Session 1453

Creating the Spirit of Teamwork in the Freshmen Experience

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Abstract

Building an attitude that senses the need for a team effort in engineering is an important aspect of the Freshmen Experience. Students who come from a variety of backgrounds where competition and winning may be more important than collaborative endeavors must be quickly acquainted with tactics that will make team activities a vital part of their education. The idea of networking and developing strong links to individuals who can supply help and counsel in future work can and should be instilled early in the college or university career. Strategies for dealing with team activities, elements for creating a team environment, activities that will allow teaming to be part of the natural engineering education, and ideas concerning the type of students who may enter engineering programs (and their teaming potential) will be discussed. The incorporation of problem solving as a team activity will also be reviewed. Attitudes towards the teaming activities and their benefit to the students will be explored through the students' assessments of the activities.

Every fall thousands of freshmen join the ranks of college and university students across the country. They come from large schools and small schools and everything in between. We expect them to come freshly washed and filled with basic information that will enable them to survive in any of the courses that we deem acceptable for the freshmen mindset. We also expect them to adapt to a variety of wide ranging teaching patterns, to vary their learning styles, and function as specialists on a mission to submerge themselves in the educational system. They sometimes, and more than not, continuously fall short of our expectations; and this creates a foreseeable tension in our interactions. One of the areas that we fail to spend enough time on because we assume that students should be completely capable of performing in is teamwork. We throw projects at students and then become frustrated when the process disintegrates into bedlum. Parker Palmer states, "Everyone must be educated into a capacity for connectedness!" The process of moving

from individual focused activities or following blind the orders of others must be developed into a intelligent team mentality.

There are many reasons upon which we can focus that lead us to believe incorrectly that every entering freshman will work well on a team. The number of students who have participated in team sports makes us believe that everyone will be oriented to being let loose as a team and will succeed in whatever they are asked to do. We fail to realize that team sports do not build the skills to think on one's own. It is more an attitude of doing what you are told. This train of thought carries through most of the other pre-college activities: plays, education itself, peer groups. They all move students into acting in groups but with little or no real independent thought activities. They do not instill in students a sense of what it really means to be an integral part of a team, responsible for independent thought that comes together in the group as a consensus of ideas.

Engineers especially must function as team members, but how do we define the attributes of a team member? What are necessary tools that make an individual into a valuable team player? The attributes that will make a team successful encompass the following:

- Creativity
- Willingness to listen, speak, and question
- Follow through
- Responsibility
- Aptitude to work
- Leadership qualities but ability to follow

With these thoughts in mind the College of Engineering at Michigan State University decided that a program would be instituted to bring select freshmen together and prepare them for their entrance into the university and the College of Engineering. The thought was to develop in them a sense of comaraderie that reflected the team approach to all things. As a team they would attend classes, study together, live together, and approach problems together as a team.

The Residential Option for Science and Engineering Students (ROSES) provides students with not only close proximity to fellow engineers through centralized housing but to classes that group these students together in math, physics, and chemistry. The students are required to enroll in a customized engineering course housed in the College of Engineering. This course addresses issues that are commonly experienced by most freshmen, but it also focuses on highly specialized topics involving engineering in particular. Topics range from introductory material on their chosen majors to ethics. It is also an important time in which to make clear the necessities of studying, time management, networking, and coping with the normally difficult engineering freshman's course load. This beginning effort shows great promise in developing skills that are needed by students when they actually enter the specific departments within the College of Engineering in their junior year.

One aspect of the program involves the increased concern voiced by engineering faculty, ABET, and employers that students need to be experiencing much more design based orientation incorporating team activities than they are now receiving. Design is one area that holds high interest for freshmen; and, therefore, it is a perfect place to introduce those team activities. The

design aspect allows for developing team awareness through in-class design, out of class assignments in design, and extracurricular activity that focuses on design.

Since the retention of students in any engineering program may revolve around their abilities to see relevance in the courses they are taking, it is imperative that courses clearly show the relationship between what is being taught and future application. Freshmen, especially, are searching for paths to follow and answers to a myriad of questions that are posed in the first days of their college or university careers. The introduction of teamworking activities in design in some form in every course provides a means to draw correlation between technical knowledge and the real world and the importance of those teamworking skills in that pursuit.

One of the things that we can focus on is the definition of design. In its simplest forms a dictionary definition will suffice: "to make preliminary sketches of, sketch a pattern or outline for, plan to plan and carry out in a skillful way; to form in the mind, contrive, to develop according to a plan." With these ideas in mind it is a relatively easy step to begin formulating one's own plans to involve students in the world of design, a world where the participants understand that design is the heart of engineering. It is also relatively easy to direct the students' attention to the importance of working together to form the best ideas for a design, to use all their individual skills to perfect the best choice, and finally to build the unit and test its performance. With time a premium, the students can experience the need to share the load of a project. They can work through the whole design process as a group not as an individual by:

- defining a problem
- developing a plan
- being creative
- integrating various disciplines
- manufacturing the unit
- testing the product
- communicating the results

Too many jobs to be handled by any one person. Too many responsibilities to shoulder alone. Design begins the process of developing the team mentality.

Team building exercises bring the world of actual engineering design into class when students form groups to work with a variety of materials to create bridges, towers, and exotic devices. The building activities do not end with the final whistle that signals the end of the competition. This is the time for the discussion to begin on what techniques
each team used to produce its end product.

A variety of activities have been used to utilize the interest of students in hands-on engineering with the need to build their teamworking skills. One such activity requires the students to look at a simple problem of building a tower from straws and masking tape. They must build the tallest tower possible that will support a full can of soda. All the above steps in the design process must be discussed by the group. Each person is encouraged to express his/her ideas in regard to the problem. After discussion, the best solutions are selected, the final course of action is set, and the building begins. The whole activity from beginning to end encompasses only 40 minutes.

Students need to get all members of the group involved or the project cannot be completed. The response from the students were very positive. One female commented, “This is the first time anyone listened to my ideas concerning something related to engineering.” Another student was heard over the general noise, “Let’s go. We have to have everybody on this thing or we won’t get done!” The activity itself fostered learning. The students became their own teachers concerning teamwork.

The 40 minutes of frenzied activity was not the end of the teamworking exercise. Students left the classroom, but their towers followed them. All towers were delivered to their dormitory and within the next week, each team was required to arrange meeting times, investigate a tower built by another group, make recommendations for improvements, and produce a document that could be given to the other tower’s builders. The exercise gave the students an opportunity to investigate design but also to evaluate their experiences in teamwork. The insights that they gained were shared with the entire class and the learning that took place showed that a hands-on experience was exceedingly valuable in showing students the value and pitfalls of teams.

Students found that this out-of-class activity provided them with a set of new tools to use in their next team activities. They could discuss any methods that were learned in other classes that came to bear in the final design. Here students are not involved in the frantic activity to build the actual tower, they talk about the thought processes that went into the design, what went well, and what failed to be achieved. A wide variety of activities are incorporated into assignments. Activities that do not require a great deal of time but do initiate thought in future engineering issues are quite valuable. Design techniques are discussed. Problem definitions are created in relation to the projects, whether they be large or small. The importance of time lines are expressed. And lastly written documents in the form of Gantt charts, progress reports, preliminary reports, and final documents are discussed and produced. These reports, created around real world activities (large or small) will be remembered by the students.

It is important to state at this point that programs that only allow students to enter their programs in their junior year must be mindful of teamwork and its importance to design in the early days of the students' lives. If colleges and universities expect to retain students, there is a distinct need to give them a correlation between the real world and the required courses that they are taking in their early years before they are fully immersed in engineering. Design activities incorporating teamwork can easily perform this task.

Directing students within the classroom setting with activities such as tower building allows for immediate explanation of why a particular course of study is being required. Issues that will never be raised in a mathematics course can be tied to the study of particular angles that may or may not produce a workable structure. Designing reports can also make the student aware that design neither simply revolves around mechanical devices or is best done alone. Students can be drawn into the world of communication and how the particular design of a report can make or break the acceptance of a proposed project with fellow team members.

Design out of class allows the students to formulate ideas over the dinner table, in the dorm room, or out under a favorite tree as a group. Working into the late hours of the night trying to come up with a team oriented design that can be demonstrated in class will have a much greater

effect upon the student than the commonplace lecture. The act of planning, researching, and building keeps the minds of the students active and interested. There is reality in design. Reality that is sometimes in very short supply in many courses. These freshmen, then, are constantly made aware of the relationship of the courses in which they are enrolled and the world in which they will eventually work.

Extracurricular design is the third area in which students are directed to participate. Direct mailings, phone calls, e-mail, personal contact, flyers, and class visits are used to encourage freshmen and sophomores to participate in activities that have in the past been the domain of the upper classmen. Designing, building, and racing the Formula SAE cars; doing the same activities with the Baja vehicles, and researching the true needs of hybrid energy efficient vehicles all are promoted with these younger students. The very contact with upper classmen will gain a transfer of knowledge along with a tangible reason for taking many of the courses in the curriculum. Again the individual is not the focus of the activity, It is the concentrated effort of the group that brings each individual project to a successful end.

There is one last area that may not have received much discussion but can produce interesting results. Most colleges and universities have final projects, courses, or capstone design courses that culminate the entire body of courses taken by the student. A future project hopes to introduce freshmen to members of the senior design class and allows these freshmen to sit in on some of the initial meetings, work sessions, and company visits. The connection between what they are going to face in their classes and the final real world projects may clarify much of what they will find in their courses. Here the teamwork encompasses a real world design project at the senior level. The effort is driven by a team of students who realize that only by utilizing all the members of the team will the project succeed. But the plan is to have freshmen students, fresh into college, be a part of this project to allow them to see where their next 4/5 years are leading.

Conclusions

Teamwork within design can be an integral part of every course in the curriculum. Using it to show correlations between what is taught and what will be encountered in the real world gives the student the tools to continue to accept the educational system as a valuable activity. Allowing students to quickly formulate plans and even more quickly build the designs in in-class activities gives them the chance to see design at work and keeps alive the connection with other courses.

Out-of-class design activities allow students to create within environments of their own selection. Working together in teams the natural enjoyment of design can make otherwise seemingly worthless courses valuable. If these teams contain upper level students, the added value of previous experience and the passing on of valuable lessons will only strengthen the bond between technical knowledge and how it is used in the real world.

Teamwork and design and all their components must be made an integral part of the everyday activity of students in engineering departments because the teamwork found in design is truly the heart of engineering.

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