

ProCEED: A Program for Civic Engagement in Engineering Design

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Abstract

This paper highlights the success of the ProCEED (Program for Civic Engagement in Engineering Design) recently started at the University of Michigan, Ann Arbor. The program is aimed at giving mechanical engineering students access to the community in a way that engages their engineering skills to provide valuable contributions to the surrounding community. The program was also aimed at fostering student leadership roles within the department by allowing Pi Tau Sigma, The National Mechanical Engineering Honor Society, to take the lead role in the program. Students involved in the program help solicit projects from the surrounding community for development and prototyping in the senior design course, ME 450. Students in the course benefit from the projects by learning to interact with community sponsors, usually without technical training. Students also benefit by learning how to use their engineering skills to solve everyday problems in a community service capacity. This paper will provide an overview of the current course structure in the Department of Mechanical Engineering and Applied Mechanics at the University of Michigan, how the ProCEED program fits into this existing course structure, the goals of the program, community education resulting from the introduction of the program, projects that have resulted from the program, sustainment and expansion of the program, and finally an evaluation of the program by an external source.

1 - Introduction

Medical and legal professionals often use their skills to benefit the community by engaging in pro bono work. University of Michigan College of Engineering students also engage in pro bono work in the form of extracurricular community service. Unfortunately, this service rarely requires the technical skills engineering students have to offer. Problems lie in (i) identifying community needs requiring engineering skills, (ii) providing a forum for selecting the service, (iii) integrating the service into an academic environment, and (iv) building a strong infrastructure for long-term success.

ProCEED is the University of Michigan's initiative to instill community service awareness in mechanical engineering students and to foster community leaders within student organizations through civic-based design projects in the mechanical engineering senior capstone design course,

ME450. Students in the course interact closely with community sponsors to create a working prototype solution to a community's technical problem.

This paper describes the motivation behind the program, and details the goals of the program. Specific content of the program's infrastructure is outlined with an in-depth look at the ME450 course into which the program was integrated. An overview of the semester operation of ProCEED is given along with examples from the first semester the program was implemented. Independent evaluation of the course is also reviewed to assess the learning and civic orientation impact of the program in its first semester of implementation. The paper will conclude with a look into the future of ProCEED including sustainment of the program and possible future expansion.

2 - Motivation and ProCEED Program Goals

ProCEED started as a vision to integrate engineering design skills into community. While students are taught to solve industrial type problems throughout the engineering curriculum, relatively little focus is devoted to the application of such skills in more common circumstances, such as community service. ProCEED was initiated as a vehicle to help plant the seed for community-oriented service into the students of the mechanical engineering department. Through the use of community-responsibility lectures in ME450 and through designing a community project, students learn the personal satisfaction that comes from helping the community in a meaningful way. Students also gain knowledge of the civic responsibility they have to "give back" to the community.

ProCEED is also aimed at educating the community about the role of engineers in society. The role of medical and legal professionals in the community is very clear to most individuals. The community understands this type of service through the widespread publication of these professions through popular television programs. The same circumstances are not so for the engineering profession. Rarely, if ever, is the same sort of attention paid to the practicing engineer. Hence, the role of ProCEED was also an engaging, community program aimed at teaching the community about the role of engineers and the work they perform.

Finally, ProCEED is a program that helps to teach and inspire leadership from the students actively participating in the program. The idea of integrating and instilling community awareness into a course or curriculum is not a new idea. Purdue University has successfully initiated the Engineering Projects in Community Service (EPICS) Program with the intent of integrating the community into the curriculum. EPICS has been successfully integrated into the electrical, mechanical, and chemical engineering curriculums at Purdue University and has a significant infrastructure made up of faculty, staff, and teaching assistants. ProCEED is different because it is student run. It is a program maintained by students for students. This unique implementation of the program allows student to take an active role in contacting the community as well as an active role within the department. Students take the lead in the success of the program and learn to be involved with the department. This activity fosters teamwork as well as the abilities needed to become strong group leaders.

The goals of ProCEED are summarized as follows:

- To link the technical needs of our community to the technical skills of university mechanical engineering students
- To provide our community with low-cost alternatives for solving their important technical problems
- To provide hands-on technical experience to mechanical engineering students
- To instill community service awareness and leadership in mechanical engineering students and impart to each student that their role and responsibility as an engineer is to serve society in all aspects of work and life

3 - ProCEED Infrastructure

To accomplish these goals, ProCEED is broken into five “nerve centers.” These nerve centers make up the infrastructure of the program and are shown in Figure 1. The five main focus areas are the local community, the ProCEED Advisory Board, ME450 Course Leadership, the ME450 course itself, and Pi Tau Sigma. Each of these focus areas will be discussed in the following sections.

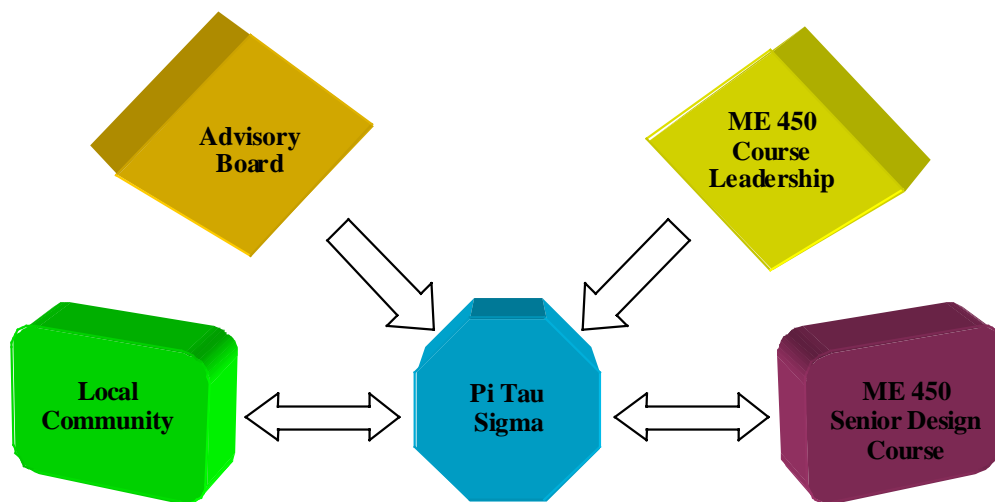


Figure 1: ProCEED Infrastructure

3.1 - The Local Community

Key to the program is the successful integration of the program into the community. This involves a highly focused effort by the ProCEED team members to identify specific community groups who would benefit by such a program as well as informing community members about the role engineers serve. The program started by targeting specific organizations that could help spread word of the program. Presentations at multiple Rotary Club meetings as well as a presentation at the United Way Ann Arbor helped to spark intense community interest in the scope and potential of the program.

Next, local community service groups were identified with the help of the university and other agencies. From this list, mailings were generated to inform the targeted groups of the program about its goals and potential relevance of the program. This was done by means of a brochure containing information on the program, examples of previous community-service type projects, and contact information.

While informational brochures on the program helped to spread the word, previous experience with ME450 project solicitation in industry showed clear need for further interaction with the community. Further complications in soliciting projects from the community lie in the lack of public awareness of engineering practice. While the public knows that engineers in a broad sense "make things," we found the level of knowledge about what we make was generally low. Appropriate design topics are even harder to obtain from the non-technically trained community sponsor. For instance, we had individuals ask if we could install air conditioning systems or construct new walls for their buildings.

To overcome the possible problems associated with misconceptions of our abilities, ProCEED members also called each contact to help further define the program and answer any questions about potential projects. Further support was offered by making site visits to potential sponsors to help further clarify possible project submissions. This personal interaction with the community served two very important purposes. First, it helped the community representatives become acutely aware of the service the ME450 students could provide for them. In general, we found that the community was very quick to grasp the potential of our program and understand the specific benefits we could offer. However, it was usually harder to help the community organizations develop a project "on the spot." Second, students in Pi Tau Sigma conducting the follow up phone calls quickly became adept at solving unique and very challenging project questions "on the spot." In most cases, students would personalize possible projects for the organization. This provided an invaluable learning experience for communication and problem solving skills.

As the project continues, we hope to build a strong connection with the local community service agencies by maintaining close contact every semester. Currently, ProCEED is building an extensive database of local community contacts and serving in an educational capacity to those agencies. Through continued contact with these organizations, an effort is underway to help them identify potential projects suitable for submission to ProCEED.

3.2 - ME450, Mechanical Design II

The introduction of a program such as ProCEED into an established curriculum required a synthesis approach with existing courses. As students in the mechanical engineering department already had a significant amount of courses to take for graduation, the introduction of a non-required course into the curriculum was not a feasible approach for the immediate success of the program. The program needed to be integrated into an existing course with an existing infrastructure. Furthermore, the course needed to provide an avenue for students to actively engage the community, learn the value of their engineering skills in the community, and provide a forum in which to dedicate that attention. The design curriculum in the mechanical engineering department provided an ideal vehicle through which to introduce the program.

The design curriculum supplements the department's strength in fundamentals (i.e., math, science, dynamics, solid and fluid mechanics, heat transfer) and consists of three courses in design and manufacturing (see Figure 2). The first course in the series, ME250, introduces students to design and manufacturing basics. ME350 builds upon these fundamentals, teaching students the synthesis and analysis of mechanical components and systems by extensively integrating design and manufacturing. The final course, ME450, exposes students to system design and integration. In ME450, students work hand-in-hand with external sponsors (industry, the community, and other faculty) on real world projects. Student teams have one semester to take a mechanical engineering project from a vague problem statement to a full-scale working prototype.



Figure 2: Mechanical Engineering Undergraduate Design Sequence

The innovative teaching methods employed in these courses have made them very successful over the past few years and highly visible. Student teams work on open-ended, hands-on assignments and projects. The students not only design and analyze parts or systems; they also build, test, and present their designs. Many of these projects require interdisciplinary interaction. These types of projects help students gain a deeper understanding of the course material, develop critical thinking, and practice communication and team dynamics skills. This provides invaluable experiences for the students and prepares them well to practice engineering when they graduate.

ME450, Mechanical Design II, is the capstone course in the required design curriculum with 80 to 120 students enrolled each term. Student teams consisting of four undergraduates take a real-life design project through the entire design process from problem definition to conceptualization, through analysis to fabrication, and finally, testing of a prototype. This course concludes with a Design Exposition where students present and demonstrate their products at their team booth in a public arena.

Lectures are organized according to design process theory: design specifications, conceptualization, design embodiment, material selection and product fabrication, and design validation. Different design methodologies are taught such as Quality Function Deployment (QFD), Failure Modes and Effect Analysis (FMEA) and Design for X (DFX where X can be for manufacturing, assembly, environment, safety, etc.). To further prepare our students, technical communications, environmental concerns, and ethical issues have been added to the lecture series. In these lectures, we teach the role of the engineer in serving society. Further, that in all aspects of their work and life, they should consider their social responsibility.

ME450 lectures establish strategies that enable students to integrate their newly learned engineering skills to solve real and complex problems with ethics and integrity. They exercise the course material by applying it to their design project with close supervision from a section instructor. The design projects come primarily from industry, but occasionally projects have come from community-based organizations, such as the Ann Arbor Hands-On Museum, or

individuals, such as the physically challenged. The community-based projects are very popular with students, as they feel fulfilled to have truly helped someone. Even other students in the class that are not working directly on the project benefit because they all participate in the design reviews for civic-based design projects. Since the inception of the ME450 class, there have been multiple community-service oriented projects submitted. To get a feel for the scope of the design challenges associated with such projects, past examples of community-service oriented projects are included below. These projects highlight the specific intent of the program and the projects it hopes to receive. It is interesting to note that projects such as these are usually highly prized by the ME450 students. They are sought after projects that tend to generate a lot of interest in the design class and generally win awards at the design exposition.

Past ME 450 Community-Service Projects

Arboretum Selective Entry

A selective gating system was designed to provide unrestricted wheelchair access to the UM Nichols Arboretum while preventing bicycle entry.

Interactive Greeting Robot

This project involved the design of an interactive robot for greeting children at the Ann Arbor Hands-On-Museum. The purpose of the robot was to spark children's curiosity within the field of science. An out-of-sight person could remotely control the robot and converse with guests.

Heat-Raised Ink Braille Printer

The University Unions Graphic Design Office produces Braille text and graphic materials for visually impaired students. Typically, graphic materials are produced by silk screening a thick ink which rises under heat, a process that is time-consuming and wasteful. The goal of this project was to design a faster, less-wasteful, computer-driven Braille printer.

Mobile Examination Station with a Wheelchair Lift

This project involved the design of an examination station with an incorporated wheelchair lift. This lift allows for the examination of wheelchair-bound patients without removing them from their wheelchair. They no longer have to experience the helplessness of needing assistance to get from their wheelchair to the doctor's examination chair. The immediate use for the mobile examination station was in a medical capacity. Future models may be adapted for home use.

Engineering Module for Middle School Students

The goal of this project was to create hands-on educational equipment that introduces engineering principles to middle school students, especially girls. This module allows the girls to work in teams and requires problem solving. However, the module is non-competitive and allows the girls to feel a sense of accomplishment. The purposes of this project were to foster interest in math and science and encourage engineering as a future career.

3.3 - Pi Tau Sigma

Central to the infrastructure of ProCEED is Pi Tau Sigma, the National Mechanical Engineering Honor Society. ProCEED is unique in that it is the only student run curriculum program of which we are aware. ProCEED expands the numerous activities Pi Tau Sigma already engages in for the benefit of the department and the entire college.

Students in Pi Tau Sigma who participate in ProCEED gain invaluable experience working with faculty, staff, College of Engineering representatives, and the community. Rarely in a large

school like the College of Engineering can students gain such broad exposure. This exposure helps the student participants become leaders by making them partners.

ProCEED provides student participants with ownership in the outcome of the project solicitation. More importantly, student participants hold the future of the program in their hands. As students spend time working on the program, they become increasingly aware of their own abilities and generally extend themselves to meet the deadlines for the program. Students generate these skills by identifying potential community partners and establishing the communication lines between these partners and the ME 450 course leadership. Pi Tau Sigma is also responsible for soliciting proposals each term, screening proposed projects, and assisting in selecting projects for ME 450.

Students involved in ProCEED are solely responsible for the day-to-day business of running the program. These students must take an active role in establishing meetings for the semester, setting deadlines for ProCEED events, contacting the ME450 course leadership, and submitting projects for ME450 course review. Pi Tau Sigma student volunteers are responsible for contacting the community at large each semester and seeking projects. These students are the programs direct link with the community. They help convey the program intent to the community, help the community formulate ideas for projects, and answer any general questions that may come up through the initial stages of project submission.

Currently, the members of Pi Tau Sigma also conduct surveys of ProCEED with the help of the Center of Community Service and Learning. These surveys are administered to the students in ME450 at the beginning and end of each semester. These surveys are used for internal evaluation of the program to help assure we are meeting our goals. These surveys also help in external evaluations of the program. A current assessment of the program and its results are contained in the following pages.

3.4 - ME450 Course Leadership

The student members in Pi Tau Sigma work closely with the ME450 course leadership to insure the projects solicited conform to the educational requirements of the class. The ME450 course leadership includes the course coordinator for the semester and the permanent course leader. The course leader assists in maintaining continuity and sustaining this effort from semester to semester. The primary role of the faculty is ensuring the quality, scope, and educational value of accepted projects.

3.5 - ProCEED Advisory Board

An advisory board to assist Pi Tau Sigma, ME450 course leaders, and the community partners was created to handle any long range planning for ProCEED. The board consists of two primary faculty members, the Pi Tau Sigma President (or the president's designate), a representative from the College of Engineering, and a representative from the Center for Learning through Community Service. This advisory board assists Pi Tau Sigma in contacting and describing ME450 opportunities to the community partners and in helping screen and select final candidates for ME450 projects that will be presented to the ME450 course leadership. Project selection is

based on the likelihood of success in ME450, the impact on the community, and the support structure (finances, facilities, external experts, and ME450 course leadership).

4 - Operation of ProCEED

At the start of every semester, the ProCEED officers within Pi Tau Sigma along with the ProCEED Advisory Committee set up a weekly meeting schedule. The group also sets requirements for the semester in the form of a hard deadline for mailings and phone calls to the various organizations, a deadline for project submission, and target goals for projects solicited.

ProCEED interacts with the community through various forums and mailings designed to engage the community and help them formulate ideas for design projects. At the beginning of each semester, mailings are sent to service organizations on file. These mailings contain an informational pamphlet on the program and an “Offer of Project” form. The “Offer of Project” form is a documented way for the program to record projects and is the mechanism through which projects are selected for use in ME450.

Each organization is also contacted by phone to show our sincere interest in any design problems they may be facing. Personal interaction over the phone with these groups clarifies the role the program wishes to play in helping address specific problems of the organization. This personal interaction usually leads to an example-based description of the program where specific projects submitted in the past are offered as examples of appropriate projects. This usually initiates a flow of ideas for possible future projects. The use of examples helps the organization understand the limits of what the program can accomplish and helps to stimulate ideas that may have been previously undefined. ProCEED members can help the organization actively work through a problem and find a solution. This helps the project become tractable in the context of ME450 course goals.

It is highly desirable to have a project that will fit both the needs of the organization submitting the project and the educational goals of the ME450 course. An “Ideal Project,” as specified in the mailing for the program is defined as follows:

- **Physical:** The course emphasizes a hands-on approach, including use by the students of our newly expanded machine shop. Paper studies are acceptable, however projects leading to physical construction are preferred.
- **Innovative:** The course emphasizes creativity. Projects should ideally allow for the generation of multiple solution ideas. Project Sponsors should avoid imposing a solution on the students (but should provide all available information, including previous solutions, patent data, etc.)
- **Unique:** Students do well on new products or mature products where new technologies may make possible a breakthrough. However, they do not have the specialized knowledge to do well on a project where they are in effect competing with large, highly expert teams of engineers.
- **Decomposable:** The best projects can be divided into pieces; therefore, a design consisting of a single complex part may not be a good idea. However, a one-piece product can be excellent if the team also designs the manufacturing process.

- **Based on minimal proprietary information:** Students must make presentations in class, and U-M cannot contract to maintain security. Project Sponsors may negotiate separate intellectual property rights agreements directly with students.
- **Attainable:** Project solutions should be attainable within the single semester time frame (approximately 4 months). However, project continuation may be possible beyond the single semester to aid in design implementation.

Upon completion of an “Offer of Project,” the local community organization submits its project idea to the ProCEED group for review. Members of Pi Tau Sigma perform initial review of the projects. This initial screening helps to filter inappropriate projects. Any projects not rejected by the initial screening are passed from the members of Pi Tau Sigma to the course leadership and the ProCEED advisory board for final review and acceptance.

5 – First Semester ProCEED Projects

The first semester of ProCEED activity resulted in two projects that were accepted by ME450. These projects were a modular wheelchair ramp and a reconfigurable wheelchair for growing children. The modular wheelchair ramp project was sponsored by the Neighborhood Senior Services (NSS). NSS provides assistance to senior citizens by providing carpenters to build ramps to make a person’s home wheelchair accessible. The current system is time consuming, permanent and expensive. In this project, the students designed a generic modular ramp system that was portable and quick to assemble. It was also adjustable.



Figure 3: Portable Wheelchair Ramp

Ken Ludwig and a group of independent contributors sponsored the reconfigurable wheelchair for growing children. While many people in the United States use wheelchairs, most wheelchairs continue to be expensive, unreliable and difficult to fix in a timely manner. One of the root causes for the problem is that wheelchairs are still designed to be “one-of-a-kind” products. In this project, the students designed a modular, cheap and robust wheelchair that was easily modified. The focus was to accommodate growing children.



Figure 4: Reconfigurable Wheelchair for Growing Children

Both of these projects presented the students with good open-ended design problems. In addition, students working on the projects were generally more apt to be faced with challenging problems outside standard engineering practice, such as communicating and interacting with non-technical sponsors. Market research conducted by the reconfigurable wheelchair group highlights the importance of ProCEED in helping to work with the community.¹

Meeting with people who experience wheelchairs in their everyday lives was highly important. We have met with different individuals to discover their insights into this project. Our consumer contacts included an occupational therapist, bio-mechanics professor, and several individuals who are either disabled or have direct contact with wheelchair users. Their input helped to formulate ideas as to what is good and bad about current wheelchair designs.

Laurel Health Care allowed us to examine different [wheelchair] models. While adjustability was a feature on almost all of the chairs, it was only for minor comfort changes, such as arm rest height and reclining angle. Axles were all repositionable.

We also visited High Point Elementary School, a school for disabled children, many of whom use wheelchairs. Betty Cotzen gave us a close look at all the wheelchairs they use at the school, along with her own personal opinions about each one. Her primary dislikes about wheelchairs were the brakes and the clumsiness of the foot rests.

Similarly, the group of students working on the wheelchair ramp project found themselves out in the community looking at existing ramps. The team also found they were restricted by building codes they needed to abide by². In general, the ProCEED groups found themselves interacting more with people of differing backgrounds. Both ProCEED projects resulted in well-designed solutions that were favorites at the Design Exposition. It should be mentioned that the reconfigurable wheelchair won second place at the end of the semester in the Design Exposition.

6 – Initial Assessment of ProCEED³

Evaluation of the program was conducted with the help of Greg Markus from the Institute for Social Research at the University of Michigan on behalf of the W. K. Kellogg Foundation sponsored Curriculum Initiatives in Civic Engagement and Student Leadership.

Surveys handed out at the beginning and the end of the semester in the ME450 class provided a means to help judge the effect of the ProCEED projects over the duration of the semester. This allowed an estimate of the effectiveness of the civic engagement content in the course. As this content is largely untaught in the rest of the mechanical engineering courses, the change may be attributed to ProCEED. Further, free response answers allowed course participants to voice more specific answers regarding their projects and sponsors.

Table 1 compares the survey results from the ME450 class provided by students who worked on the community-oriented team projects and those who worked on the traditional team projects. Although the return-rate of post-course assessments was relatively low (30%) and the numbers of responding students are small, the general pattern of results is very consistent, and the between group differences often quite large, across all survey items.

Table 1. Assessments of ME 450 by students working on traditional vs. community-oriented team projects, Winter 1999.

	Agree Strongly	Agree	Neutral	Disagree	Disagree Strongly	Total
<hr/>						
ME450 provided opp'tys to put my knowledge to good use outside class.						
Traditional (N=21)	24%	67%	10%	0%	0%	100%
Community (N=5)	80%	20%	0%	0%	0%	100%
<hr/>						
ME450 demonstrated how engineers can help address community needs.						
Traditional (N=21)	0%	43%	33%	19%	5%	100%
Community (N=5)	60%	40%	0%	0%	0%	100%
<hr/>						
... improved my ability to work with others to achieve shared goals.						
Traditional (N=21)	19%	71%	10%	0%	0%	100%
Community (N=5)	40%	60%	0%	0%	0%	100%
<hr/>						
... increased my willingness to help community using my technical skills.						
Traditional (N=21)	0%	29%	57%	10%	5%	100%
Community (N=5)	80%	20%	0%	0%	0%	100%
<hr/>						
... deepened my respect for experiences/wisdom of others.						
Traditional (N=21)	19%	52%	24%	5%	0%	100%
Community (N=5)	40%	60%	0%	0%	0%	100%
<hr/>						
...increased interests in working with others to make community better.						

Traditional (N=20)	0%	45%	30%	20%	5%	100%
Community (N=5)	20%	60%	20%	0%	0%	100%

I discovered ways to connect my career interests to ... public goals.

Traditional (N=20)	0%	45%	30%	20%	5%	100%
Community (N=5)	20%	20%	60%	0%	0%	100%

I enhanced my ability to provide leadership ... on public issues.

Traditional (N=20)	0%	50%	25%	20%	5%	100%
Community (N=5)	20%	20%	40%	20%	0%	100%

I increased my understanding of leadership as a collaborative process.

Traditional (N=20)	5%	85%	0%	5%	5%	100%
Community (N=5)	20%	60%	20%	0%	0%	100%

As compared with their classmates who worked on the traditional projects, students who participated in the community-oriented projects were consistently more likely to report that the course provided opportunities for them to put their knowledge to good use outside the classroom and that the course demonstrated how engineers can help to address community needs. Student participants on the community projects were more likely to report that the course improved their ability to work with others to achieve shared goals, increased their willingness to help their community using their technical skills, and deepened their respect for the experiences and wisdom of people from backgrounds different from their own. Finally, student participants on the community projects were somewhat more likely than their classmates in traditional projects to report that the course increased their interests in working with others to make the community a better place to live, helped them to discover ways to connect their career interests to broader public goals, enhanced their willingness to provide leadership and promote desired change on public issues, and increased their understanding of leadership as a collaborative process.

The community-oriented projects had some interesting outcomes on the individual student level. As an example, one of the students working on the ramp project expressed amazement at the number of regulations to which wheelchair ramps must conform. She mentioned that she had not realized at the outset that the project would be so serious, complex, and challenging. It opened her eyes to how legislation and regulation affects engineers. The lectures also had an impact on students in the course, regardless of whether or not they were involved in a ProCEED project. For example, a number of students expressed interest in the lecture on product liability and how governmental regulation will affect them in their careers as engineers. A number of students expressed interest in the connections between liability issues, ethical considerations, and their social responsibilities as engineers.

7 - Project Sustainment and Expansion

The goal of this effort is to have civic-based design projects each term in the design curriculum. ME450 is well established and has mechanisms already in place to sustain such design projects if

proposed. However, to maintain and generate offerings of civic-based projects, a successful infrastructure is required. The students in Pi Tau Sigma will help sustain the link to the community partners and insure each semester that there is communication between the community partners and the course coordinator. The ME450 course leadership will also assist in maintaining this essential link.

Initial Funding came from The W.K. Kellogg Foundation with matching funds from the College of Engineering and Department of Mechanical Engineering and Applied Mechanics at the University of Michigan. This funding was focused on establishing the initial infrastructure. During the course of implementation of the program, it became clear that many of the local organizations with good projects did not have the financial means to participate in the program. Thus we have actively sought funding to offset the course administrative costs and to share in the prototype cost with the community organization. Continued funding comes from industrial and alumni gifts directly to the program.

The continuing success of this program will serve as a model for the other design courses within Mechanical Engineering (ME250 and ME350) along with other student-based organizations such as the American Society of Mechanical Engineers (ASME). Expansion into other student organizations within the Department of Mechanical Engineering and Applied Mechanics will allow for significant expansion of the program and help with the infrastructure and sustainability of the program.

We have every indication that expansion outside the Mechanical Engineering department is not only feasible, but also necessary. In the numerous community contacts the program has already generated, many requests for projects outside the scope of mechanical engineering have been encountered. ProCEED has already handed off one design project to the Architecture School for development. Efforts are currently underway to interact with the Electrical Engineering and Computer Science program as well as the Civil and Environmental Engineering program at the University of Michigan.

8 - Conclusions

This paper provided a description of ProCEED, a program at the University of Michigan. The program focused on teaching students the importance of using their technical skills to help improve the community. This program was integrated into an existing course structure of the mechanical engineering curriculum to ensure maximum exposure and success. This course provided students an environment to work one-on-one with community sponsors to take an idea from conceptualization to a working prototype. Involvement in this process proved to have positive effects on students as they consistently felt they were better able to both use their engineering skills to help the community and better able to communicate with others to achieve a shared goal.

Acknowledgements

The authors of this paper would like to sincerely thank the following for their contribution to the program: The College of Engineering at The University of Michigan, The Department of Mechanical Engineering and Applied Mechanics at The University Of Michigan, Pi Tau Sigma Mechanical Engineering Honor Society (Pi Rho Chapter)

at The University of Michigan, The Michigan Leadership Initiative, The Center for Community Service and Learning, and the W.K. Kellogg Foundation. Without the contributions from these groups, this program would not have been possible.

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