

Thinking Outside the Box in Engineering

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It is clear to all engineering institutions of higher learning that the principal focus of study are the technical skills needed to function as a professional engineer. Whether it be controls, vibrations, heat transfer, biomechanics, or a concentrated list of technical subjects, our students are carefully prepared for life in the technical world. The issue with stopping in our teaching at this list is that we do not provide our students with experiences that aim to bring them into contact with areas that may make their lives both interesting and instructive. The expectation is that they will receive in general university courses all that they need to know about art, literature, and music, along with professional behavior and ethics. This would be fine, except that much of that instruction in “other than technical areas,” does not seem to stick in a student’s mind. These students may hear it briefly in their freshman classes, but quickly forget it as the years pass by. It is believed at Michigan State University that they need to be encouraged within their technical classes to explore areas that are normally not experienced in regular technical courses.

Over the past three years, a new course in mechanical engineering was required of all incoming junior mechanical engineers, ME 300 - Professional Issues in Mechanical Engineering. The topics chosen to investigate are wide and ranging from rights and responsibilities to creativity, from economics to entrepreneurship. The paper to follow will investigate some of the topics chosen, the rationale behind using them, and the response from the approximately 800 students who have taken the course. It is important to note that with very little effort these topics could also be introduced in technical areas without taking time from those important technical areas. Whether one chooses a stand-alone course or an integrated program, the importance of giving our engineering students a wider scope of understanding is critical.

The Ombudsperson

Although one would assume that everyone in our classes has a clear indication of what their inherent rights are as students and the responsibilities that they have at the university and as citizens, this may be far from the actual case. This is a wonderful assumption, but when the ombudsperson at our university was introduced to the class of juniors over the past three years, only a handful of the over 800 students even knew what an ombudsperson was or is and the rights that that ombudsperson advocates. With that beginning in the semester, the ombuds quickly led the discussion on the rights that students have and the paths that a student could follow if they assume that their rights have been violated. Discussion has ensued on issues that students have had with grades, lack of instructor support, and the lack of syllabi being given. These over 800 students have been surveyed and the most common response is “Why weren’t we told this when we were freshmen?” The students were also fascinated to know that the role of ombudsperson extends to many of the companies that will employ them in the future.

While the above might be ignored in technical courses because the information does not pertain to figures and tables, equations, or particular laws, one needs to realize that students who are

under duress because their rights are being denied are less able to function in our classrooms. When we focus part of our time on making proper decisions concerning their rights in our classrooms, classes run smoother and students will be more prone to ask questions and seek a better understanding of our topics. These concerns may not be technical, but they do support our teaching of the technical.

Focusing on Creativity

Very early in the semester an investigation of creativity takes place. We have found that students at an institution that admits its students into the majors in the junior year focus chiefly on their technical skills. The skills of communication, speech, and business take a definite back seat to the need to secure a place in the major through technical expertise. Many students react to being asked to deal with creativity as something that is worthless or at best not important to an engineer. With that in mind, the class spends time discussing that many things that they actually have created from musical numbers to modified vehicles to short stories. Once the floodgate is opened the many creative activities of the class pour forth. It is then easy to work in groups to come with as many ways as they can to show creative movement, another method to show students that they do have creative skill and to get the attention of the students involves simple drawing periods where students are asked to draw anything that comes to their minds at a moment's notice. Usually the faster the better because they don't have to fall into the feeling that everything must be perfect. It really shocks the class to see all the material that is produced by their "creative" peers. Students are then asked to write a piece of poetry on a topic of their choice. If help is needed, they are given ample examples of verse that they could mimic or investigate. If asked why this exercise has any value to them as engineers, it is easy to respond. Investigating text helps one to look in a different way at what you want or need to say. Taking a topic and boiling it down to ten or twenty words makes you really think about what you want to say. Isn't that what we want as engineers conveying meaning? We need to be able to think about all the information that is at our disposal and how our readers will interpret and understand it. As an engineer writes the following words we have to believe that he really thought about what he was trying to convey.

"Roses are red.
Violets are blue.
I have a machete.
Get in my van."

Does he let the reader grow with a feeling of fear? Does he wait for the audience to laugh? What is he allowing his readers to do with those fourteen words? He was being creative. In this class of 800 plus engineers, we witnessed over 800 pieces of poetry being created. Some of it was shocking, some relatively simplistic, but all of it was creative and the students knew it. They were allowing themselves to operate outside the technical box.

The Students' Place in the Real World

Once we captured the students' focus on themselves and their rights and allowed them to realize that their own creativity was an integral part of them being engineers, we moved on to giving them a picture of what existing in the world outside of the college setting would be like. We didn't want the traditional co-op and internship presentation where they were indoctrinated into what those early jobs would be like. We wanted to go past this to actual life as a full-blown engineer facing daily work with no return to the institution. We wanted daily life as an engineer. To accomplish this we introduced engineers to the class who had spent life in factories and in offices across the country and the world. We brought in speakers who could testify to what it was like working for companies that might not always have the employees' best interest at heart. We wanted speakers who had lost their jobs and how they adjusted their lives when pay checks disappeared. Some of the speakers had served industry, academia, and government as engineers. Some had done all three and could offer comparisons. What we wanted was a stage upon which we could let students see the broad range of the working world and be able to ask pertinent questions to help in their decisions of their own futures. What we achieved was a font of knowledge on how one acts as a supervisor, how one saves money for future retirement, how it is important to know what is going on in your own employment that might make you leave a job before the job leaves you. Instead of looking at only the first days of employment we tried to influence the students to look from the very beginning of their employment all the way through to their days past retirement. One response seemed to be repeated, "I never thought about my real future beyond that first really good paycheck!"

The World of Entrepreneurial Pursuits

A few engineering students start dabbling in the area of entrepreneurship early in their studies. They have interests that involve communication and their own creativity and they make a run for businesses and the like simply because they have a focus that allows them to get out of the restraints that may hold others captive. The problem is that many others have little or no connection to the world of being entrepreneurs and may never get the chance to experience that world or at least learn about it. We wanted to give students a chance to see how being an entrepreneur did not require them to leave their companies of employment and go out on their own as most think is required in order for them to be entrepreneurs. We wanted the students to take a different approach to entrepreneurship. We wanted them to see how thinking like an entrepreneur could help them as they worked in industry and academia. This required combining entrepreneurship and systems thinking and how the two work together. Both require an enormous amount of investigation to discover how the product, the infrastructure, and the systems all work together to accomplish the desired goal. Industry requires many parts to eventually arrive at the end product. The entrepreneur also needs to realize all that goes into producing his or her product. Knowing how to address those needs are good for the individual business owner and the individual who works for the corporation.

Students responded with a number of questions that showed that while they were not ready or highly interested in rushing out to start their own businesses, they did see a broader view of what knowing about how the multitude of elements that are required to actually allow a company to function would be valuable to them as both entrepreneurs or as employees of the larger

corporation. Again we discovered that giving students the chance to investigate a particular area was not meant to change their minds to an item. It was meant to make them aware of the area and understand that it could be valuable to them in the future. Knowledge truly became a force to reckon with.

During the next semesters, we plan to expand our reviews of the material and the students' reactions to all the topics covered in the course. Our principle concern is that the student reaction focuses on material that they have not encountered in other courses on campus. It is especially important to create an atmosphere where students can gain from topics that they might originally feel are outside of their engineering foci.

Obviously, there are more parts to the puzzle we created for this introduction to Professional Issues in Mechanical Engineering and those will be addressed in future work. Our goal was to introduce topics that had not been previously encountered by these students, at least in the ways we thought that they should learn. We wanted to bring the level of consciousness from only technical issues to that of equality with the areas of employment, creativity, ethics, and a sense that as with the entrepreneur that life as a product is composed of a myriad of parts and those parts need to be at least exposed so that the engineer can make the most of the life they will lead as great engineers.