Transformation in teaching and learning in Engineering Education

(Transformation with transforming mind)

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***Abstract*—In Indian scenario; need for transformation in Engineering Education arrived from more than one decade. It was observed that students from various fields are unemployable and not capable enough to work after receiving their graduation degree. There is gap between faculty teaching the subject and students receiving end. Though students get practical exposure of theoretical knowledge through industry interaction and it may be helpful in practical application of day to day life but there are many distractions students face in present days and need to work on it effectively. Efforts should be made that students learning should be effective and helpful to industry; society and not limited to exams. This paper focuses on the ability of human mind to absorb the new techniques introduced to them in study based of concentration level. Author feels that a trained mind or mind with awareness can learn the new techniques quickly otherwise it acts as a burden and will not stand for long time.**

Keywords—transformation, engineering, mind, awareness, study, students, teachers

I. HISTORY OF ENGINEERING

Engineering education witness its presence since 1847 in India i.e. 100 years before independence but in USA it started around 1802 in military; though the first engineer officer was appointed by George Washington in 1775 during American revolution but education in engineering could start only after 1802 [1]. During early period, most American engineers started as apprentices on canal and railroad projects such as the Erie Canal and the Transcontinental Railroad. Around the 1850's few schools started following the French model – the 'polytechnics' – Engineering was apart from the university This changed with the Morrill Act of 1862[2].

The word *engineering* probably derives from the Latin word *ingeniatorum*. In 1325 a contriver of siege towers was called by the Norman word *engynours*. By 1420 the English were calling a trickster an *yngynore*. By 1592 we find the word *enginer* being given to a designer of phrases -- a wordsmith. The *Oxford English Dictionary* gets to the first use of the modern word engineer in 1635[2].

Though in India word 'Engineer' might have came late but Engineering in amazing ways was existing here from many centuries. Civil Engineering specially can be called as the start of the engineering. Mauryan art encompasses the arts produced during the period of the Mauryan Empire (4th to 2nd century BCE), which was the first empire to rule over most of the Indian subcontinent. It represented an important transition in Indian art from use of wood to stone. It was a royal art patronized by Mauryan kings especially Ashoka Pillars, Stupas, caves are the most prominent examples. First civilizer of India was Samrat Ashoka (265–238 BC), amazing structures were built by him which are still in good condition after many centuries. Remarkable feature of pillars is the fine polish of their surface**.** As Vincent Smith rightly remarks, "their fabrication, conveyance, and erection bear eloquent testimony to the skill and resource of the stone-cutters and engineers of the Maurya age [6]. During the time of Asoka, Engineering was existing and there is a unique collection of documents proving it. It gives us insight into his inner feelings and ideals, and it transmitted across the centuries almost the every words of the great Emperor Ashoka.

In later days; in Akbar period architecture, building style that developed in India under the patronage of the Mughal emperor Akbar. The architecture of the Akbar period is characterized by its strength, elegance and graceful rich decorative work. The style is best exemplified by the fort at Agra (built 1565–74) and the magnificent town of Fatehpur Sikri (1569–74), but fine examples are also found in the gateway to the ʿArab Sarāʾī (guesthouse at Humāyūn's tomb), Delhi (1560–61), the Ajmer fort (1564–73), the Lahore fort with its outstanding decoration (1586–1618).

Above examples are few from the vast history of Indian Architecture and it clearly shows that without Engineering education Engineering work was existing in past and people were skilled and knowledgeable enough to build amazing structures.

II. HISTORY OF ENGINEERING EDUCATION IN INDIA

The first engineering college was established in the Uttar Pradesh in 1847 for the training of Civil Engineers at Roorkee

which later became IIT Roorkee. Later in 1856, In pursuance of the Government policy, three Engineering Colleges were opened. In Bengal Presidency, a College called the *Calcutta College of Civil Engineering* which later became Indian Institute of Engineering Science and Technology. In Bombay Presidency in Shibpur; college was opened at the Writers' Building in November 1856. Pune eventually became the College of Engineering, Pune and it was affiliated to the Bombay University in 1858. In the Madras Presidency, the industrial school attached to the Gun Carriage Factory became ultimately the College of Engineering, Guindy and affiliated to the Madras University (1858). Another major step taken in the pre-independence era was the creation of the N. R. Sarkar Committee in 1945, which submitted a preliminary report recommending the setting up of four higher technical institutions with broadbased education, patterned after the Massachusetts Institute of Technology, USA in the four regions of the country[3]. Almost after a century while implementing the Sarkar Committee recommendations, five IITs were established at Kharagpur (1951), Bombay (1958), Madras (1959), Kanpur (1960) and Delhi (1961) as institutions of national importance by an Act of Parliament. After a gap of over three decades, the sixth IIT was established at Guwahati (1995) and the Engineering College at Roorkee was first made a University and then as the seventh IIT (2001). In 2008, four more IITs were established at Patna, Jodhpur, Hyderabad and Gandhinagar followed in 2009 by four more at Ropar, Bhubaneswar, Mandi and Indore, making a total of 15 IITs. The older IITs are mentoring the newer ones.

Past few decades witness exponential growth in education and research in engineering institutes like IIT's, NIT's and IIIT's and many other good private colleges/Institutes.

III. CHALLENGES IN ENGINEERING EDUCATION IN INDIAN SCENARIO

In India, there is a great need of trained or professional engineers in all the domains of engineering. Challenges in present scenario for faculties and students especially in private engineering colleges are as described below:

Challenges faced by faculties:

1. Class strength: Class strength in Engineering Colleges is more than 60 and nearly 70 students; except in renowned institutes like IIT's and few others. Generally it was observed that; in one class out of 70 students only 25% students are very good in studies and 30% are average students with interest in studies and rest of them are facing difficulty in coordination or poor in studies. Faculties face difficulties in one to one coordination with students and solve their difficulties because of high strength of students.
2. Exciting or interesting lectures: Faculties should make lectures interesting so that students take interest in learning. Mere targeting completion of syllabus will not produce fruitful results.
3. Capable faculties: Faculties should be experienced and capable enough to take the class effectively and ensure students learning.
4. Class control: This is one drawback observed in many cases; few faculties lack class control reasons being many; like faculty is not prepared well for class; lacking in confidence or just want to complete syllabus in given time span.
5. Work load: There should be check on faculties work load as per AICTE norms. Faculties teaching more than two subjects in one session will reduce effective delivery of classes. As most of the time will go for the preparation of the subject. In most of the colleges this fact is ignored as per the reviews received from faculties.

Challenges faced by students:

1. Concentration level: This is very important aspect for students. Presently most of the students are preoccupied with many things in their mind and concentrating during the class hour becomes challenging for them.
2. Student's interest in study: Students interest in study based on many factors like; they want to seriously achieve the degree or they are in particular field by choice or by force of parents. Some students are found to attend college as formality and show no interest in actual learning of the subject.
3. Background of the subject: Students may not be having fundamental knowledge required for the subject; reasons may be; easy entry in Engineering due to many options for admission in Engineering colleges are available now a days or student may lack interest in particular subject.
4. Distractions in present days: This aspect can be considered as the most harmful but overlooked for student's career. Now a day's every hour; every minute and every second student's are addicted to the mobile phones; computers; latest gadgets for social media. Social media like facebook, twitter, Whatsapp are spoiling their important time otherwise they could have used in their career planning. In these distractions television is equally harmful for student's career; as students spend enormous time watching it. These distractions are even applicable to the faculties to the great extent but may depend on the maturity level of the individual.

IV. UNDERSTANDING HUMAN MIND AND CONSIOUSNESS

A. Levels of Consiousness

To get maximum benefit from the engineering education and develop as an individual is a big challenge presently. Concentration in studies includes listening in classroom attentively, seeing the action or explanation of faculty and

matter written on board or in presentation is related to the perceiving through eyes by seeing. Registering things in mind after listening and perceiving is a difficult task. Overall it may look simple to sit in class and listen to the faculty but if mind is not at its place then listening to class and perceiving information becomes superficial. Students mind mostly distracted due to various reasons as discussed above.

Control on human mind is a big challenge in present days. According to Buddhist study; human mind experience eight level of consciousness as shown in Fig. 1 and 2

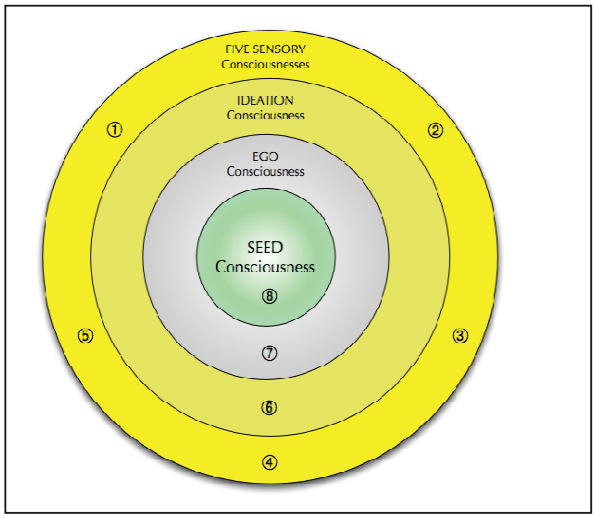

Figure 1: Buddhist Consciousness [4]

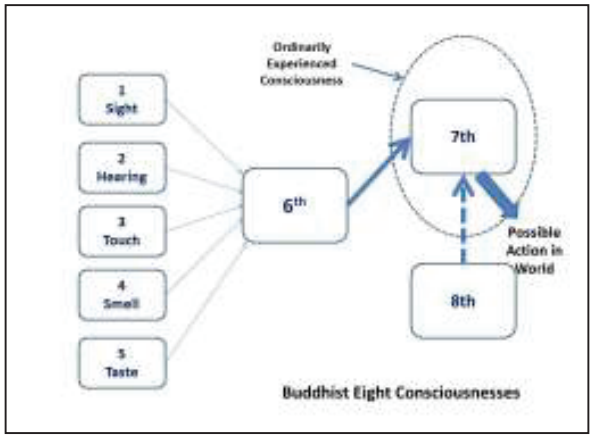

Figure 2: Buddhist Consciousness flow chart

Figure 1 shows the outer circle numbering 1 to 5 are five senses also called as sensory consciousness as. Depending on the strength of the input of these senses, one will have differing awareness of these consciousnesses at different times. If concentration level is weak or mind is distracted student can find difficulty in perceiving these things like seeing and listening in the class.

The 6th level of consciousness is the mind. It is the layer that integrates and processes the information from the various senses into a coherent whole – this level corresponds closely with the western concept of 'the mind'. For most people, these first 6 levels of consciousness are where we spend most of our time in performing daily activities.

There are higher level of consciousness which are not in scope of this study but would like to mention them; like 7th level which is looking inside is called as Mano consciousness, next level called as alaya consciousness and 9th level called as Pure consciousness.

There are many other studies done regarding human growth as an individual. Engineering education can be considered as part of it.

Few other studies includes modern psychology which brought us 'Maslow's hierarchy of needs', the middle ages brought us Bunyan's "the Pilgrim's Progress' etc.

B. Classroom example: Introducing Anapansati Meditation

Anapansati (pali language word) is mindfulness of breathing given by Buddha (563 BC) [5]. In a classroom of around 70 students where author being faculty conducts class regularly, before starting a difficult topic to teach; author asked all students to do one small exercise for few minutes. First students were asked to maintain complete silence in classroom and also asked to be aware of the silence and feel happy from inside. Then students were asked to close their eyes or keep it half open and concentrate totally on breathing; just only watching the coming and outgoing of the breath for two minutes; leaving away all the good and bad thoughts for two minutes and only observing breath single-mindedly; peacefully; silently. Meditation helps in increasing concentration level; after few minutes beautiful silence experienced by all the students. Then author developed interest about the topic within the students by giving some practical examples. Later, lecture was delivered which helped the students to understand well. This method can be used before starting with difficult topics.

C. Implementation of Anapansati meditation in Engineering College:

A training session can be given to the faculties by organizing a seminar in weekend or as per the comfort level of concerned people involved. This method is very easy and can be learned easily. Once faculty understands the importance of the concentrating mind by observing breathing they can start using it in classroom and in their personal life as well.

V. CONCLUSION

Paper focuses on effective methodology to train the mind of students and increase concentration level which is equally applicable to faculty as well. A scattered or distracted mind can not perceive things to the higher level and knowledge will remain at superficial level. Time has arrived that one must learn the methods to train their mind and understand level of

consciousness. By developing their mind students and faculties can benefit to the great extent as not only in their day to day teaching and learning but also they will be able to live a happy life. Happy life of an individual can certainly help in creating bright future of the society and nation.

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