

Stimulate the Young Minds Today to Create Efficient Engineers for Tomorrow.

(Technical Article on Innovative Teaching Methods)

Author: Dr. S. Kumar

**Department of Civil Engineering
Jyothy Institute of Technology**

Introduction:

Engineering is an artistic science which has evolved in the name of technology. *“A Creative mind is the home of technology but one should know how to kindle it”*. It is important to invent the method of teaching and illuminate the thoughts through ideas.

With the advent of outcome based education, several methods have been developed to achieve an effective outcome based education system. This write up is an effort to suggest few more innovative methods which would improve the productivity of the students and make them better engineers.

The innovative methods discussed here are;

1. Prototypical or model based teaching.
2. Thought process implications
3. Cluster of teaching aids
4. Exposure on reality or practicality.
5. Inculcating ideas for inventions and advancements.
6. Brainstorms (Discussions and debates)
7. E3 Techniques (Entertaining, Elucidating and Exploring)
8. Researcher's Discussion Forum (RDF)

1. Prototypical or model based teaching

The relevant prototypes or engineering models will be the effective teaching aids which make the clarity in understanding the concept. 3D or 2D drawings can be used if prototypes are not available. Students can be assigned to prepare the 3D models or 3D drawings in relevance with subject attributes. The model based teaching increases the memory and easy retrieving capabilities of students.



Fig 1: Model Based Teaching

2. Thought Process implications.

Thinking process on particular objectives will produce thoughts. The thoughts may derive the assumptions or hypothesis. We can see lot of the examples on thought process which gave the inceptions for great inventions. Thinking process may give infinite number of assumptions and solutions about one particular topic and some times it may also lead to great confusions. The tutor must refine and channelize the student's thoughts about the basic concepts and boundary conditions. Thought process training can be given to resolve the solutions for complex engineering problems under practical or analytical conditions. The thought process can be effectively applied for the subjects related to mechanics. The tutors should train the students by imposing the questions to make them think in several possible ways to get the solutions. The student's response to a couple of tricky questions would portray their level of understanding of the concepts taught. Some of the examples of tricky questions are given below which would make them to think out of the conventional way.

- *“When a beam is subjected to bending, what would be its bending equation if the transverse section is assumed, not to be in the plane surface?”*

- *“What would be Euler’s equation of fluid flow if assumptions are made on increment of pressure is zero in the equation. Think and comment over practical conditions”*
- *“What is the difference between ‘force on the body’ and the ‘body force’? Explain with reference to the Newton’s laws of motion”*
- *“Acceleration due to gravity is zero when the body is at rest”. How does the ‘body force’ exist when it is under rest? Define these concepts with mathematical functions”*

The tutor should record or write all the assumptions or answers given by students and drive their thoughts or assumptions in a proper way by highlighting the practical examples with boundary conditions.

3. Cluster of teaching aids

It is the art of handling more number of teaching aids in the same session of teaching. This method reduces the boredom and breaks the monotony of teaching and learning which may occur due to the use of same method or same aid of teaching. Applying minimum of three teaching aids would be recommended for better results. It would be better to conduct the theory classes in the respective laboratories where relevant equipments are available for better teaching. Few examples for the use of cluster of teaching aids are given below.

Projectors, writing boards and models or equipments will be used in the same session of teaching. Power point presentations could be used for conceptual understanding. Models may be used to explain the fundamental and practical applications. The writing boards or digital writing pads or screen capture devices can be used for illustrations with mathematical functions.

4. Exposure on reality or practicality

Professionalism is an attribute that is developed with the exposure to reality or practicality. Students should get exposed to actual practices and real world examples. Some of the methods or systems like Internships, site / industrial visits may be conducted along with academic activities. These conventional methods may provide a partial view of the practicality. Students can learn more when they get engaged in a part of real projects as assignments. The faculty in-charge of this process is expected to have at least three years of industrial experience for better explanation of the practical concepts.



Fig 2: Project visit (Kabini dam visit, Mysuru)

5. Inculcating ideas for inventions and advancements.

This topic is all about inventions, implementations and advancements of technology which can be evolved by instigating the curious minds of the students. The tutors should be aware of the modern science and technology in relevance to their field. Tutors can share their ideas about new inventions, drawbacks of existing technologies with their students and suggest suitable alternatives. Tutors should provide the time slot for discussion about the implementation of an idea on products, core applications and technologies. Examples on ideas of advancements are given below.

- *Development of alternative products or materials under techno-economic aspects.*



Fig 3 HACC (Hot Air Curing Chamber-2013, Source: Concrete lab equipment, JIT)

- *Controlling measures on heavy flooding due to rain in dense cities by using modern technology.*

6. Brainstorming (Debate and Quiz)

Tutors should give importance on debate programmes about socio-technical aspects for the development of society. Properly organised debates and quiz competitions will enhance the knowledge of students. Examples of some of the debate topics are given below.

- *Impact of cost on maintenance of infrastructure on socio-economical regimes*
- *Comparison between the selling price of PPC and OPC: Market ethics of cement industries*
- *Contribution of civil engineers in Swachh Bharath Abhiyan and development of smart cities*
- *Pros and Cons of Green building concepts in actual constructions.*

7. E3 Techniques (Entertaining, Elucidating and Exploring)

The efforts of tutors are not just limited to complete the syllabus, but it is also important to see its outcome to analyze the level of understanding of the concepts or lessons which were taught. ***“Many times the efforts taken to scale-up the learning level will end-up with boredom not due to lack of attentions of students, but due to the lack of grabbing the attention of students by the tutors”***. The tutor should create an interactive atmosphere in the class room to grab the attention of the students. This is purely a techno-art of the tutor to develop techno-crafts. Tutors should create curiosity amongst the students by posing questions and encourage them to come up with doubts and explore probable solutions. The best solution is then elucidated by the tutor.

8. Researcher’s Discussion Forum (RDF)

The above said methods are focussed on improving the learning levels of the students. These methods will be effective only when there is an increase in the learning level of the tutors also. Updating the knowledge by FDP (Faculty Development Programmes) and STTP (Short Term Training Programmes) are the traditional methods which have been followed over the years. The knowledge acquired in such programmes can be disseminated by having discussions pertaining to the training programmes.

The Department of Civil Engineering has planned to initiate this concept of an open discussion platform to discuss the subjects, research topics and skillsets. The discussions on various subject and research topics will be carried out amongst the faculties. This process of discussion will help in pooling and enhancing the knowledge of the faculties.

Acknowledgement:

I would like to express my heartfelt gratitude to Jyothy Institute of Technology (JIT) and Centre for Incubation, Innovation, Research and Consultancy (CIIRC) for their continuous support and encouragement.

“Reinforce the mind to concrete the thoughts”