



TEACHING LEARNING CENTER BITS-PILANI GOA CAMPUS



BITS Pilani
K K Birla Goa Campus

ANUNAAD- THIRD EDITION-May 2022

WHEN TEACHING RESONATES WITH LEARNING

FEATURED ARTICLE

Prof. Uday Khankhoje - IIT Madras

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MY TEACHING METHODS AND PHILOSOPHY

“Students come from extremely diverse backgrounds spanning differences in gender, region, native language, proficiency in English, economic and social background, and so on. While we would like to believe that none of these matter once the student steps into the classroom, in practice, it is never so”

Experience Sharing and Teaching Insights

Prof. Prasanna Kumar



“I believe teaching something you know to someone is a good thing that any society appreciates!”

Prof. Toby Joseph



The most important thing I had learnt in my teaching career is “RESPECT THE STUDENTS”

Prof. Rayson Alex



“I need to be a student always to teach well”

Prof. Ashwin Srinivasan



“Teaching brings me in contact with bright young students. It's a honourable way to earn a living!”

FROM THE EDITORIAL DESK:



Welcome to the third edition of the *teaching learning center* (TLC) newsletter. After a gap of two years, all of us are going back to doing what we love the most i.e “teaching in classroom”. Even though online teaching had its own share of advantages, it deprived us of the intellectual and emotional connect we had with the students in regular classroom. The “thrills” and “excitement” of delivering live lectures and the perennial challenge of keeping the students interested is a very unique experience. Live classroom also has its own ebbs and flows with students exhibiting varied emotions ranging from “eagerness” to “weariness” over the course of the lecture. The most successful and popular teachers are those who often find ways to change the mood of the class by suitable improvisation.

Conventional teaching practices do not appeal much to the students of this current generation. They expect the learning process in the classroom to be fun, vibrant, interesting, intellectually challenging and more importantly to stimulate their curiosity in the subject. It is not easy

to meet all their expectation. Teaching engineering and science subjects in a way that captures student’s imagination which most often than not has abstract theories studded with complex formulae is a no mean task. Teachers of this era need to be like a magician who will dazzle their audience with their ticks and performance.

How are we going to become the “performers” that student’s expect us to be in the classroom? What approach should we adopt to provide the students with a healthy mixture of different flavours they expect from the classroom lectures? The answer to this question is not simple and the process is a very lengthy one. In this newsletter, we bring to you the insights about some of the best teaching practices of the most popular teachers of our campus and also from Prof. Uday Khankhoje of IIT Madras. Prof. Uday is a very popular teacher at IIT, and known for his unique teaching style and technique. I hope you will enjoy reading the views and teaching methods of the contributors of this newsletter and adapt some of their techniques in your lectures and tutorials.

On behalf of TLC, I wish you all the very best.

Prof. Ethirajulu Senthamarai Kannan
(Faculty in-charge TLC BITS Goa)

MY TEACHING METHODS AND PHILOSOPHY

Prof. Uday Khankhoje



Uday Khankhoje is an Associate Professor of Electrical Engineering at IIT Madras. He graduated with a B. Tech. in Electrical Engineering from IIT Bombay in 2005, and received his Ph. D. in Electrical Engineering from Caltech in 2010. He leads the numerical electromagnetics and optics (NEMO) research group at IIT Madras;

For further details see <https://www.ee.iitm.ac.in/uday/>

As a teacher, it is a privilege to have an opportunity to connect with young minds on various technical subjects. During the course of a semester, one introduces technical content to these minds via various techniques and then watches, as a rich interaction takes place between the teacher, teaching assistants, and students. At the end of the semester, it is a true statement that all three entities have grown in some or the other way. In the text that follows, I will share some of the methods and insights from my teaching experience that, in my opinion, lead to maximum all round growth of all involved.

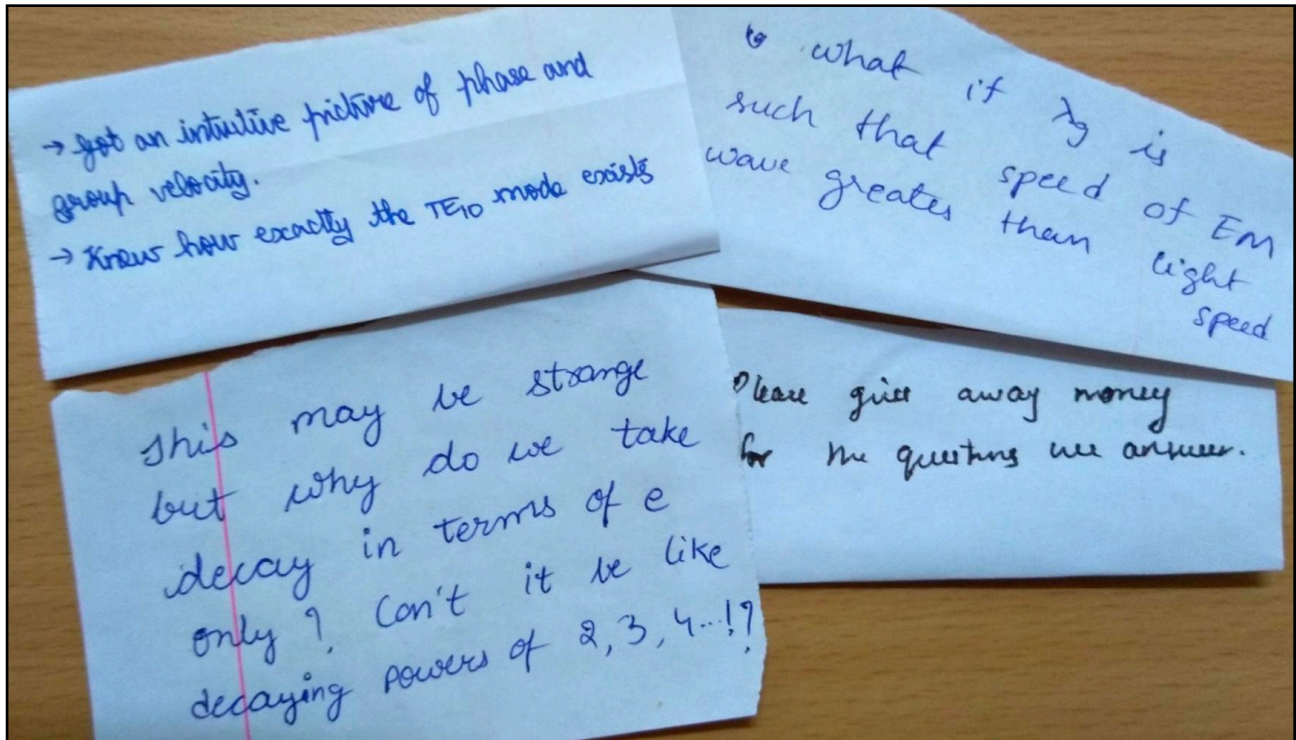
On interaction: Reflecting back on the various courses I have taught, if there is one goal I can recommend for a teacher to aim for, it is that of encouraging as much interaction as possible. Before getting into the “how to” part, it is worthwhile to investigate the “why” part. Students come from

extremely diverse backgrounds spanning differences in gender, region, native language, proficiency in English, economic and social background, and so on. While we would like to believe that none of these matter once the student steps into the classroom, in practice, it is never so. The student from the city who has some degree of self-confidence has no hesitation in answering questions and asking her doubts, whereas the student from a vernacular background is overawed by the English-speaking Instructor and city student and keeps silent in class, lest he embarrass himself with his broken English. Similarly, a girl student may come from a background where she has imbedded the idea that “good girls don’t ask questions,” and does not express herself in class even though she has many questions regarding the content. Thus, what the instructor believes to be irrelevant, in fact continues to operate during the semester and leads to unequal learning across the students due to a lack

of active intervention to nullify, to the extent possible, the differences in background.

In this regard, it is the responsibility of the instructor to create a safe space for the students. A safe space is simply one where the instructor makes

on the order of one sixth of an A4 page that a student gets about 5-10 minutes before the end of class (so, it is important to not teach till the very end of class!). In this chit, which can be filled anonymously, the student can express any course related thoughts. Typically I ask them to summarise



it explicitly clear that anyone can express their thoughts without any fear of judgement and ridicule, and that everyone is united in the objective of learning. The rest of the teaching and interaction is now framed within this safe space, with periodic reminders by the instructor of the existence of the safe space.

On the effectiveness of feedback chits: For students who are shy at first, a very effective method to get the students to start interacting is to use feedback chits, an idea picked up during a session organized by TLC, IIT Madras. These are small chits of paper,

a few points of what they learnt during the class on one side, and what they found confusing on the other side. In addition, they are encouraged to express any other issues that they might be facing. For instance, I have had some students write that they have a visual disability and request that they be given priority on the first row of the class. Just having that space where they could express this request made all the difference, while who knows how many other courses the student would have suffered through with the request being unexpressed due to shyness? In other instances, I have been asked to slow down the pace at which I speak, or to

go over a particular topic again in the next class. With a majority of students, almost none of this feedback would have come to me if I had done the default action of asking students to speak in front of their peers out loud about their difficulties.

Another great aspect of the feedback chit is that it conveys in a statistical sense if I messed up during class. For e.g. if most of the students expressed the same difficulty, it means that I did not do a good job of explaining a particular concept. It gives me an apt opportunity to start the next class from a revision or a re-telling of the part I bungled up. I have also found the chits to be a fit way of inflicting some self-deprecating humour on myself in the instances where I messed up! By hearing from the instructor in class that (s)he messed up, it makes us more relatable to the student, who might otherwise think of their instructors as being perfect or unattainable or plain boring! Over the course of the semester, I have found students to become more comfortable in sharing their thoughts publicly rather than only using the tool of the feedback chit. The beautiful thing about interaction is that it is a positive feedback loop — the more students do it, the more they enjoy it, and greater the interaction as the semester goes.

On tutorials: As has been discussed in the pages of this newsletter in the past, it is important to have a regular set of problem sets and tutorial sessions as a key component to achieve the learning objectives of the course. I would pair a teaching assistant (TA) to a set of students for the duration of the semester.

This TA would help the students with problem solving during the tutorial sessions. To ensure that the students actually work out the problems, each tutorial is accompanied by a short “tutorial quiz,” which is a short 25 minute test of a few problems randomly lifted from the tutorial or from class material. The solutions to the tutorials are distributed only after the completion of this quiz. Having several (4-8) such quizzes regularly throughout the semester, and attaching a significant fraction of the course evaluation (e.g. 50%) to these quizzes eases out the pressure that would otherwise fall on a single large-fraction evaluation such as an end semester exam. It also largely ensures that student don’t lag behind too much in their revision of the content that has already been covered, since something tangible is regularly at stake.

While tutorial sets offer a great opportunity for students to learn and master the content, they also help achieve another goal — that of improving the critical thinking and pedagogical skills of the TAs, since the problem sets are largely constructed by the TAs. Once the set is ready, a session is held where each TA presents the problems they have chosen, and explains what concepts they mean to test via these problems. Lively debates about the wording and possible ambiguities follow until the tutorial is finalised. Similarly, once the tutorial quizzes are conducted, the grading is largely done by the TAs based on a solution key, with my interventions sought whenever necessary. Thus, when the tutorials are conducted in this spirit, we

accomplish the building of technical and soft skills of the TAs in addition to all else.

On exams: As a student I was never a fan of closed book exams, and swore to never have such exams if I ever became a teacher. So, in the early days I would hold open book exams, thinking them to be a great idea. However, the student performance and their anxiety during the exam told a different story. Many students would have procured notes from their more studious counterparts the night before and were seen flipping through the notes just trying to find the relevant portion of the text! I realised that having the comfort of notes during the exam meant that many students took the exam lightly and were actually trying to understand the content *during* the exam. So, after a few semesters of this failed experiment, I have been walking the middle

path; of the exam being closed book but with a one or two page handwritten “cheat sheet” allowed. Based on the feedback of various students, being forced to review the entire content at least once before the exam (for creating the cheat sheet) makes for a much more effective exam taking experience for the students. The cheat sheet itself takes off the pressure of having to remember something they believe they can’t.

On course projects: In order to make the course come alive to the student, it is advisable to have a course evaluation component (approximately 15-20%) be something other than tutorials and examinations. I present a couple of concrete examples to illustrate the point.

I have often taught the core undergraduate course on Engineering Electromagnetics (EM).

ELECTROMAGNETICS POSTER DAY 2019

Saturday 19 October
2-5pm ESB Foyer

Wireless Power Transfer Remote Sensing
Radio astronomy Lasers Bio-Electromagnetism
Metamaterial Superlenses Millimetre Waves Magnetic Monopoles
Photonics X-rays Smart Radios THz Imaging
Chipless RFID Cavity Resonators Night vision
Holograms RADAR
Electromagnetic Universe

EE2025: Engineering Electromagnetics - Deepa V/Uday K

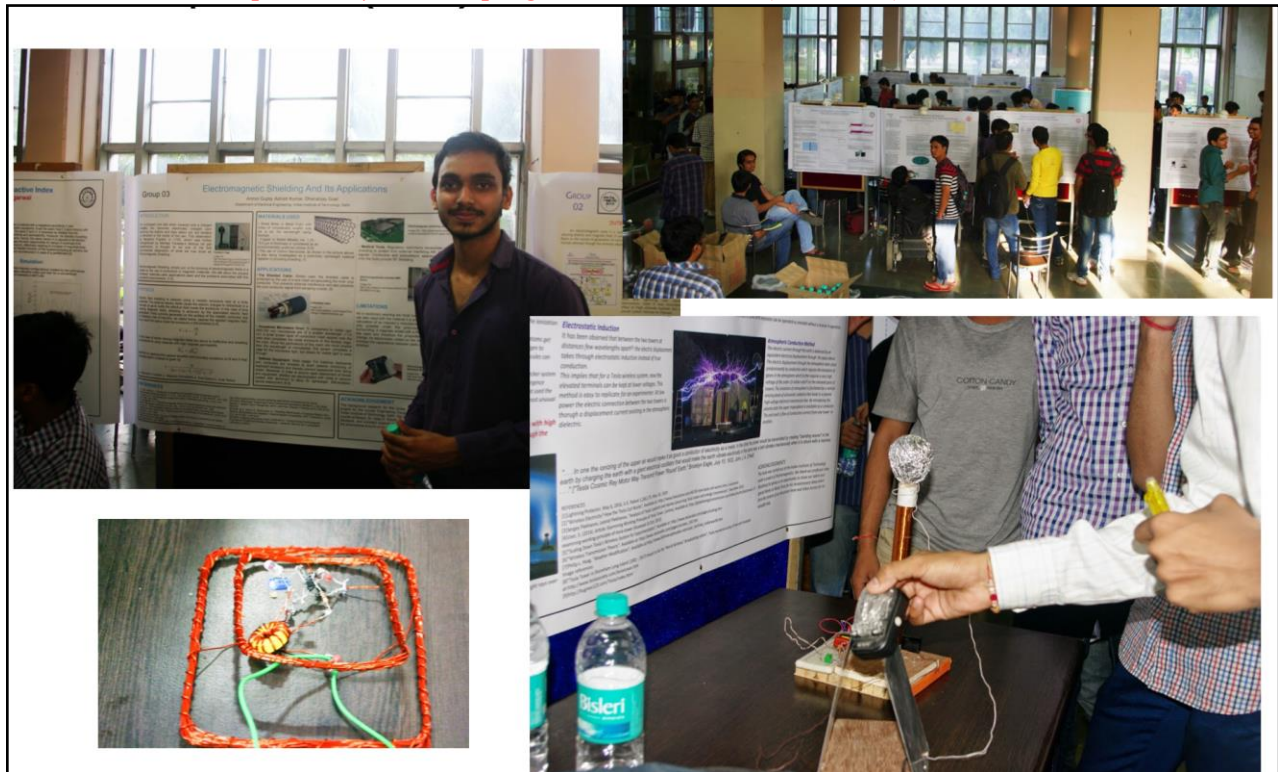
A sample flyer for the poster day event publicized in the entire department and institute

Within it, I have created a “Poster Day” event, where, students in groups of 2-3 get together and work on a topic of their choosing (after getting an okay from me) on the broad themes of “EM in nature,” “EM in research,” and “EM in industry,” and present their work in a professional sized poster. They are also encouraged to make a working demo to illustrate their ideas, if feasible. On the appointed day, the entire department is invited to a session where the students stand by their posters

student’s feedback in particular has stayed with me over all these years; he said — “I never knew that I could have so much fun with my friends talking about technical stuff!” Needless to say, such an event generates very rich interaction between everyone involved.

In the case of a graduate elective course, I have innovated with having a “YouTube Day” instead of a “Poster Day”, with the goal of nudging students in the direction of research. Again, in

A poster day event in progress in IIT Madras (Nov. 2015)



(like in a conference) and explain their work. Some light refreshments are also arranged, and the whole event ends up having a nice festive feeling. The TAs and some volunteer faculty also evaluate the posters in the course of this session. Even though such an event requires significant logistical effort, the feedback from the students is just fantastic. One

groups of 2-3 they would seek out research papers published in respectable journals or conferences in the last two decades. They would attempt to connect the concepts in these papers to those they have learnt in the course, and create a 10 minute YouTube video where the paper and the underlying concepts are explained. Students are encouraged to

use animations, and or simulations to effectively demonstrate their understanding. Apart from boosting their research skills, this adds a component of fun to the course which can otherwise feel like the learning of textbook content. The course projects (i.e youtube links) are shared with the Department students and faculties at the end of the process.

Final note: It would be a pity if we looked at a course as simply a platform for the students to learn, say, linear algebra or engineering electromagnetics. A course also presents a teacher with a chance to talk about ethics and technology, and the importance of using science/technology for the greater good of humanity, rather than just for enhancing the bottomline of their employees. Many of the students will get employed by big tech companies, so it is important to talk to them about the full cycle — from basic concepts, to the end products that use those concepts and their impact on people — *while* they are in the process of learning.

As an example, a student in a course on Linear Algebra might learn concepts of dimensionality reduction and matrix factorisation. Such concepts are in turn used to build recommendation systems, for e.g. on social media such as Facebook or Netflix. But, is it sufficient for a student to only master these concepts? Shouldn't (s)he also know recent history of Cambridge Analytica, which abused the recommender systems of Facebook to essentially change the course of the

2016 US presidential election? Shouldn't (s)he also know of the amplification of hate speech, which facilitated the genocide of Rohingya muslims due to a lack of resources devoted by Facebook in taking down inflammatory material in 2018? Shouldn't (s)he also know that the internal algorithms of Instagram knowingly promoted its users to only share their “best” moments, or “perfect” looks, which in turn led to severe mental health problems among young people (while the instagram's research showed this to be true, they chose to prioritise profit over the greater good)?

There are many more such examples. The bottom line is that in some way or the other, the life of an engineer will intersect with questions of ethics during the course of their careers. Should that be their first encounter with these difficult questions? I feel that it is our responsibility to anticipate some broad themes of ethics and technology, and talk about them within the safe spaces of our courses. I find that when I raise these discussions in class, the participation increases dramatically. That way there is hope that the to-be engineer, when faced with a difficult decision in the future, is aware of the lessons from history and is thereby less likely to repeat them and instead make a more intelligent, conscientious decision.