only in terms of micro-ethics. Micro-ethics pertain to the individual ethical decision-making of the engineering professional. However engineers are more and more expected to be moral agents responsible for helping to develop solutions to societal ethical problems. Consequently engineering education must include elements of macro-ethics. Macro-ethics pertain to the ethics of the broader collective and social decision-making. Responding to macro-ethics issues requires individual engineers to understand ethics in a social context and address these issues with leadership and communication skills [5]. This skill set for solving ethical problems is paramount to environmental engineers since environmental engineering designs often incorporate elements for the input and representation of diverse societal groups. As a matter of fact, the goal of EIA is to develop a framework for implementing an action or project while addressing societal issues in a structured way.

Unfortunately, macroethics problems don't fit neatly into traditional engineering education and the unavoidable fact that there are no concise "right answer" that can be imposed by the individual engineer challenges the typical engineering student's worldview (student's perceived "common sense"). In this regard a change is needed in the way engineers think about ethics and a change in pedagogy is needed. Furthermore, an element of critical and transformative pedagogy is indicated to encourage critical thinking by engineering students regarding ethics [6].

The content regarding environmental justice issues is presented in case studies as part of a required environmental engineering course titled Environmental Impact Analysis (EIA). The case studies also present the implementation of EIA via the National Environmental Policy Act (NEPA). Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations", was accompanied by specific guidance from President Clinton regarding recognizing the importance of procedures under NEPA for

identifying and addressing environmental justice concerns. In this regard case studies that facilitate the interpretation of NEPA naturally extend to environmental justice issues. In Environmental Engineering practice, ethical concerns are intrinsically tied to social and political environmental justice issues. Case studies that demonstrate failures implementing NEPA and resulting in environmental injustice, intrinsically involve ethical conflicts for engineers involved in the cases. Engineering ethics issues that arise in this manner are intrinsically embedded in overall impact on society.

2.0 Methodology

Environmental Justice Content

A fair treatment of all the social and political aspects of environmental justice is not possible in the limited amount of time available in an environmental engineering curriculum. Nevertheless, there is an obligation to prominently incorporate environmental justice issues into teaching environmental engineering. Environmental engineers are key decision makers in the NEPA process and often serve as liaisons between the public and industry/government. Furthermore environmental justice issues are an integral part of environmental engineering education and should be addressed to some degree in environmental engineering courses such as solid/hazardous waste management and regulatory oriented courses such as Environmental Impact Analysis.

There is a general consensus that minorities and low-income people experience disproportionate exposure to hazardous waste and pollution from waste management facilities. The intent behind environmental injustices aside, the fact is that the poor, working class, and minorities have historically born a disproportionably high share of environmental risks associated with waste facilities [7, 8, 9, 10, and 11]. This societal problem persists today in spite of Executive Order 12866 signed by President Clinton in 1993 officially incorporating risk assessment into the U.S. regulatory process. USEPA responded to the Executive Order 12866 with its own Environmental Justice initiative and its own definition of Environmental Justice. Parsing the legalese of EPA's definition of environmental justice reveals that community residents can influence regulatory decisions that will affect their environment or health by being "meaningfully involved" [12]. This language only succeeds in codifying the concept that a segment of the population (the uninvolved in this case) could be negatively impacted even if a truly objective risk assessment indicated they were at a higher risk. Experience often shows that lower income communities are not as well informed especially in the earlier stages of the decision making process regarding the environmental impact of proposed projects or actions. In this regard, the lack of involvement of poor communities in the public vetting process is often due to a failure of government to adequately inform the public. Specifically and in particular for proposed actions that fall under the auspices of NEPA this represents a failure to interpret and implement federal regulations to achieve the goals of NEPA.

Engineering Ethics Content

Engineering ethics refers to those morally permissible standards of conduct that every engineer expects every other engineer to follow. Engineering ethics applies to engineers and no one else [13]. The particular standards that constitute engineering ethics are what ABET requires to be taught to engineering students (not just the philosophical aspects of ethics in general). These standards consist of formal codes of ethics and informal practices passed on to each new generation of engineers. It is important for engineers to be familiar with these codes and

standards and it is equally important for engineering students to be taught the intent of the standards and the nuances of ethical engineering practice. The basic intent of ethics standards is to provide a structured environment for the resolution of ethical conflicts associated with engineering practice. Here the "conflict" is meant to describe the situation where an engineer is drawn in different directions over an issue due to competing considerations. Consequently, an excellent way to teach engineering ethics is to simulate ethical conflict via case studies and challenge students to resolve conflicts within the confines of ethics standards. As depicted in Figure 1 the core of the course remains the technical aspects of EIA. The methodology for delivering the engineering ethics content did not detract from the core technical content of the course. The incorporation of case studies for implementation of NEPA that involve environmental justice issues naturally leads to learning engineering ethics as a related subject. Students were encouraged to study and discuss the case studies from the perspective of both side of the issues and experienced firsthand the ethical dilemmas that the case study stakeholders faced. These case studies not only exposed the students to ethical conflict resolution but served to heighten interest and awareness in engineering ethics in general. Studies suggest that stressing the social aspects of engineering can leverage the interest of students that otherwise may lack motivation to study engineering ethics [14, 15].

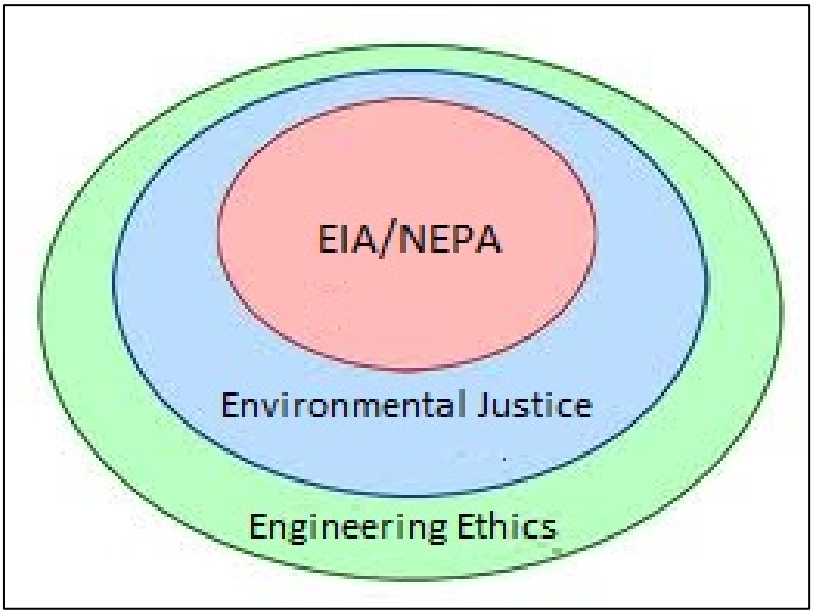

Figure 1: Leveraging Interest in Engineering Ethics in an Engineering Course By Incorporation of Environmental Justice Related Case Studies.

Pedagogy

The call for engineers to be moral agents in helping to solve society's ethical problems may result in an increase in practice based engineering education reminiscent of medicine and nursing education [16]. This approach to teaching professional responsibility is at the core of the pedagogy for this course and an integral part of most engineering design courses. In the process of "learning by doing" students are encouraged to develop conscientious habits and the importance of ethical issues to their work is reinforced at every opportunity. Unfortunately as pointed out below the ethics education of engineering students is still severely lacking. There are many reasons for this deficit but one primary reason is the failure to foster critical thinking on the part of students regarding the application of engineering ethics principles in the context of competing

positions of various stakeholders. The worldview ("common sense") of a typical engineering student is strongly influenced by their perceived hierarchy of engineering knowledge and epistemological assumption that the authority lies with the professor and textbook to determine what is correct and incorrect. This worldview applied to engineering ethics is reinforced by the way that micro-ethics are taught to engineers. For example the Fundamentals of Engineering Exam offers multiple choice ethics questions suggesting that ethics problems can be solved in an analytical fashion like other engineering problems. This worldview is problematic for learning macro-ethics where there is often no single, precise "right answer" and where the power to decide what is right or wrong lies in the broader society. This worldview left unchallenged largely precludes critical thought and reflective judgment regarding macro-ethics because it shores up the paradigm that "technology is neutral" and this leads inexperienced engineers to believe that engineering principles can be applied in abstraction and separate from the larger societal picture [17]. Experienced engineers know that this is the realm of abstract science and have learned to negotiate the societal aspects of the larger role of the engineer. In this context it becomes clear that the goal of the pedagogical approach in practical terms is to teach students aspects of this particular skill-set that experienced engineers learn in the "school of hard knocks". A valid pedagogical approach to encouraging critical thought and reflective judgment is to use a critical lens for looking at the world. This approach has its roots in critical pedagogy and in this case the critical lens that challenges the world view of engineering students regarding macro-ethics is the case studies presented that involve environmental justice issues. The EIA course case studies and associated assignments are fashioned to espouse a transformative learning experience for students by challenging their perceptions of themselves and their future profession. This approach can be explained in terms of transformational learning theory (TLT). Mezirow, 2000 describes TLT as follows: "The focus of TLT is on how we learn to negotiate and act on our own purposes, values, feelings, and meanings rather than those we have uncritically assimilated from others—to gain greater control over our lives as socially responsible, clear-thinking decision makers" [18, 19]. This pedagogical approach is a practical response in light of the short comings of traditional engineering education and a growing awareness that engineers need an expanded skill set regarding engineering ethics that allows them to participate in providing solutions to society's ethical issues.

3.0 Results and Discussion

Role playing simulation of the ethical conflicts was especially effective in exposing the students to macro-ethics problem solving. Most of the graded coursework involved essay writing. None of the essays written by students after the intervention were perceived to exhibit a "cut and paste" approach to essay writing. This represents a substantial improvement in the quality of essays following the roll playing exercises because cut and paste was an issue in previous assignments. This is a qualitative assessment as it would be difficult to quantify but the assessment is supported by the literature. One of the accepted methods for prevention of unintentional plagiarism among student writers is the incorporation of ethical and social topics into the learning environment[20].

Robert McGinn, professor of engineering at Stanford University surveyed engineering students regarding the engineering ethics content of their technical engineering courses over a three year period [21]. The survey data revealed that most engineering students expected ethical issues to arise in their future careers but at the same time the data indicated only a superficial and infrequent exposure of students to ethical issues in their technical engineering classes. Research by Shuman, 2004 supports McGinn's conclusion that engineering students ethical learning is

inadequate and suggest that an important reason for these low scores is that only a small percentage of students had taken an ethics course (17 out of 120) and none had taken an engineering ethics course [22, 23]. To make matters worse research on the impact of different college majors suggests that engineering education is significantly less effective than other majors in instilling qualities of responsible citizenship and cultural sensitivity [24]. A survey was conducted at the end of the semester to assess the impact of the course on student interest and awareness of the engineer's role in societal ethical issues. The responses to questions fashioned after McGinn, 2003 are presented below and compared to McGinn. Below the responses to the survey questions that correlate with McGinn, 2003 are presented and discussed.

Q1*: Do you think it might be useful to study such (ethical) issues and conflicts as part of your engineering education?*

EIA Course		McGinn Survey	
Yes	No	Yes	No
16 (94.1%)	1 (5.9%)	69 (100%)	0 (0%)

Q2.a: *Has any engineering-related ethical issue ever been discussed (not just mentioned) in any of your technical engineering classes?*

Including EIA Course		McGinn Survey	
Yes	No	Yes	No
13 (76.5%)	4 (23.5%)	20 (29.9%)	47 (70.1%)

Q2.b: *If you answered yes to 2.a, what issue in what course?*

This (EIA) Course	Other Courses
8 (61.5%)*	5 (30.5%)

*Percent of total responses.

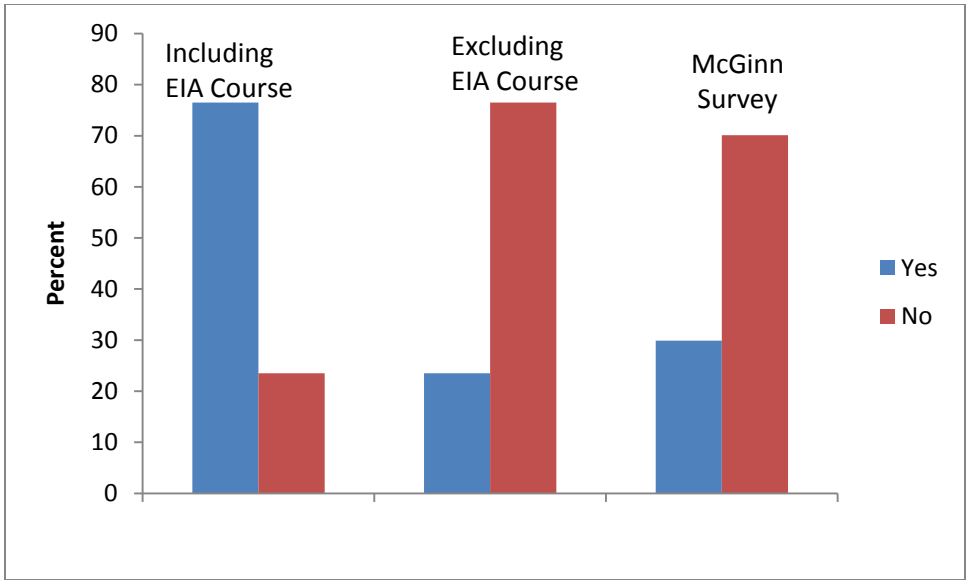

Figure 2: Response to Q2.a and Q2.b- Indicating student perception of the ethical content of the EIA course relative to other engineering courses.

Q3*: Have any of your engineering instructors ever conveyed anything specific to you about what is involved in being an ethically or socially responsible engineering professional in contemporary society?*

EIA Course		McGinn Survey	
Yes	No	Yes	No
14 (82.4%)	3 (17.6%)	9 (13.2%)	59 (86.8%)

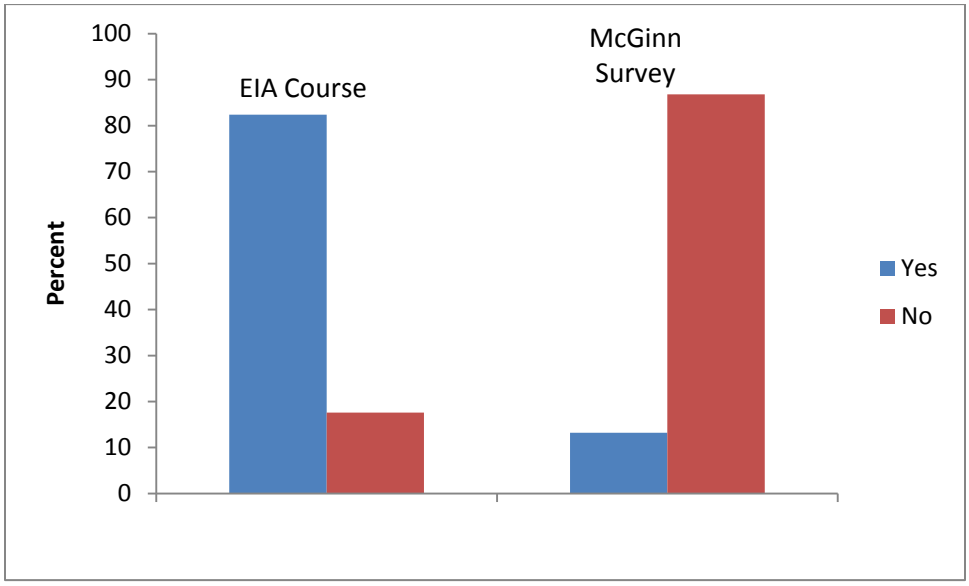

Figure 3: Response to Q3-Indicating a dramatic impact of the EIA course on awareness of ethical issues.

Q4*: How much has your undergraduate education helped prepare you for coming to grips thoughtfully and effectively with engineering ethical challenges that you might encounter in your career?*

0-Not at all
1-Little bit
2-somewhat
3-good deal
4-great deal

EIA Course	McGinn Survey
0-5.9%	0-15.7%
1-11.8%	1-54.3%
2-29.4%	2-22.9%
3-47.1%	3-5.7%
4-5.9%	4-1.4%

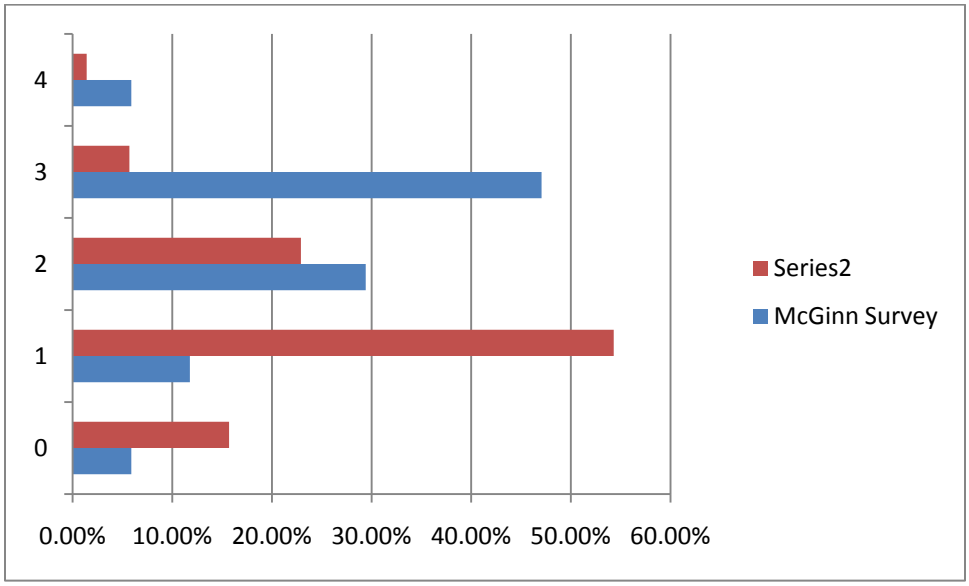

Figure 4: Response to Q4-Indicating a dramatic impact of the EIA course on awareness ethical issues.

Q5: *In the course of your engineering education have you gotten the message to the effect that there is more to being good engineering professional in today's society than being a state of the art technical expert?*

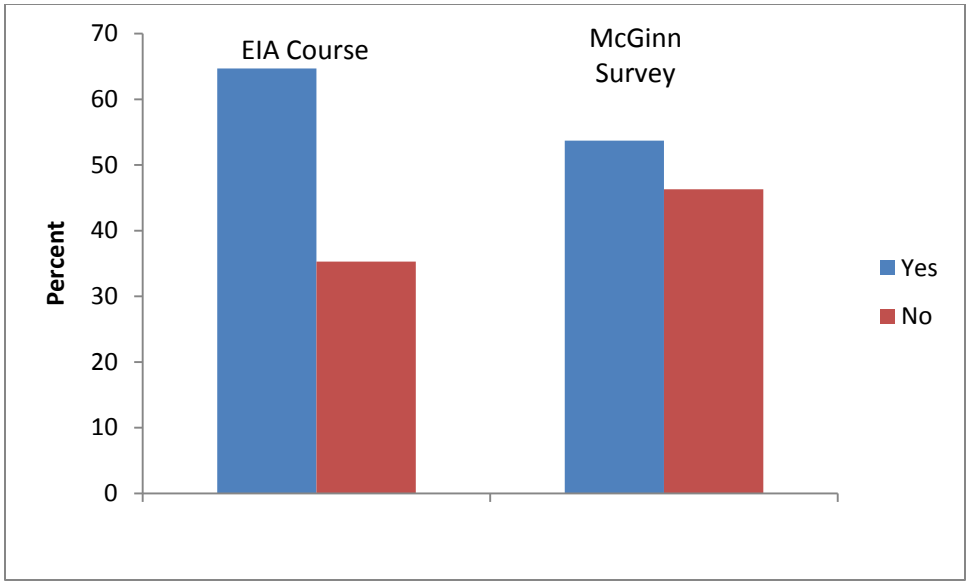

Figure 5: Response to Q5-May indicate an improvement in this perception by students but indicates that this is an area where further efforts are merited.

The response to Q1 by the EIA course students is borne out by the observations by McGinn indicating that most engineering students recognize the importance of engineering ethics in their engineering education. The responses to Q 2.a show a significantly larger fraction of the EIA course students have the perception that engineering ethics was addressed in a significant way in any of their courses. The responses to Q2.b indicated that a significant fraction of the students that answered yes to Q2.a attributed their positive response to the EIA course. Excluding the EIA course responders that attributed a "yes" answer to Q2.a to the ethics content in the EIA course show a response very similar to the generic McGinn results. The survey results excluding the impact of the EIA course indicate that almost all the students expect to face ethical issues during their careers, but less than one-third say they have discussed an ethical issue in any technical engineering course. The responses to Q3 and 4 show a dramatic difference in the perception of the EIA course students and the results of the McGinn survey. It is likely that the specific mentioning of social responsibility and the inclusion of environmental justice issues in the course attributed to this result. These positive responses suggest that, at a minimum, the course succeeded in increasing awareness and interest in engineering ethics. The responses to Q5 suggest that students believe more needs to be done to emphasize the importance of ethics in engineering.

4.0 Conclusion

Studies suggest that stressing the social aspects of engineering can leverage the interest of students that otherwise may lack motivation to study engineering ethics.
The primary goal of this research was to investigate a methodology that seeks to leverage the interest of students in engineering ethics by encouraging them to reflect on their own world view regarding ethics. This was accomplished by encouraging them to resolve ethical dilemmas in the context of the roles that engineers serve in society from the viewpoint of stakeholders on both sides of controversial issues. In this regard, EIA case studies proved to be an effective critical lens for students to visualize their role in a broader society.

The survey results show that almost all the students expect to face ethical issues during their careers, but less than one-third say they have discussed an ethical issue in any technical engineering course. Furthermore, most students report that they believe it is just as important to be "professional" as it is to be technically expert but very few had learned anything specific from

their engineering courses about what this entails. This worldview left unchallenged largely precludes critical thought and reflective judgment regarding macro-ethics because it leads inexperienced engineers to believe that engineering principles can be applied in abstraction and separate from the larger societal picture. The pedagogical approach used in this course to encourage critical thought and reflective judgment was to use a critical lens for looking at the world. This approach has its roots in critical pedagogy and in this case the critical lens that challenges the world view of engineering students regarding macro-ethics is the case studies presented that involve environmental justice issues. The EIA course case studies and associated assignments are fashioned to espouse a transformative learning experience for students by challenging their perceptions of themselves and their future profession. The survey results indicate a dramatic increase in the interest and awareness of the EIA course students regarding the role of engineering ethics in society. The survey results excluding the impact of the EIA course are very similar to McGinn and indicate that almost all the students expect to face ethical issues during their careers, but less than one-third say they have discussed an ethical issue in any technical engineering course.

References

1. Schimmel, K (2000), "ABET 2000 – Can Engineering Faculty Teach Ethics?", http://engr.calvin.edu/ces/ceec/schimmel.htm

2. ABET (1998), Engineering Criteria 2000, http://www.abet.org/eac/EAC_99-00_Criteria.htm.

3. Stephan, K.D. 2002, Is Engineering Ethics Optional?", *IEEE Technology & Society Magazine*, vol. 20, no. 4, pp. 6-12, Winter 2001/2002

4. American Society of Engineering Educators (ASEE), 1999, ASEE Statement on Engineering Ethics Education; http://www.asee.org/about-us/the-organization/our-board-of-directors/asee-board-of-directors-statements/engineering-ethics-education

5. Herkert, J. R., 2003, Microethics, Macroethics, and Professional Engineering Societies. *Emerging Technologies and Ethical Issues in Engineering: Papers from a Workshop October 14-15, 2003*. Washington, DC: National Academies Press, 2004.

6. Riley, D., 2008, Ethics in Context, Ethics in Action: Getting Beyond the individual Professional in Engineering Ethics Education. In Proceedings of the American Society for Engineering Education (ASEE) Annual Conference and Exposition, June 2008.

7. Bullard, Robert, 1990, Dumping in Dixie: Race, Class, and Environmental Quality. Boulder, CO: Westview Press.

8. Costner, Pat, and Thornton, Joe, 1990, Playing With Fire: Hazardous Waste Incineration. Washington, DC: Greenpeace.

9. Goldman, Benjamin, and Laura Fitton, 1994, Toxic Wastes and Race Revisited. Washington, DC: Center for Policy Alternatives.

10. Mohai, Paul and Bunyan Bryant, 1992, Environmental injustice: Weighing race and class as factors in the distribution of environmental hazards. University of Colorado Law Review 63 (1): 921-932.

11. United Church of Christ Commission for Racial Justice, 1987, Toxic Wastes and Race in the United States. New York: United Church of Christ Commission for Racial Justice.

12. Painter, R. and King, L., 2006, The Role of Environmental Justice Issues in Environmental Engineering Ethics. In *Proceedings of the American Society for Engineering Education (ASEE) Annual Conference and Exposition*, June 2006.

13. Harris, C., et. al., 1996, “Engineering Ethics: What? Why? How? When?," Journal of. Engineering Education, Vol. 85, No. 2, April I996, pp. 93~l01.

14. Davis M., 1993, “Ethics Across the Curriculum: Teaching Professional Responsibility in Technical Courses,” *Teaching Philosophy* 16, September 1993, pp.205-235.

15. Herkert, J.R. (1999), ""Ethical Responsibility and Societal Context: The Case for Integrating Engineering Ethics and Public Policy,"" in H. Luegenbiehl, K. Neeley, and D.F. Ollis, eds.,*Liberal Education in 21st Century Engineering*, Peter Lang, New York.

16. Benner P, Sutphen M, Leonard-Kahn V, Day L. *Educating Nurses: Teaching and Learning a Complex Practice of Care.* San Francisco and Stanford, CA: Jossey-Bass and Carnegie Foundation for the Advancement of Teaching. In press.

17. King, P.M. and Kitchener, K.S. *Developing reflective judgment: understanding and promoting intellectual growth and critical thinking in adolescents and adults*. San Francisco: Jossey-Bass, 1994.

18. Kabo,J., 2010, Seeing Through the Lens of Social Justice: A Threshold for Engineering, A thesis submitted to the Department of Chemical Engineering In conformity with the requirements for the degree of Doctor of Philosophy, Queen’s University, Kingston, Ontario, Canada, April, 2010.

19. Mezirow, J. (2000). Learning to think like an adult. In *Learning as transformation: Critical perspectives on a theory in progress* (pp. 3-33). San Francisco, CA: Jossey-Bass.

20. McGinn, RE 2003. "Mind the gaps": an empirical approach to engineering ethics, 1997-2001. Science and Engineering Ethics 9: 517-542. Rest, JR 1986.

21. Elander, J, Pittam,G. Assessment & Evaluation in Higher Education, Vol. 35, No. 2. (2010), pp. 157-171, doi:10.1080/02602930802687745

22. Shuman, L. J., M. Besterfield-Sacre, and B. M. Olds. 2005. Ethics assessment rubrics. In Vol. 2 of Encyclopedia of Science, Technology, and Ethics, eds. C. Mitcham, L. Arnhart, D. Johnson and R. Spiers, 693–695. NY: MacMillan Reference Books.

23. Colby, A., & Sullivan, W., M. (2008). Ethics teaching in undergraduate engineering education. *Journal of Engineering Education, 97*(3), 327-338.

24. Astin, A. W. 1993. What matters in college? Four critical years revisited. San Francisco, CA: Jossey-Bass Publishing, Inc.

Appendix

Example Case Study Assignment: Claiborne Enrichment Facility, Homer, Louisiana

During the first half of the semester lectures covered NEPA and EIA in the conventional manner and research papers are assigned for EIA case studies. Beginning at midterm the relationship of environmental justice issues to NEPA and EIA is introduced and subsequent case study assignments also involve environmental justice issues. For these case studies, the students role play the various stakeholders on both sides of the environmental justice issues. One of the case study assignments is based on the proposed Claiborne Enrichment Facility in Homer, Louisiana.

In 1989, Louisiana Energy Services (LES), a British, German and American conglomerate, applied for a government permit to build a privately owned uranium enrichment plant in the United States. A national search was undertaken by LES to find the "best" site for a plant that would produce 17 per cent of the nation's enriched uranium. LES supposedly used an objective scientific method in designing its site selection process. However lawsuits ensued and dragged on for more than eight years when a three-judge panel of the NRC's Atomic Safety and Licensing Board ruled that "racial bias played a role in the site selection process". It was found that the environmental impact statement prepared by the NRC underestimated the hazards and costs imposed on the nearby low income, minority community and overestimated proposed benefits. Besides that, alternative sites to this location were not analyzed, which is generally required as part of standard NEPA procedures. It appeared that this process favored the corporation trying to build the facility above the stated goal of NEPA to promote the public good. It was further found that in a more affluent community the inequity in burden could have been fought, yet these individuals in their socioeconomic state were uninformed and uninvolved unable to detect and fight flawed EIS for the licensing of a plant that would result in unjustified discrimination. From a technical point of view it was determined that the NRC used a deterministic evaluation process rather than a probabilistic one standard to the industry. In other words, they indicate that contaminants will be limited as much as possible, but do not provide quantitative guidelines for the maximum amount of contaminants that can be released. Basically, the statement speaks in qualitative and subjective terms and is very vague as to actual regulations on emissions.

Required Reading: Claiborne Enrichment Facility, Homer, Louisiana

American Society of Civil Engineering (ASCE) Code of Ethics.

U.S. Nuclear Regulatory Commission, Atomic Safety and Licensing Board, "In re Louisiana Energy Services" (Claiborne Enrichment Center), Docket No. 70-3070-ML, Final Initial Decision (Addressing Contention J.9), May 1, 1997, 32 pages. (Read closely sections II.C. Licensing Board Determination, III.B. Impacts of Road Closing/Relocation, III.C. Property Value Impacts) http://www.nrc.gov/OPA/reports/lesfnl.htm

U.S. Nuclear Regulatory Commission, "In re Louisiana Energy Services" (Claiborne Enrichment Center), Docket No. 70-3070-ML, Memorandum and Order (Addressing NEPA Contentions), April 3, 1998, 16 pages. http://www.nrc.gov/OPA/reports/lesorder.htm

Nuclear Information & Resource Service. "Victory! Louisiana Energy Services Gives Up!" 22 April 1998. 1 page http://antenna.nl/~wise/491/4872.html

Supplemental Sources: Claiborne Enrichment Facility, Homer, Louisiana

U.S. Environmental Protection Agency, Office of Federal Activities. "Draft Guidance for Consideration of Environmental Justice in Clean Air Act 309 Reviews." July 19, 1995, http://es.epa.gov/oeca/ofa/ej_nepa.html

Johnson, Stephen M. "NEPA and SEPA's in the Quest for Environmental Justice." Loyola of Los Angeles Law Review. Vol. 30, January 1997, pp. 588-604. [Full article is pp. 565-604]

The written assignment is a 2000 word report describing the projects failure to implement C E Q regulations to accomplish the stated goals of NEPA. The report will cite appropriate regulations from 40 CFR 1500-1508

Role Playing Exercise: Claiborne Enrichment Facility, Homer, Louisiana

The role playing exercise extends over a three hour period (two class periods). During the role play the instructor, T.A.s and selected students play the roles of elected official, corporate official, concerned citizens and environmental activists. The remaining students role play as engineers from a firm representing LRC. Successful completion of the role play exercise required that students representing various stakeholders reach a consensus regarding whether the facility would be sited at Claiborne or elsewhere. After a total of approximately four hours of discussion spanning three class periods the students ultimately reached a consensus agreement that the facility should not be sited at Claiborne.