# Conscientious and Incisive Learning In Engineering : A Pedagogical Approach

[1]Sreedevi. M. Nair S., [2]Tamil Selvi
Department of Applied Sciences Department of Applied Sciences
[1,2]M.G.M's college of Engineering & Technology, Kamothe, Navi Mumbai Maharashtra, India Navi Mumbai, Maharashtra, India
sree.nairmk@gmail.com, tselvi_kannan@rediffmail.com

## Abstract—

Engineering education is a Conglomeration of Technical, Scientific, Mathematical concepts and applications. Teaching English in engineering disciplines is a complex process. It needs a knack of identifying the students of different intellectual quotient levels in comprehensiveness. In addition, there is a growing awareness that teaching English within discipline-specific contexts as per the syllabi. This leads to reassessments, discussions and suggestions on course design, content and teaching methodologies. A confined approach of teaching at a university specified context always adds to complexity. English language educators are not only required to teach students to be able to communicate in English effectively, but also to teach soft skills such as developing Emotional Intelligence, Leadership Skills, Decision Making Skills, Conflict Resolution Skills, Presentation Skills etc. This paper is an analysis of how English language teachers negotiate with the complexities of language teaching for technical students by applying different pedagogical applications. Computer solutions are part of engineering practice however the challenge for engineers is to correctly verify and interpret these solutions. Communicating mathematics is an important part of engineers' work. Engineers say there is a skill in communicating Mathematics. It is the way of putting the mathematicsinto a form that a non-engineer will understand.

**Key words : Conglomeration, conflict resolution, emotional intelligence, Incisive, Conscientious**

## I. INTRODUCTION

ENGLISH is a global language and it is invariably used in almost all the fields to exchange ideas and thoughts. . Because of the rapid development of industry and technology, an increasing need has been felt for improving skills of communication at all levels of administration. So it is necessary to equip the students with suitable teaching methodologies. Both students and teachers are expected to be aware of the significance of English language. In modern days, developing effective communication skills is extremely important and inevitable. Engineers, doctors, managers, officers and other professionals require the power of effective communication in order to excel in their respective fields. Since the world has become a global village it has been mandatory to transform knowledge to the aspiring professional candidates in English. Teaching them by adapting different methods with a pedagogical approach is utmost important. In the university syllabus there is always an opportunity to work in a team environment. In the first instance there can be an introduction session. The qualities like confidence, positivity and grammatical accuracy will be expressed. English language is a part and parcel of an engineer's interaction at various levels. It is no more considered as an alien's language. In Indian education, English language is a compulsory subject at both school and university level. Despite the lengthy years of learning the language, the proficiency level on English language among undergraduates at higher institutions still needs to be improved. Teaching English in technical institutes included theoretical perspectives and practical approaches. It becomes a challenging one when teachers handle pupils from different medium of instruction at school level. Identify the comprehending level of students to create an interesting teaching learning environment. Teachers must negotiate with the specific educational frame work with course objectives and course outcomes. Engineering is a discipline which demands multifaceted professionals to achieve the targets effectively in a workplace. They have to interact with different expertise to solve engineering problems and keep up the repute of the organization. To serve this purpose, engineers must possess linguistic competence because more than what is said, how it is said is important.

## II. OVERVIEW OF THE STUDY

This study investigated the way an English language educator addresses the engineering industrial demands for communication skills in English and problem solving skills among future engineers. The primary focus is how to curb the inhibition of students in using the language because most of them hail from places where the use of English is very limited outside English class rooms .University frames the syllabus with a view of ensuring the standard and quality of future engineers produced. Teaching is not only about applying knowledge and skills learnt in teacher education but also about the interactions of various human and contextual factors. Make the students aware of the significance of English language and create an interest and desire in them to learn.

In providing English language learning for engineering students, two courses were set up. One of these courses is the Communication Skills in English course which was located in the second semester of the first in an engineering curriculum. The syllabus consists of theoretical aspects of general communication, letter writing, grammar and technical language exercises. Unlike the other subjects one the two university tests is Public speaking. The oral communication session helps them to curb the stage freight. English language teachers play a macro and micro role at university level and institute level respectively. To enable the students to be proficient, both the levels are to be executed which is tantamount to the program outcomes defined by the university.[1] In this study, the findings showed that opportunities to interpret the program outcomes outlined, with the course objectives and mapping of the teaching process.

## III. PROFESSIONAL APPROACH

Professional attitude and approach towards training the students play a pivotal role in improving the language skills. This suggests that the way English language educators identify themselves depends on the way they perceive and deliver lectures To make the teaching learning process interesting, effective interaction and understanding are needed. First, establish a rapport with the students. This helps the students to discuss their inhibitions with the faculty members. Studying the students is the first criteria for a teacher. It means, understand their problems thoroughly ie their secondary and higher secondary background, their family back ground etc. As second parents of the students the teachers must analyse their background especially the ones who are weak in language. The pedagogy here is create a harmonious environment. Discussions across will always prove worthy.

Familiarize the students with the syllabus contents, make them aware of the need of language proficiency and grammatical accuracy etc. But the teaching strategy should be based on the students' comprehensive levels. Within the frame work of university guidelines the program specific objectives must be defined and work upon. As a facilitator the teacher has the freedom to decide the teaching methodologies and implement evaluative measures. More efforts should be invested on weaker sections. Undergraduate students are adult learners who should be directed towards out of the box thinking. Learner centric approach should be seamless. It should grow by leaps and bounds because the students have to be lucid in their technical language expressions. Factually and grammatically correct expression is the order of the day.[2] Once the barriers are identified, strategic planning is easy for an educator. Some students may not be able to find out their own barriers. Help them identify through a SWOT Analysis. This is another rational approach.

Based on the communication principles, practices, patterns and barriers a need based communication architecture can be established. As a skilled language educator, put forward eight key questions to yourself.
Can words describe everything we see, feel and know about our experiences?
When you say a word, does it mean the same thing to you that it means to your listener?
What keeps us from hearing and understanding one another?
How can you find out whether I understand what you tell me?
How should your listener's/ reader's needs affect what you say/write?
What keeps us from communicating information to one another?
How does the medium of communication affect the message being communicated?
How does technology affect communication? Do we communicate to it, with it or through it?

Observe the communication situations and needs. Notice the obstacles the students face and assist them to overcome the hindrances. Situational communication exercises can be given.
First practice should be:
i) Identify the barriers from the given situation
ii)Find solutions to overcome those barriers

Let the students relate the problems with their own if any. When they find solutions for the given situations, their thinking power increases, problem solving skills reflects and they can have a judgement about the nature of problems. Discussions can be held on their answers because they will be based on different perceptions, definitely.

Speaking sessions can be an effective tool to curb the fear in students. Over the course of their career they have to speak hundreds of words for every one word they write.

Ten Tips for Effective Speaking:

Do speak up. Do not mumble
Be brief. Do not talk on and on about your points
Do have proper eye contact
Do organize your points
Do use visual aids when appropriate
Do use natural gestures
Do vary your volume, pitch and tone
Do maintain comfortable pace
Do use pauses effectively
Do listen. Do not ignore your listener's gestures or comments

Effective Writing is another important factor to be practiced because the purpose is to generate a specific idea choosingthe right words maintaining grammatical accuracy. Even for technical students, general writing practice such as various letters pertaining to requests, medical problem and any examination result related issues can be given. Situational problems for a group can be given to discuss, analyse and find out solutions. Final draft will be with the opinions of all the members. This would develop the quality of team work and adaptability in them.
Expressing the ideas in skillfully written sentences contributes success to the whole writing. When the students will have the ability to construct sentences effectively as per the need, it adds value to their technical documents such as e-mails, memos, letters, reports, proposals etc. The words you choose must be apt because in English one word has multiple meanings and this can cause lexical ambiguity.
The strategies of creating an interesting and interactive language learning environment must change in accordance to the requirements and advancements.

A pedagogue requires to be skilled in measuring the four quotients such as Intelligence Quotient, Emotional Quotient, Spiritual Quotient and Physical Quotient in students. This will help the educator, to analyse the personality aspects and barriers of the students and take remedial measures at various levels to improve their communication. In modern business transactions, 10% of the message is conveyed verbally, 38% by voice and the rest 52% by visual means which is an approximate calculation by some studies. However, the greater impact of non-verbal communication is an undeniable factor. Enhancement of appropriate non-verbal communication in technical students should be considered as another pedagogical approach. For an effective communication situation devised training programmes on non-verbal along with verbal communication can be organized. Reading is one of the most important academic responsibility of the students. It is equally important in the corporate sector. Reading comprehension exercises will improve the listening skill of the learners and thus improve concentration, presence of mind and perceptions.

Language educators must try to improve the comparative advantage of students (COMAD) by comparing their intuitive skills to handle different situations such as gift of speech to convince, negotiate, present etc. There should be a measuring system in language education as in organizations which largely determines what should be the next pedagogical approach. A close watch on the measurement indicators will be a gate way to enhancement.

Engineers' Curriculum mathematics usage is measured by a derivation of de Lange's mathematics assessment pyramid and with reference to three dimensions: mathematics domain, usage type, and academic level. Mathematical approach at different levels vary from person to person.Engineers' experiences of school mathematics would definitely define their aptitude in their chosen disciplines for the applications of it concretely. The findings show that (i) students' previous perceptions about mathematics become a major influence on their choice of engineering as a career; (ii) teachers are the main contributors to engineers' interest in and learning of mathematics; (iii) While high level mathematics is used in engineering practice, the thinking of mathematical applications have a greater relevance compared to curriculum mathematics (iv) Curriculum mathematics usage is dependent on the interaction of engineering discipline, their mathematical thinking and usage. Mathematics is often associated with certainty and with being able to get the right answer. For example, [3] suggests that "doing" mathematics means following the rules laid down by the teacher; knowing mathematics means remembering and applying the correct rule when the teacher asks a question and a mathematical "truth" is determined when the answer is ratified by the teacher" [3]However there appears to be a distinction between mathematics as a study subject and mathematics that is useful. Mathematical literacy "involves moving beyond a knowledge of concepts and procedures produced by others to gathering and interpreting information about open-ended problems, making conjectures, and building arguments to support or reject hypotheses" [4] view of mathematics as the "product of people and societies" contrasts with the commonly held view of mathematics "as objective knowledge, codified and transmitted inertly and separated from the people who learn and do mathematics"[ 5]. According [6] pure mathematicians are of the view that mathematics is: "objective facts"; "a study of reason and logic"; "a system of rigor, purity and beauty"; "free from societal influences"; "self-contained"; and "interconnected structures". At school level what is taught in school and that there are many reasons for and capabilities desired in teaching and learning mathematics. Functional numeracy (for successful functioning in society and minimum requirement for general employment at end of schooling); practical work-related knowledge (solve industry and work-centered practical problems, not necessary for all) and advanced specialist knowledge (specialist high school or university mathematics needed by a minority). He adds that there is also mathematics that has "personal, cultural and social relevance".

This includes deploying mathematical knowledge and powers in both posing and solving mathematical problems, being confident in one's personal knowledge of mathematics and being able to identify and critique the mathematics embedded in social, commercial and political systems. International Student Assessment (PISA) assesses students' mathematical literacy. Students' mathematics literacy is assessed in relation to: content (space and shape, change and relationships, quantity, uncertainty); competencies (reproduction, connections, reflection) and situations (personal, educational/ occupational, public, scientific). So the educators of applied mathematics must be competent in : thinking mathematically (mastering mathematical modes of thought); posing and solving mathematical problems; modelling mathematically (analysing and building models); reasoning mathematically (proof and proving); representing mathematical entities (objects and situations); handling mathematical symbols and formalisms; communicating in, with, and about mathematics and making use of aids and tools (information technology included). The intuitive knowledge about the domain; facts and definitions, and like; algorithmic procedures; routine procedures; relevant competencies; and knowledge about the rules of discourse in the domain". According to [7] there are two forms of mathematics knowledge, these are explicit (theorems, definitions) and tacit (personal know how). Ernest's view is that knowledge is usually learned in a social context. He says that the transfer of learning between contexts often does not take place and that it is the social context that elicits the skills and knowledge from long term memory. There is some evidence to suggest that mathematics is a special subject compared to other school subjects. Smith refers mathematics as "a major intellectual discipline," providing "the underpinning language for the rest of science and engineering and, increasingly, for other disciplines in the social and medical sciences". A study of student participation in upper 20 secondary mathematics education in 24 countries found evidence of students behaving strategically by not choosing mathematics, particularly advanced mathematics, because it is perceived as being more difficult than other subjects or one in which it is harder to achieve higher grades [8] Compared to most other subjects, mathematics is a "hierarchical subject" where later learning depends critically on earlier learning and students perfect their technique at each lower level before they progress to the next level [9]. Mathematics has a number of dimensions, including: developing knowledge and skills; applying mathematics in a range of contexts; relating mathematical ideas to each other; and expressing mathematics. It is the teacher's task to facilitate this learning.

Innovative ways proposed for the teaching of mathematics to engineering students include problem based learning (PBL), multidisciplinary approach, computer based methods and active learning methods[10],[11]. While there is little consensus on how reform of mathematics education in undergraduate engineering should take place, key issues of concern include: the "one-size-fits-all" approach to engineering mathematics which leads to teaching more mathematics than is required by specific disciplines.[12][13] Applied mathematics is of greater interest to engineers compared to theoretical mathematics; and [14] teaching computational methods given the availability of powerful computing and design too. As we are in a digital era now computer related applications are of greater magnitude.

## III.CONCLUSION

Recent years there have been numerous calls to reform engineering education. A significant reform not just to the content but the pedagogical strategies of engineering education. Engineering culture is rigid and focused on knowledge rather than on the human beings who operate within the engineering educational system. We argue here that engineering culture might be altered towards a more pragmatic perspective with more skilled faculty and students could be encouraged to reflect critically on the assumptions they hold about the nature of engineering education. We believe a change in culture of this sort would not only be a positive development, but would involve a transformation in both the quantification of the current system (i.e. better prepared students, more diverse students and faculty, etc.) and in its qualitative nature (i.e. the way that faculty, staff and students interact within the system, how power is shared, and how individuals are motivated to thrive).

Mathematics is an essential component of modern engineering. It provides a strong foundation for graduate studies in theoretical branches of engineering. Mathematical and statistical applications are taught in a broader aspect. Application of mathematical techniques are there in every discipline of engineering. The word Mathematics is derived from the Greek word "mathema", which signifies knowledge, study and learning. The study of quantum computing, quantum optical communications, quantum mechanics, statistics and reliability, solution of non-linear partial differential equations and systems etc. The widely used mathematical applications are the solutions to all engineering problems. A number of barriers hinder the culmination of the communication process. Some of them originate from the sender, some occur on the channel of transmission and some surface at the time decoding the message by the receiver. We may classify the barriers into the following six categories: linguistic, psychological, interpersonal, cultural, physical and organizational. For success in one's career it is essential to understand clearly the factors that cause barriers and to avoid them with conscious and sustained effort. Moreover "Excellent communication skills" is the buzz word of the industry now. Because of the rapid development of industry and technology, an increasing need has been felt for improving skills of communication at all levels of administration. So it is necessary to equip the students with suitable teaching methodologies.

University of Mumbai has introduced Communication Skills subject in the engineering course with the purpose of improving the linguistic skills of students who come from different academic back ground with some knowledge in English.
Every pedagogical approach can have a profound effect on the future of the aspiring professionals and their long term prospects in the areas of self- expression, negotiation and teamwork. Identifying the leverage points and thinking about what is best for the teaching process as a whole can help us overcome long standing barriers to improvement of language. Setting up a common standard to eliminate the differences among the students in using English language does have no practical value. Different methodologies should be adapted to elicit the intuitive skills of the students which are complementary and concurrent to the enhancement of learned skills.Mathematical skill along with soft skills can bring a conscientious reformation in all disciplines of engineering.

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