

Work-in-Progress - A Project Centered Course for Socially Conscious Engineering Freshman

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Abstract - University students embark upon the new experience of higher education with hopes and dreams of their future. Freshman students are told they will be the new innovators, they will change the world. Freshman engineering students are no different. Freshman engineering courses are usually designed to introduce the “rookies” to their chosen field in a cursory way, that is, the courses look at various engineering disciplines, functions, history, ethics etc. Engineering projects are mechanisms by which the freshmen are immersed into a quasi-design environment, complete with a modest budget (their own), multi-disciplinary teammates and deliverables to be submitted by a deadline. This institution’s investigation was initiated to combat the perceived apathy of the freshman students towards learning more facts and studying for tests that may or may not hold relevance for them. Students at various universities and colleges nationally and internationally develop their own idiosyncrasies based on their caregivers, personal experiences, religious affiliations, etc. At this particular institution, one characteristic that has prevailed is one of socially-consciousness. This peculiarity may have its roots in the social upheavals of the 1960’s and 1970’s, of which, the caregivers of this generation of students are keenly aware. That social consciousness seems to be transferred to the students of this age. Recognizing the cohorts of engineering students at this institution as socially conscious, attempts were made to assign projects that awaken the passions of the students. The hypothesis is: as the students’ passions increase, their involvement will also increase so that the quality of the deliverables is more appropriate to the professor.

Index Terms – DAC process, freshman engineering projects, retention, socially conscious

INTRODUCTION

The ten-step engineering design process, advertised by *Eide* [1], includes as its first step the Identification of a Need. Eide goes on to say that “more often than not, then, someone other than the engineer decides that a need exists.”

For the socially conscious engineering student, that need must be perceived as real in order for passion towards the project to develop. As the students’ passions increase, their involvement will also increase so that the quality of the deliverables is more desirable to the professor.

Thus, a course centered about the project [2] will yield a crop of students with a desire to continue in the engineering field and with a thirst for more knowledge in the field. Needless to say, academic institutions are wary of their retention rates in engineering fields especially since engineering is perceived as difficult and unrewarding when compared to other majors. Why stay in engineering when one could pursue a degree in a non-STEM area and have a life?

UNIVERSITY IDIOSYNCRASIES

This university, like all, has a target population that has developed its particular idiosyncrasies. It seems that most students come from a lower socioeconomic status. Some are still first generation college students; while some are second generation college students.

The official enrollment for fall 2014 was 10, 725 [3]. In 2014-15, 96% of full-time beginning undergraduate students received some sort of financial aid. Although a good portion of that number may be in the form of scholarships, most do not receive 4 year full scholarships. Those scholarships would be supplemented by student loans and/or work study assistance. It is reasonable to conclude that those students know first-hand of the plight of the underprivileged and so now may be eager to provide some sort of restitution, some kind of aid to rectify the situation.

One of the events that launched the civil rights movement of the 1960s was the Sit-In at the Woolworth’s counter on February 1, 1960. At that time four minority college students sat down at a whites-only counter to be served. One of those students was Franklin McCain; his grandson was a student in the Introduction to Engineering Design and Ethics course during the fall of 2015.

On January 28, 1986 the NASA spacecraft Challenger exploded above its launch pad barely a minute into its mission. Ronald McNair, for whom the administrative building of the College of Engineering at this university is named, was one of the spacecraft’s passengers. During the

fall of 2015, the nephew of Mr. McNair was also a student in the introductory engineering course; he offered validation to the lecture that was conducted about Mr. McNair. Students who are second (and third) generation college students seem to have been passed down knowledge of social struggles of decades past.

The College of Engineering worked with the Center for Creative Leadership (CCL) in order to evaluate our clientele, our students. Our personas, as developed by CCL, point to our students as being socially conscious [4]. From that development it was concluded that projects with a social theme would be of more meaning to the students.

FALL 2014

Projects for three semesters are outlined here. These were incorporated into the Introduction to Engineering Design and Ethics course, GEEN 100. “GEEN” is the university’s prefix for General Engineering.

During the fall of 2014, with the assistance of CCL, we included the DAC process in three of our eight GEEN 100 sections. “DAC” stands for direction, alignment and commitment. Our premise was that, coupled with a socially centered project, DAC would provide the students with tools needed to successfully complete the project. The semester group project was entitled “A Functional Backpack for the Homeless.” The project was a 10-week long activity completed by a multidisciplinary engineering student team grouped by the professor. Deliverables included the prototype, an instruction manual, a recorded oral presentation (submitted via flash drive) and a written report.

The DAC process allowed us to insert milestones or “pause points” into selected course sections. “White Coat Days” were announced to the students as course periods in which we would intermittently check the design. Of course, the professors, teaching assistants, supplemental instructors and CCL faculty would wear white lab coats while these checks were made.

It sometimes seems as if while students are working on a project that they are just “going through the motions” to complete it or “checking the boxes” to say the project is done. “Squirt Day” was the first of a few special activities generated in an attempt to develop empathy within the student for the end user. Since rainfall would be encountered by the homeless individual, a backpack made of water resistant material and construction would be practical.

During the first day of class, a “Squirt Day” was held; students were immediately placed in groups and were to make judgments on the response of various materials to being saturated with water. The students would then soak these materials and the professor could then discuss puncture, shear and other failure modes based on the simple hands-on experiments.

The next milestone was the mini-project “A College Paper Grocery Bag Backpack.” On the White Coat Day, during the fourth week of class, different mechanical tests

were applied to the backpack prototype as project groups rotated through various stations. An oral presentation and a 2-page paper also had to be submitted. During the subsequent course meeting time, the students were afforded a time of retrospection; students were given a form to complete with questions such as “How does your group feel about the results of your exercise?” The students would assess what they had done and how things were accomplished. Then they would be asked a series of questions that would lead them to think about how things could have been done in a better way. This mini-project allowed the students to think about the functions of the backpack in more detail and to empathize with its potential owner.

The subsequent milestone occurred during the seventh week of class. Information concerning the homeless and their needs had been posted on Blackboard. After reviewing the videos accompanying the information, the students were able to discuss in class what they saw and how they felt in response to watching them. Forms were distributed to the students again to reflect on their decision making and their processes.

During the eleventh week of class, another White Coat Day was conducted. Most of the mechanical tests performed on the prototypes were similar to those used in the mini project White Coat Day.

The final White Coat Day was held during the fourteenth week of class. The prototypes were subjected to mechanical tests, all of which had been used before and so there was familiarity of them among the students.

SPRING 2015

During the spring of 2015, another project was launched: “Elementary School Outreach.” The first milestone in this semester was a homework assignment that required the semester project groups to research how engineers are portrayed through the media. The following is an excerpt from the assignment:

Research how elementary school students view careers. You may even interview elementary school students. Write a 2-page report, in an appropriate format, that details the kinds of things that capture the attention of elementary school students and how those things influence the career decisions of our youth.

Another assignment required the semester project teams to submit story boards. Each story board was to contain 5 frames that contain a graphic rendering, either by hand or by computer. Apprehensive students were happy to know that the bulk of the marks to be earned were not for artistic prowess but for representing a well thought-out project. The five frames must have addressed the following:

- The introduction must include an overview of what is expected in the video and answer the questions “Why is this relevant?” and “Why would I want to know what is on the video?” as may be posed by the elementary school students.
- “Real Life Engineering Example 1

- “Real Life Engineering Example 2
- “Real Life Engineering Example 3
- Conclusion

Additionally during the spring of 2015, each semester project group was asked to generate questions to ask elementary school students to ascertain their knowledge of what STEM is and what sparks their interest in STEM topics. These questions were sent to a partner elementary school in the area. Answers came back from the elementary school students that even the professor would not have anticipated. Although a few knew that STEM stood for “Science Technology Engineering and Mathematics,” a more typical response was that it “was a part of a flower.” These milestone activities inserted into the semester course gave the college students some time to really reflect on how the video project should be made and how it could be attractive to their customers, the elementary school students. The goal was to have the elementary school students assist in the evaluation of the college student generated video but that did not materialize during that semester.

FALL 2015

The project for the fall of 2015 was entitled “Metanoia.” It was named for a group in North Charleston, South Carolina, as outlined below:

The United States of America has been beset by numerous incidences of racial unrest. One such occurrence was in Charleston, South Carolina when a gunman opened fire on parishioners of Emanuel African Methodist Episcopal Church as they were in evening Bible Study. There have been other acts, which have been deemed questionable, performed by police officials.

These deeds fuel the growing distrust of police among African-American citizens. To assist with mending broken relationships between the African-American community and the law enforcement officers, a group in North Charleston, Metanoia, has recommended the idea of “Positive Ticketing” within the community. (See the website: <http://pushingforward.org/>.) This occurs when police cite youth for good deeds and reward them with a ticket. This ticket may be traded for coupons or vouchers for such items as movie tickets. Positive Ticketing seems to have its roots in Canada.

Presently, there is no convenient way to store and analyze the data from this activity.

The semester project groups could either design or utilize an app that could store and track the number and details of the Positive Ticketing citations. An alternative project was to design a board game for the elementary, middle and high school members of Metanoia to become more familiar with engineering.

The only White Coat Day during this particular semester was a time for the students to research statistics from their electronic devices during class. Each semester

project group was to complete a form that asked them to cite the crimes and violent crimes as well as the good things in North Charleston, South Carolina. These statistics were compared to the per thousand capita statistics for South Carolina and the United States. The students also gathered data on the age, gender and race of the perpetrators of the crimes as well as the good things that go on in North Charleston. They were also asked how things could be changed.

Again, by providing this “pause point” the engineering students were able to empathize with the situation in North Charleston and perhaps produce a more well-thought-out prototype.

FUTURE WORK

Detailed conclusive data are not available at this time. From a professor’s vantage point, it seemed as if the students were more engaged in the project and produced better work. More socially conscious projects are being sought for the 2016-17 academic year. The DAC process will be incorporated more fully into those next projects.

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