

Promoting Innovative Thinking between Engineers and Non-Technical Team Members

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Introduction and Objectives

Ideation and design-novelty require diversity along multiple dimensions:

- Diversity of experiences
- Diversity of opinions
- Diversity of design concepts
- Most of all, the ability to accept and appreciate diversity of the team members.

The objective of this work is to develop activities and tools that help engineers understand the need for a diverse group of team members. Students need to also recognize that this diversity is imperative to successful development of a new product.

I'd like to explore approaches for ways that will help students realize and appreciate the need for this diversity – videos, teaching modules, etc.

I'd also like to develop a tool to assess which approaches are the most effective – some may be more effective for engineers and others for non-technical team members.

The initial focus is on Mechanical Engineering students at the junior/senior level.

Developmental History of Innovation

My *Biomechanics and New Product Development* course is a unique undergraduate biomedical design experience consisting of engineering and marketing students. The goal of this course is to cross-link engineering design with business for the purpose of developing improved biomechanical products such as assistive devices (e.g. crutches, walkers) and rehabilitative devices. My students must understand human biomechanical needs and develop engineering design solutions; in addition, they must also understand the context of the market.

As the course matured, I began to notice that the teams who produced the most positive, interesting and innovative final products also listened to one-another, put their desire to be the "right one" aside and together explored many ideas and possible design solutions. So, I began to wonder if this appreciation and valuing of diverse opinions could be nurtured and fostered. Of course, not all team members will necessarily become best friends, but could they learn to respect and appreciate one another and embrace the fact that they came from different areas of study?

Learning Activities and Materials

To help students, particularly the engineers realize that product designs benefit from a diverse set of experiences, I discuss two extreme cases that address products in the medical environment. I compiled a combination of videos, lecture material and question/answer material for this application.

In class, I began by introducing familiar concepts from the US medical system – for example, features of our local hospital, a video of a medical emergency with ambulance service, and care received in an operating room. I asked the class to reflect and discuss what they observed: What did the patient experience? What were expectations if they were to have an emergency and were in the US?

Then I began to probe into topics that they had not put forward. I asked students if they were ever in fear that there would be a power shortage or power outage while they were on the operating table. Of course, the response was "No, there are back-up generators". I asked them if they were ever fearful of dying from a snake bite while in the US – again, they said "No" because there was anti-venom in the US. I then asked the students if they would feel the same way if they were in another country. Students did not have a concrete answer to this question – and I pointed out it was because they did not have experiences they could rely on for other environments.

Next, I switched to the medical environment in Malawi Africa. We talked about the need to seek out and value opinions of others because they must have a diverse group on their team if they are to successfully develop a product for an area where they do not have first-hand experience.



Execution

I have conducted a few activities in the classroom. These activities include a personality assessment, and corresponding lecture on team dynamics and personalities.

I also presented material on two contrasting cases (US Hospital vs. Hospital in Africa) in terms of new product development.

The goal of these activities was to have students begin to think about the need for team members with experiences different from their own, and to appreciate feedback from potential consumers (who are generally non-engineers).

Major Issues to Resolve

Right now, I have a "focused approach" with two lecture periods that address the need for diversity. I'd like to develop ways to infuse this topic into some of the other topics related to the new product development process.

I'd also like to explore other ways to present the material to the students that could be used in other classes that involve teams – even teams of engineers but with different engineering disciplines.

Assessment approaches are also needed.



Discussion

Participation in the FOEE program will allow me to explore, discuss and share interesting and effective innovations in teaching and learning with other faculty. I will be exposed to activities, techniques, and material that have demonstrated success with regard to teaching. This will allow me to better prepare students for their careers whether in industry or academia.

In particular, as engineering students graduate and move into industry or continue in academia, I would like them to be better innovators. To accomplish this, students must be able to appreciate and embrace team members with different experiences, different opinions, and training different from their own. Therefore, the benefits I garner from this program will translate to my students and make them better prepared for their future careers.

I also hope to develop methods of assessment for this topic. Through use of these assessment tools, I can explore different approaches of presenting my material and determine which approach is most effective.

A NSF submission is planned and a collaborator will be our Center for Engineering Education.

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Figure: Left photo - Operating room in Malawi Africa,
Right photo - Operating room in the US.

These two situations are used to discuss the thoughts of the class regarding needs of an operating room.

The goal is for students to realize and appreciate the need for a team with a diverse set of experiences is a must for new product development .

