

# **A Study on Shaping Engineers to be Effective Project Managers : Teaching Models**

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## **ABSTRACT**

Shaping Engineers with technological background to be managers with creative leadership qualities has always been an onerous task. Most engineers aspire to become managers. The transition has to take place from engineering skills to managerial skills. This is possible when there is creativity, envisioning and innovations in training them. With input costs going higher, the challenge is to keep the cost of processes and methods low for the cost of output to be competitive and at desired limits. Hence, there is paradigm shift in the ways the projects are envisioned and conducted.

The existing engineering curriculum at universities does not meet this need. The change in curriculum has not kept pace with the advances and needs of the corporate world. Imagineering is yet to find inroads as a requirement of the industry.

Organizations will have to strategize in current economic situations to build capacities. Multiple tasking through increased skill and competency is a one of the options in the pipeline. There are several initiatives in training by companies; this study looks at the parameters driving creating training models for construction organizations to deliver projects effectively.

## **KEYWORDS**

need analysis, nature & nurture, personality traits, training models, engineering manager

## **INTRODUCTION**

Engineers are always on pursuit to reach the pinnacle of being project managers. Basic qualification achieved by engineers from the curricula of universities is the threshold level for seeking a job. Having got into a job in the industry, there is need for continuous training, education and development.

Training needs of an individual are requirements for the job he / she hold in the organisation. There is always a mismatch between what is taught through the curriculum and the requirements of the job position. Training fills that gap and makes an individual current to the job profile.

While working, educational endeavor is essential for an individual to enhance the knowledge and to tread further up the hierarchical ladder of an organisation. Having gone up, again there would be requirement of training as there is always a difference between education and action. Scaling up the ladder necessarily happens when performance is found consistent after evaluation. Hence, education is the basic input necessary for the next profile or future profiles.

Development of an individual is not directly related to the current and future job profiles. Application of education and training coupled with behavior is crucial for an individual's development. Non application of knowledge and skill after training doesn't mean that learning has not happened. Failure to apply has certain other constraints related to non-

application which need identification. This in turn is an input for training and need for an opportunity.

Education, training and development of an engineer to shape him into a role of a manager through structured training need a specific system and models. The models in this system needs to be designed and developed taking nature of individuals and nurtured environment into cognizance. Hierarchy of training needs should have congruence to Maslow's hierarchy of needs. The pedagogy of training including the methodology will have to be creative keeping in mind Bloom's taxonomy.

To climb up to be a manager on-job requires additional domain learning on knowledge, skills and attitude (KSA) (Bloom B.S. 1956). Enhancement through learning for technical and managerial skill will have to complement one another for higher performance levels of an individual. In this paper the authors intend to study the relation between hierarchy of needs, learning domains and training pedagogy specific to engineers to shape them as managers.

## **THEORY AND PRACTICE**

University curriculum imparts 'Theory for practice' as a standard for on-job applications. For engineers this theory encompasses materials and its physical & chemical properties, laws of physics & fluid dynamics and mathematics. Application of various branches of these sciences and engineering, systematically and systemically, to produce project deliverables is primary productivity level of an engineer. The project environmental and organizational system has its own precedence that need adherence. Understanding this precedence while on-job, results in few corollaries which are results of best-practices. Hence, 'Theory for practice' needs to be supplemented with 'theory by practice' and 'Theory in practice'. With practical application

of modified standards, lots of ideas are implemented, breakthroughs accomplished leading to innovations. Hence in engineering organizations, managers need to have sound knowledge of these theories.

*Experience is the key to the practitioner's skill. And until a manager learns from his own firsthand experience on the job how to take action and how to gain the willing cooperation of others in achieving desired results, he is not likely to advance very far up the managerial ladder* (Sterling J Livingston 1971). A manager as practitioner needs to deal with people and their emotions, situations and their consequences, faults and their causes, future with envisioning, organisation and their politics, policies with ethics, process & procedures with just, and systems with synergies.

Connect between theories in engineering and management with practice by an engineering project manager is an arduous combination. Creatively creating learning models in organizations to shape engineers to managers through imparting theories and practice of engineering and management, either sequentially or in parallel, is herculean task.

## **NATURE, NURTURE and TRAINING NEED ANALYSIS**

The requirement to understand nature and nurture is important as these influences the social, intellectual and behavioral advancements of an individual. An individual acquires all or almost all their behavioral traits from 'nurture'. With regard to Big five personalities, an individual's IQ or a portion of the overall, is attributed to partially hereditary (Gosling, S. D., Rentfrow, P. J., and Swann Jr, W. B. 2003). In this context, the 'nature' component of the variance is also important that ascribed to the influence of family upbringing. Nature and nurture is considered to be an appropriate division of developmental influences. Since both

types of factors are known to play such interacting roles in development, understanding these influencing factors in an individual is necessary for designing a training pedagogy.

The moot question is whether project managers are plain born or managing projects is a skill that needs to be learned. The answer to this question will have leads to those who design training content and its delivery.

There is a dichotomy to the answer. Firstly, from what evaluators believe, “..aptitude assessment represents up to 50% of predictive performance of an individual”. Whereas, famous trainer Linda Richardson says “..training provides an opportunity for individuals for continuous refinement, create repeatable success, and help company to take an individual from good to great”. Theories on evaluation and performance evaluators would suggest that the former is true while in world of realities the latter is also proved to be true.

In enhancing the skills, knowledge and competency of an individual, nature and nurture, both together plays an important role. It is known that good leaders need to have a certain personality traits that are ‘nature’, but training and development, ‘nurturing’, will help them to be successful in the role.

Training needs analysis (TNA) as a process results in identification of gaps and relates it to training content development. The outcome of understanding nature, nurture and TNA of an individual are inputs to training of that individual. While certain skill development and knowledge enhancement include classroom training, how will training conducted in groups addresses the requirement of an individual? Training models should address this aspect of individual development and retain him or her competitive.

## **CHANGE MANAGEMENT PERSPECTIVE IN IMPARTING LEARNING**

Eklavya, in the epic Mahabharata, was known to be greater archer than Arjuna. What made the former to seek training from guru Dronacharya and be in the competition? If one reads the tale of Eklavya, it is clear that it was his deamination coupled with faith coupled with courage and perseverance that made him an extraordinary archer of exceptional prowess. It was Eklavya's deamination from being a pupil of Dronacharya led him to resolve to practice in front of his guru's idol and emerge as an achiever.

There are situations in life of an individual that triggers a turning point and thereon phenomenal change in the perception of the individual and his growth is witnessed. This situation can be due to social, economic, emotional or psychological reasons. An individual's relation to nature and nurture determines the degree of the change and quantum leap that is accomplished.

In organizations, adoption of any new training processes or tools requires careful and well-planned change management. Fostering a culture of change and adopting training can be very challenging, as it requires transformation of many skilled and successful individuals to adopt to learn, unlearn and relearn. Organizations, mentors and trainers need to diagnose reasons for resistance to this change. Leads and insights from this diagnosis will determine the training content which will have to be appropriately woven into the training model.

When training models are not customised, tested, measured and updated, change for development through training can be very ineffectual. Hence, it is important that training be

realistic, achievable, and measurable in any organization. Results from understanding, nature, nurture and TNA are utilised for designing training models by designers.

From the theory of Abraham Maslow, an individual will not get to next level unless his needs are fulfilled in the current level. Hence, it requires lots of effort by organisations and current managers to manage talents, detail career plans and create a progressive plan for learning. Motivating resources and empathise that need for personal development, enhancement of knowledge, skills and competency complements personal growth and allows one to rise up in hierarchy of needs, is an onerous task. Training models shall include relation to personal and professional development needs.

Classroom or on-job training was considered as imparting knowledge from teachers / trainers to learners. Learning is linked to existing knowledge. Learners mind is always active. They don't receive a pre-digested or organised material while in training for honing technical skills. The focus of training module is not on what is to be learnt, but, on how it needs to be taught. This implies that importance of training is not to transfer knowledge but primarily create opportunities for learning. This role of a trainer as facilitator needs to be captured in the training model.

Training model is incomplete if evaluation of effectiveness of training's conversion to learning is not accomplished. This is an integral part of the training as this drives subsequent modules, levels of learning. Reaction of students about the training, increase in knowledge & capability, extent of behavioural changes, effects on personal environment due to change in resources' performance needs to be captured. (Kirkpatrick's learning and training evaluation theory, 1959 [online] Available at: <

<http://www.businessballs.com/kirkpatricklearningevaluationmodel.htm> [Accessed 29 February 2012])

## **PROCESS IN A TRAINING MODEL**

Few questions that arise while one commences work on this transition from engineers to managers are – do we lose good engineers to managers? Are all engineers' good managers? is it necessary that managers be good engineers? It is essential that these questions are analysed and relate the outcomes to training models.

Projects are so completely different from process driven work that there is ever changing scenarios, deadlines, challenges and opportunities. Real work like situations with stimulation tests would enhance the capabilities of engineers to face challenges and credibility among peers. Experience in implementing projects with various domains of expertise is a necessity in a manager. Hence, it will be inappropriate to say that we lose a good engineer in a manager. However, in any field of engineering, to manage projects, a technical skill compliments and enhances managerial skills.

While the intent of learning outcomes is understood, various levels in the process of shaping engineers to managers are determined by following M.E.T.A.L.L.I.C cycle. This cycle will have to be iteratively used from motivation to character play. While in character play, measurements will have to be implemented for evaluation to continue with the METALLIC cycle for next category or level.

“How effectively a manager will perform on the job cannot be predicted by the number of degrees he holds, the grades he receives in school, or the formal management education programs he attends. Academic achievement is not a valid yardstick to use in measuring



managerial potential. Indeed, if academic achievement is equated with success in business, the well-educated manager is a myth. Managers are not taught in formal education programs what they most need to know to build successful careers in management. Unless they acquire through their own experience the knowledge and skills that are vital to their effectiveness, they are not likely to advance far up the organizational ladder (Sterling J Livingston, 1971)” .“...Men who get in to top in management have developed skills that are not taught in the formal education system and may be difficult for highly educated men to learn on job ... (Sterling J Livingston, 1971)”. This is relevant even today.

Learning through authors’ experience, this process of shaping engineers to managers is long drawn. The challenges are in honing and enhancing the skills, knowledge and attitude of engineers. Classroom or online training is not the only solution in this process. It is a systematic gradual change that needs to be brought about in an individual’s behaviour to attain the status of an effective manager.

Two major types of learning arise in this long drawn process, Incidental and Intentional, which is true in any field of engineering. Incidental learning is unplanned, not important at the time of learning, but is contagious – transmitted to the company’s culture immediately. Rather than conflicting, incidental learning is important as it reinforces and influences intentional learning.

Intentional learning is a requirement in an organisational culture. The designs of training programs though hinges on intentional learning, case studies, anecdotes and illustration on benefits from incidental learning forms the basis of training. Effective blend of incidental and intentional learning is necessary for the designs of effective training models.

## CONSTITUENTS OF TRAINING MODELS

Initial constituent of a training model to mould engineer to manager is motivation. Learning models shall encompass illustrations around David C McClelland's '*needs theory*' of motivation which should indicate how 'need to excel' is a primer towards becoming a manager from an engineer. Essentially focus on enhancing (a) desire to achieve more and higher (*n-Ach*), (b) desire to seek social and personal power (*n-Pow*), (c) sense of involvement and belonging (*n-Afil*) needs to be built in intentional and guided learning. These illustrations for different categories of needs shall be emphasised at various levels as shown in the Fig 2. The degree of illustrations will have to be greater as one goes up in the hierarchy.

Contrary to desire to grow, inactions from engineer for learning is a bane. These three derivatives from '*needs theory*', affects the actions of an individual, leading to first steps towards learning. On trial basis, organisations should adequately empower engineers for experiential learning while they enhance the levels of needs of individuals, else, any amount of training and learning will fall apart.

n-Achievement enhances accumulation of knowledge, competition, productivity, turnover rate and skills of an individual. This furthers the chances of short term goal achievement of an individual and consequently growth in the organisational hierarchy. Cases of an accountant growing to a position of a CEO, an office boy learning and enhancing his knowledge to lead an accounts department, a typist going on to become a lead surveyor, a resource responsible for filing in an administrative department going on to lead a HR team in

a large organisation, reinforces the fact that n-achievement is a great motivator. As illustrated earlier, Eklavya's need lead him to be an archer par excellence.

n-Power signifies power of an individual due to his or her knowledge and skill and not the power due to position. It is important for an individual to understand that knowledge is power, power to perform and excel. Power of knowledge enables an individual to stay afloat in competition, envision problems, find resolutions to problems, plan implement the right resolution which further plants confidence to take challenges and convert them to opportunities.

n-Affiliation, is the spirit without which the benefits of n-achievement and n-power of an individual is not felt by the organisation and individual himself. Growth of an individual without the growth of the organisation would be a tragedy for both. Learning model constituting sense of involvement of an individual to his work & environment and belonging to organisation will yield mutually beneficial results. Affiliation also would necessitate increase in interpersonal relationship facilitating healthier competition and learning.

In parallel to imparting the essentials of achieving, power and affiliations, it is also important to understand an individual's personal needs. Inclusions of instances illustrating positive relations between enhancement of knowledge, skills & attitude (KSA) to fulfilment of personal needs & growth in organisational hierarchy are a requisite while motivating.

Fig. 3 shows the congruence of Maslow's hierarchy of needs to a generic hierarchy in an organisation. In any organisation, need to achieve & power is associated to job safety and satisfaction; need to achieve, power & affiliation is associated to love & belonging; need to

achieve & affiliation is associated to esteem. Learning organisations will have iteratively use METALLIC cycle to evaluate and elevate engineers to further levels.

Among engineers too, BF Skinner's theory of behaviour is observed. In general, visible trait of behaviours which are favourable for moulding an engineer to a manager, progressively, is depicted in Fig 4. The transition from Respondent to Operant behaviour is prevalent when individuals shift from their physiological needs to requirement of safety & satisfaction in their career. This shift is a welcome sign that the needs theory of motivation can be applied and tried. It is at this stage attrition is conspicuous. Hence, inclusion of acceptability factors of motivation and very little dosage of n-affinity shall be included in the learning models.

Operant behaviour is consequence to the environment, responses to previous actions. Here, the learning model shall include envisioning different situations than ideal, response options at various situations and assist in choosing the right response. The learning module shall include factors for distinguishing, discriminating and differentiating through imitation and modelling. While trainer, mentors and coaches shall create opportunities for this experiential learning, they shall act as beacons to guide learners. Hand-holding and mentoring are commonly used technique, reinforcing the fact that teachers are facilitators. Behavioural modifications are often seen possible in this transition to safety and satisfaction, which continuing results in progress towards converting an engineer to a manager.

Project situations are very unique, seldom problems repetitive. Even if they seem to repeat, the inputs, environmental factors, project teams' behaviours, desired end results are all unique to a project. Learning to be project manager in any industry requires experiential learning, recall of learning from a situation and modelling it to the current situation with

envisioning, coupled with right attitude towards result is essential. The requirement of imparting the right type of domain learning at various levels is crucial.

Benjamin Blooms in his identification of domains of learning referred to the categories of Knowledge, Skills and Attitude. In learning processes, ultimate goals of these KSA collectively lead an engineer to be an effective manager. In organisational hierarchies, these are found to be effective when applied as shown in the Fig. 5. The degree of this triad varies with level in organisational hierarchy. Learning models in different formats of organisation in any sector need to focus on the correct proportion of sub categories of KSA to model an engineer to a project manager.

## **CONCLUSIONS**

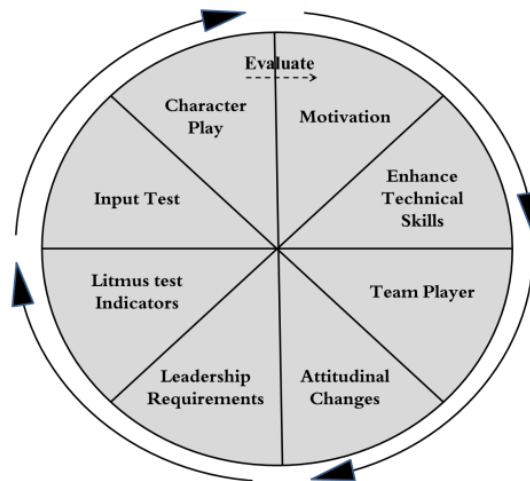
With acute shortage of engineering project managers, the gap between hope and the happening can be bridged by holistic approach to learning models in organisations. The learning of higher skills will yield fulfilment of personal, professional, organisational and needs of the community. Manifestation of shaping of engineers to project managers will be visible with collective efforts of current professional at diverse levels. Various levels of learning models applied at various occupation levels of individual will result in shaping engineers to be efficient project managers.

Effective learning models will not only allow moulding engineer to managers, it will have manifold benefits to organisations. From identifying right talent, nurturing them to develop, to create sense of belonging, increase in productivity, thereby transforming any format of organisation to learning organisation. This changeover will allow establishments to build capacities to aim and scale greater heights, thus, permitting corporations to raise the bar, have

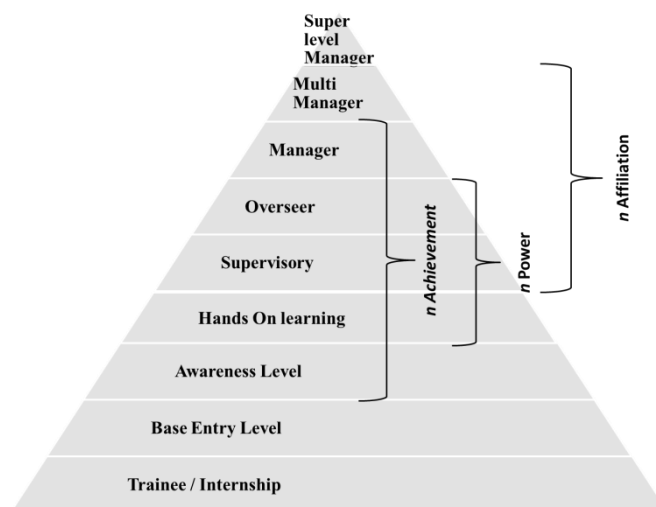
multitasking & dependable talent pool, improved crisis management and greater ability to convert challenges to opportunities.

Well-designed learning model has its own challenges that also need to be addressed. Growth is eminent for both organisations and individuals. One sided action will not be mutually beneficial. Newton’s third law ‘..equal and opposite reaction.’ is essential from organisations and as well as individuals for any learning model to be developed, adopted, adapted, implemented and enhanced for it to be successful.

**FIGURES:**



*Fig. 1 – METALLIC cycle for training model's intent*



*Fig. 2 – Level of imparting 'needs theory' in learning*



Fig. 3 –Maslow ‘Hierarchy of Needs’ and organisational hierarchy’s congruence

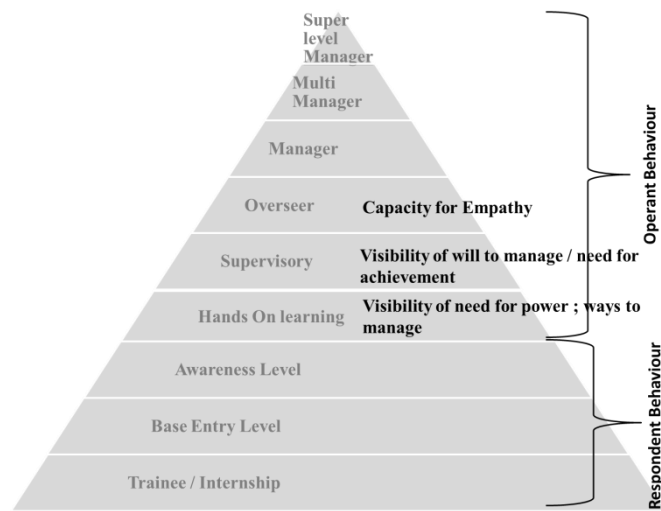


Fig. 4 –Behavioural traits of manager in organisational hierarchy

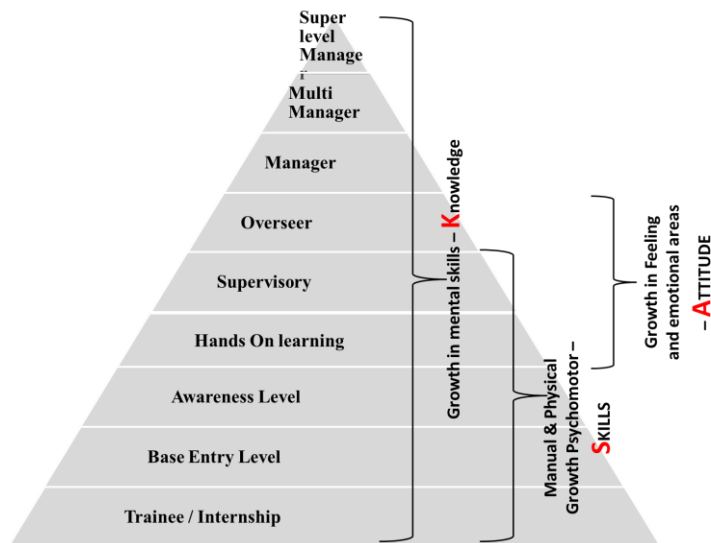


Fig. 5 –Application of Bloom’s taxonomy of learning to levels in organisational hierarchy

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