# *Reinventing Engineering Education*

## *Management Science as an Intergral Part of Engineering Education*

R. Ganesh Kumar
Assistant Professor, Department of Management Studies
and Research Centre,
BMS College of Engineering,
Bangalore, India
ganeshkumarr.mba@bmsce.ac.in

Dr. A. Satya Nandini
Professor and Head, Department of Management Studies
and Research Centre
BMS College of Engineering
Bangalore, India
satyanandini@hotmail.com

***Abstract***

**Today every Engineer needs to possess Leadership and Management skills. An Engineer works in a very challenging environment, where they have to negotiate, plan, influence, direct, estimate and resolve conflicts. Hence, the leadership and managerial competencies have become an integral part of an Engineer pushing aside the technical skills to a minimal extent. When a fresh Engineer passes out of college, he possesses the technical skills required for his job but the interpersonal ability and various leadership and management skills are acquired only through his experience. Initially, during an Engineer's career, there are more requirements for technical skills but in the long run, as he moves up the career ladder, there is a requirement of a perfect blend of Management and Engineering skills. Once an Engineer reaches the top management position, Leadership and Management competencies become more important regardless of the nature of job. This paper attempts to focus on the importance of Management Science in engineering curriculum through Experiential Learning mode.**

***Keywords— Engineer, Management Science, Leadership, Conflicts, Competency***

## I. INTRODUCTION

Organizations of today are surviving in the midst of heavy competition. The Employability statistics in India show the Current Employability rate of Engineering Graduates is less than 10% as per a research conducted by Aspiring Minds, a research firm. According to Charles Darwin's Theory of Evolution, only the fittest survive. The same holds good in the Corporate World. For any successful company "Evolution is a standard strategy." Amazon started functioning with just selling books but, now it sells anything it can ship. To emerge as the fittest, organization and its people need to be fast adaptable to change. The business organizations have survived not because of their strength or their long existence in the market but it is the most adaptable which will survive.

In the recent past the processor technology has grown exponentially. They are so much faster and ready for high profile applications. This also means they take up more power. However the batteries that supply this power have not advanced, they still have low life. That's the reason the modern phones have low battery life compared to old phones. The need for Leadership and managerial skills is advancing so fast in the Corporations which are like the processor. But the Engineering education in India is like the batteries, very traditional and not incorporated the required changes. Hence there is a need for the Engineering education to adapt, change and include aspects of the Management Science to suit to the present work environment.

According to a recent study by LinkedIn "Adapt to survive", it was found that the inability of people to change was costing Indian Economy Billions of Dollars in lost productivity. A survey of 11 countries by LinkedIn has ranked India at the bottom of the table above China in adaptability to change. Netherlands, UK and Canada have recorded the highest Talent Adaptability scores.

To improve on these shortcomings, the focus should be on Leadership, Relationship Building and Collaboration. By attaining mastery in these areas, organization and leaders in the next century will survive and flourish. To address the leadership challenges of the next era, the traditional methods of books, lectures, discussions and case studies are necessary but that alone will not be sufficient. Management aspects through Experiential Learning as an integral part of Engineering education are the need for the hour. The paper discusses about how Management Science should be a part of the Engineering curriculum and also how Experiential Learning helps in understanding Management better.

## II. OBJECTIVES OF THE STUDY

- To understand the need and importance of Management Science in Engineering Education.
- To understand the effectiveness of learning management through Experiential Learning mode.

## III. Literature Review

According to Warren G Bennis and James O'Toole (2005), Business Schools hire Professors with very less corporate experience that cannot bring in experiential learning into the class rooms, which results in graduating students becoming ill-equipped to face the complex, unquantifiable issues at work. This is resulting in poor job placements. The reason also being, many teachers of management education have never set their foot into real business except as customers. Reforming Business Education can be done by infusing the curriculum with multi-disciplinary, practical areas reflecting the complex challenges the business leaders face.

Michael Reynolds and Russ Vince (2008), in their book offer the readers a comprehensive picture of current thinking on experiential learning; ideas and examples of experiential learning in practice; and its emphasises on the importance of experiential learning to the future of management education.

Alice Y. Kolb, David A. Kolb (2005) examined the recent developments in experiential learning and explored methods to enhance experiential learning in higher education. They introduced the concept of learning space as a framework for understanding the interface between student learning styles and the institutional learning environment. As a concluding note they presented the principles for the enhancement of experiential learning in higher education and suggested its application throughout the educational environment by institutional development programs, curriculum development, student development, and faculty development.

Davies, Julia, Easterby-Smith, Mark (1984) in their article addressed on-the-job learning by managers, which has prompted some to question the value of the formal management training processes.

Bevan, David Kipka, Claudia (2012) contextualised the potential contribution that experiential learning may offer to those engaged in academic and professional management development, pedagogy and education. It offers a framework for an empirical mapping of this important area of management practice which is currently under-represented in academic writing and practice.

## IV. Key Leadership Challenges

*There is a need for re inventing Engineering education due to the following challenges faced by Leaders:*

- The transition from academics to corporates is very slow.
- The rate of adaptability to change is very poor which requires a change agent.
- The organisations had to focus on Induction or training programs.
- There is a problem of blending the Engineering minds to work in a team.
- The cross cultural aspects pose collusion among people.
- The right attitude and willingness to learn among people is poor.
- The importance of Corporate Social Responsibility and ethics.
- The transition from Strategic management to Strategic thinking.
- Need for Social Intelligence and Emotional Intelligence.
- Importance of Soft skills, communication, social and inter personal skills.

Today's Business environment is very dynamic and companies face difficulty in making its people accommodate to these changes. If only the academics can help in introducing more management aspects and experiential learning in the curriculum the problems faced by corporations in training the Engineers will be less and the adaptability will be fast.

## V. Need for Adaptability and change

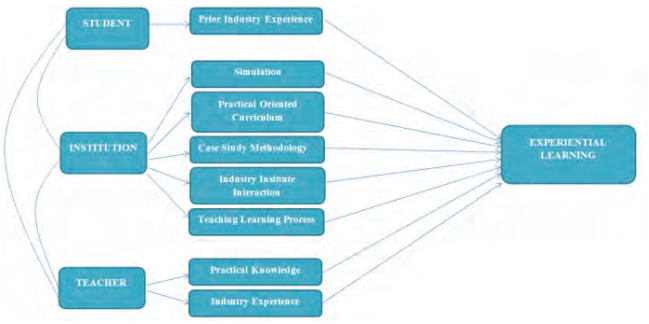
According to Michael Rendell in his blog at Price Water Coopers, 63% of the CEO's were worried about the availability of skills and talent among the new joiners. According to „Adapt to Survive' study conducted by LinkedIn, India ranked 10$^{th}$ out of 11 countries surveyed. This lacuna is costing Indian Companies Billions of Dollars in lost productivity. So there is an utmost need to incorporate the apt management subjects in the Engineering Curriculum.

## VI. Importance of Management Science in Engineering Education

Though an Engineer in his initial stages of his career will be using his technological knowledge to the fullest, as he progress up the career, he would require management knowledge as well to be able to cope up with the job requirements. According to a survey of Chartered Engineers in 2002 in the United Kingdom to understand the need for Managerial Skills and Expertise for Engineers showed that most engineers' careers include managerial tasks though many remain in predominantly technological jobs. A quarter of the respondents described their jobs as predominantly technological but over 80% indicated that they needed some of the „managerial' skills and expertise like Costing, Estimating, Project Planning, Accounting, Research, Negotiation Etc. The people-related answers to the question what is the most difficult or demanding aspect of job outweighed the technologically-related answers. For engineers generally, managerial and social skills and expertise may therefore be as

important as technical ones, and not least for newly Chartered Engineers.

## VII. Learning Management Through Experiential Learning Mode




Experiential Learning is the process of making meaning from direct experiences. It is a powerful pedagogical tool which believes that students learn from the real time experiences shared in the classrooms rather than theoretical knowledge given directly from text books. Experiential learning requires active participation from the students and also Teachers with real world corporate experiences who are well equipped to represent and project the complex work environment to students. The learner is more a participant in the experiential learning process than just a listener. The teacher needs to share his experiences, relate it to the content of the lecture, and give a feeling of the situation which will have future relevance to the job that will be taken up.

Many Corporate opine that the fresh Engineer passing out of College has to be trained further for making them job fit. The actual cause of this may be traced to the more abstract model where very little is grounded to actual practices and Education has become increasingly circumscribed and less and less relevant to practitioners. In the Medical and Law colleges the teaching faculty is also practicing Doctors and lawyers, but the Engineering educational institutions do not hire Professors who have adequate experience of managing businesses, who have the relevant corporate exposure and who write articles for practice. Instead they adopt a different scientific approach valuing the academic excellence to push the boundaries of knowledge.

The Professors use the scientific approach, test hypothesis, use regression analysis, set up simulations which are enlightening but at arm's length from actual practice and they fail to reflect the way business works in real life. The purpose of business education is to develop executives and leaders for which the faculty should give them the best class room experience with broad perspectives and diverse skills highlighting the need for ***experiential teaching and learning.***

The Indian scenario no doubt is the same as the United States. Instead of being traditional academic departments the Business Schools must create their own standards of excellence for experiential learning.

Dr. Rajagopal in his paper Innovation Teaching Practices has elaborated on Moderator Supported Learning Approaches (MSLA). He focuses on introducing new teaching strategies, increased focus on design and delivery, organization of classes, meticulous contents and coverage, more self learning in teams, increase in confidence in learning and sharing, student centered approach to teaching. Think global strategy for students and teach local strategy for teachers would be the best way to inculcate students with local management techniques. The teacher serves as a bridge integrating information, technology and students teams under a unified leadership framework. The learning tools under MSLA are:

- Learning Appraisal Seminar: There is a learner's forum at the end of each module. Students are divided into groups and current topics are given. Chairperson and discussants are appointed. Participants should use the concepts learnt in the class room to discuss on a topic or develop papers.
- Case Debates: At the end of three different cases on a given topic case debates are organised. Emerging issues from all cases are discussed and debated. In this process, insights are invited in different areas.
- Simulation: Simulation exercises are built for various situations.
- Poster Sessions: Creative learning developing attractive posters on a particular theme.
- Mock Sessions: Actual models of real situations.

## VIII. Conclusion

Last 50 years of Engineering Education was technology based curriculum. But now there is a paradigm shift where there is a need for management science in engineering education. Now Corporations require Engineers with leadership skills and managerial competencies. Today it is not about "People who are best in the world, but it is all about people who are best for the world. And it is only such people who make good leaders and good corporations."

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