

Experiential Learning: The way ahead

The current paradigm of teaching and learning can best be described as '*sage on the stage*' mode of teaching. The teacher thinks, 'he is the repository of all the knowledge in the world' and imparts a whole lot of theoretical knowledge to the students. The students often wonder, 'where is engineering in all this'. Especially when the opportunity arises to apply this knowledge, they found themselves ill-equipped.

This age old paradigm of teaching was developed when teachers often used to be practitioners in the field. They with their vast experience and real life examples often made classes very interesting. Later, professional teachers with strong theoretical concepts and knowledge replaced practitioners in the classroom. This, in my opinion, has led to the current situation where students often graduate with little applied knowledge.

Further, we are now dealing with a very different set of students with technology in their hands in the form of smart devices. Technology enables them to learn any concept without the need to search for books or visit libraries. Teachers who use bookish concepts or follow a prescribed textbook do not excite students anymore. Theoretical concepts, which are available with a click of a button on their laptops, no more attracts them to the class. Rote teaching and learning methods of yesteryears thus will never be able to stimulate today's students. They will only look forward to a formal class if it gives something more than what is available with the technology. Today's teacher must be willing to become a '*guide on the side*' rather than a '*sage on the stage*'.

Employers want 'role ready' engineers. Many employers come to campuses with the specific job roles for the students, and more often than not are disappointed with the industry readiness of the students. This can again be attributed to the rote learning methods educational institutes use. Having dealt with several employers during the past few years, we know that many industries are keen to play some role in the teaching and learning process to impart application oriented skills to the students. As industries vary, so do their requirements. It is the need of the hour for engineering institutes to produce graduates who can quickly adapt to these requirements. They must have the necessary skill sets to meet the problems posed to them. Thus, today's graduates should be skilled in self-learning, problem-solving and an ability to apply theoretical concepts to industrial problems.

There is, thus, a need to modify how engineering education is being imparted today. The ability of students to solve complex engineering problems can be improved by some fundamental methodical changes in knowledge dissemination. The large emphasis on outcome based, project led education across the globe is a step in the right direction. Hands-on experience is key to the project led education and is finding its way into engineering curricula across most engineering institutions. Experiential education is one such very effective way to equip students with such skill sets. In India, these ideas are still at infancy; but we all must move forward - beyond the customary lip service - in this direction to build a future ready nation.

We at Thapar institute have developed a sustainable model to implement these changes with the establishment of an experiential learning center. The faculty and students work together on real

world problems with undergraduate students from different engineering disciplines. Such projects are interwoven with regular engineering courses. These courses impart theoretical concepts that are applied in developing solutions for complex engineering problems. This combination of students and faculty working together is very effective in teaching problem-solving techniques. The problem-solving instills an ability to define need established realistic assumptions and constraints, build design, analyze and select designs, validate and optimize.

Example of experiential education initiatives

The freshman students often talk about lack of engineering in the first year courses. While they plan to do big things at the onset of undergraduate, what they end up doing is more physics, more maths and more chemistry. While these are foundation courses and teach basics, which are very important for the students, a complete lack of any direct application makes them very much resented. Some students thus lose interest, and then focus on graduating with least effort. Further in the upper years they do more interesting courses with some sprinkling of labs in between. But there remains an unfulfilled desire to apply, build and design a reasonably medium to large sized engineering product or service. Although most engineering institutes do offer a culminating capstone project; however lack of facilities, improper training and under equipped infrastructure for creating an engineered product results in tickling the box kind of exercise.

The experiential learning center at Thapar Institute addresses above issues for each stream of engineering. For example, in the first year all mechanical engineering students get to dissect a Honda engine. While they may have practically no previous knowledge of the parts and components, the focus is on building a design vocabulary for the students. They for the first time start to use some set of professional tools and are exposed to engineering terms never used before. They are then asked to rebuild or reassemble the engine, and the ability to use standard tools excites them immensely. The students, then in groups of four, select a sub assembly of the engine. They are encouraged to create their part drawings and exposed to specifications and tolerances. In the later years, they complete a design analysis of the subassembly and manufacture some of the parts. During the final year, students are provided with all the parts, some manufactured by them, and are asked to produce their own engine. This way, one product moves through multiple courses and students get to apply theoretical knowledge to an application.

A number of such open ended projects are offered across various engineering streams at Thapar. These open ended projects give students an opportunity to make decisions and live by their choices. It impacts soft skills such as working in teams, exhibiting leadership qualities, and verbal and written communication skills. We have been working at this center for almost 2 years now and one can feel the buzz on the campus. Happy and excited faces of students, when they participate and accomplish the task, have been a great motivator. We firmly believe that this is the way forward for engineering education in India.