Learning Organization and Process-output Association

A Case from India

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Abstract

With rapid progress in the information and communication technologies in recent years, the demand for technical manpower in these areas has also increased. This has resulted in the establishment of a large number of institutions through out India, offering a variety of programmes towards meeting the demand. As the competition increases to a stage of threatening the survival of these institutes, the concept of 'learning organization in engineering education' is getting more significant. This paper analyses the influence of the core process of any engineering education programme - 'Teaching learning process' - in determining the important 'personal mastery' construct, the 'student performance'. Framework of the study is developed from the accreditation process of National Board of Accreditation (NBA), India. The study highlighted that for an effective learning organization, both the constituents – the teacher and the learner- should be of good quality.

Keywords: Learning organization, Process-output association, Engineering programmes

1. Introduction

Chris Argyris and Donald Schon first used the phrase "organizational learning" in a book 30 years ago. The concept of learning organization was coined to describe those organizations, which experimented with new methods of business for surviving in the highly competitive, turbulent market (Senge, 1990; Argyris and Schon, 1996). As the evolution of organizational learning continues, it can be seen that existing learning tools used more often for new purposes and the development of other learning tools to increase corporate competitive advantage (Fulmer et al, 1998). The concept is getting more and more significance as the competition increases to a stage of threatening the survival of organizations itself. With the explosion in enrollments of engineering education programmes in India, engineering colleges are also trapped in such a situation. Many colleges are in the verge of closure due to shear competition and backtracking of admission aspirants. An institute, which learns through its experience and through the individual and combined learning of its human resources, can only survive in today's circumstances.

2. Concepts of learning organizations to engineering colleges

An organization grows to a learning organization when the learning by the people within the organization is converted into the learning by the organization itself. This includes two major levels – learning by individuals and learning by the team. People at all levels, individually and collectively, should increase their capacity to produce the required results they are aiming at. In learning organizations everyone's opinions are valued and amount that people can contribute is not determined by position in the organization. To meet the challenges of competitions and to maintain the quality, management must use their most valuable assets, their human resources, in the most productive manner. Towards this end, the participative management style is gaining more and more acceptance (Jindia et al, 1995). Top-down and bottom-up communication flows; learning "up and down" the hierarchy; group self-awareness; heightened collective learning; greater cohesiveness and enhanced creativity are some of the peculiarities of a learning organization.

In Indian engineering education system, the occurrence of learning is taking place at five levels. They are student level, class level, department level, college level and university level. Top-down and bottom-up learning with in the hierarchy should be strengthened (Figure 1) to convert the system into a learning organization. Proper measures are to be taken to assure the continuous improvement of learning with in the system. Presently, no formal measures are available for the systematic assessment of learning with in the system. An attempt has been made to develop a framework from the accreditation criteria of National Board of Accreditation (NBA), which is the accreditation agency for technical education programmes in India. NBA is charged with the task of evolving a procedure for quality assessment in the technical education sector in India on the basis of specified guidelines, norms, benchmarks and criteria (NBA, 2000). They have formulated the criteria or

standards, by which the strengths and weaknesses of the individual programmes in any institution can be judged. NBA uses eight criteria (Table 1) to assess the capabilities of engineering programmes. Though these criteria of NBA are not covering all the features required for the systematic assessment of learning, by combining those variables that staggered around the various criteria of NBA, we can develop some representative measures.

Five learning disciplines are described as the basis of learning organization (Senge, 1990). They are 'Personal mastery, Mental models, Shared vision, Team learning and Systems thinking'. Categorization of various (relevant) variables of NBA under these five learning disciplines for different levels of hierarchy of engineering education system is depicted in Table 2. As the NBA accreditation is for individual programmes in a college, it cannot be utilized for measurement of learning at university level. The first criterion of NBA is for the assessment of management functioning of the college/programme. Five variables coming under this criterion can be used to represent the 'mental model' concept and another set of seven variables from the same criterion can be used to represent 'shared vision' concept of Learning Organization. 'Shared vision' at department level is represented by two variables of third criterion of NBA. The ten variables, which give the indication of 'team-learning', can be found from the last two criteria of NBA. The discipline 'personal mastery' of individuals is categorized under two levels. 'Faculty & staff level learning' can be measured through four variables of third criterion of NBA. 'Student level mastery' is evolved through the five variables of the third criterion of NBA.

The present NBA accreditation process follows a 'reductionist approach' (Breaking down the whole into parts, study each part and mechanically sum up to predict the performance of the whole). Engineering education system is an assemblage of inter- dependent, mutually interacting subsystems and hence this approach is inadequate to assess the holistic- characteristic of the system. The main feature, which is lacking in the NBA criteria, is the 'system thinking'. System thinking is the ability to see interrelationships rather than linear cause-effect; the ability to think in context and appreciate the consequences of actions on other parts of the system. Hence an entirety of measurement of organizational learning that is taking place in Indian engineering colleges/programmes is not attempted in this paper. Instead, the paper tries to find out the influence of the core process of any engineering education programme - 'Teaching learning process' - in determining the important 'personal mastery' construct, the 'student performance'.

3. Teaching learning process and Student performance

Capabilities of an organization are formed through the co-ordination and integration of activities and processes, and are the product of collective learning of individual assets (Khalid et al, 2002). In an engineering college assets are physical & financial resources, faculty, students and management. The capabilities of the college are developed by the proper utilization of these assets through the teaching-learning process. Teaching learning process is represented by the fifth criterion of NBA and assessed by the ten variables under this criterion. A principal component analysis has been conducted on these variables to find out the linear components behind them (Viswanadhan, 2004). Three components, named as 'Learning facilities', 'Instruction, evaluation and feedback' and 'Academic calendar' were emerged from the analysis.

Variables connected with student performance are coming under the fourth criterion of NBA. This criterion, which is called as 'human resources – students', contains eight variables out of which five variables are indicators of student performance. These indicator variables are 'academic results, admission to post graduate courses, performance in competitive examinations, employment in past year and employer's feedback'. A detailed study of these indicators will give a clear picture of learning occurred at the student level, programme level and even college/category level.

4. Data collection, analysis and observations

Undergraduate engineering programmes are offered by four major categories of colleges in India namely autonomous, government, aided and self-financing. NBA assessment scores of 162 undergraduate engineering programmes coming under different categories from different parts of India are collected for the study. Categorization of programmes is given in Table 3. Percentage scores of the three components representing Teaching-learning process and the five variables representing Student performance are tabulated for the analysis.

*Autonomous colleges***: -** National Institute of Technologies (NIT) and some other high profile colleges are functioning under autonomous status in India. Most of them are 'deemed universities'. They enjoy academic, administrative as well as financial autonomy. The study resulted in the following observations about the autonomous colleges. Academic results of these colleges are very good (82%). Their graduates are getting immediate placements in reputed companies (77%). Employers are reasonably satisfied with their graduates' performance (67%). Performance in competitive exams (60%) and admission to PG programmes (63%) are not up to the mark in these institutes. Now the association of different components of teaching – learning process with the dimensions of student performance is given in Table 4. None of the student performance dimensions are correlated with 'Academic calendar'. 'Academic Results' and 'Admission to PG courses' are significantly associated with 'Learning Facilities' and 'Instruction Evaluation and Feedback'. 'Employers Feedback' is correlated only with the 'Instruction Evaluation and Feedback'. 'Performance in competitive exams' and 'Employment in last year' do not seem to have any correlation with teaching – learning process components.

*Government colleges***: -** Central and state governments administer this second category of colleges. AICTE, state govern-

ments and universities, to which these colleges are affiliated, fix pay scales and service rules for the staff employed in these categories of institutes. University is mainly responsible for the framing of rules for the academic part of these institutes. They frame course duration, subjects to be taught, examination pattern, and the grading system. Government, based on merit as well as reservations, does student admissions. From the study, good academic results (85%) and better placements to the graduates (76%) are found to be the strengths of these programmes. The other three student performance dimensions are at the same level and also good (67%) in these colleges. The relationship of these dimensions with the teaching – learning process components are given in Table 5. The first three dimensions; 'Academic Results', 'Performance in Competitive exams' and 'Admission to PG courses' are significantly correlated with all the teaching – learning process components. 'Employment in last year' is correlated with 'Instruction Evaluation and Feedback' where as 'Employers Feedback' is not significantly correlated with any of the teaching – learning process components.

*Aided colleges***: -** Third category of colleges is coming under grand-in-aid sector. Education societies or private bodies are managing these institutes. They take up the responsibility of providing capital assets like land, buildings, etc. Government provides salary and other working expenses to these colleges. AICTE, state governments and universities to which these colleges are affiliated, fix pay scales and service rules for the staff employed in these institutes. University frames the course duration, subjects to be taught, examination pattern, and grading system. Students are admitted to these institutes by government and management, based on merit as well as reservations basis. In the study, 'Academic Results' (79%) and 'Employers Feedback' (71%) seem to be good in these categories of colleges. Other dimensions are below the minimum requirements of NBA standards. Except for one or two outliers, the entire set of programmes considered for the study, got a 50% score for the dimension-'Performance in Competitive exams'. Correlation structure between student performance dimensions and teaching – learning process components are shown in Table 6. Most of the bi-variate correlations found to be insignificant for aided colleges. Only the correlation of 'Admission to PG courses' with 'Instruction Evaluation and Feedback', 'Employment in last year' with 'Learning Facilities' and 'Employers Feedback' with 'Academic Calendar' are found to be significant.

*Self-financing colleges***: -** Fourth category of colleges is working fully under self-financing basis. Education societies or private bodies, which take up the responsibility of running these institutes, are mainly responsible for providing physical facilities, teaching staff, equipments and other supporting staff for these programmes. University frames the rules for the academic part of these institutes. Students are admitted partly from the merit list prepared by the government and partly from a list prepared by the management. The study reveals that all dimensions excluding 'Academic Results' (78%) are at nominal level (55%) in these institutes. Bi-variate correlations are presented in Table 7 for further analysis. Most of the associations between the performance dimensions and process components are found to be insignificant for these colleges also. The only highly significant association in this category of colleges is between 'Academic Result' and 'Instruction Evaluation &Feedback'.

5. Discussion

Components of teaching-learning process are almost constant irrespective of categories. But this statement is not applicable to the dimensions of student performance. While government colleges and autonomous colleges are standing at the top in almost all dimensions, other two categories, especially self-financing colleges are weak in these dimensions. Academic results are rated as very good in all colleges. This result might be the indication of the overemphasis given to the university examinations by the engineering colleges. Engineering education might be formulated and is carrying out around an examination-oriented structure. It can be suspected that other objectives of engineering education (EPC, 2002) like communication skills; problem-solving skills, team working and 'learnability' are not being properly addressed in the present system. This is visible from the poor performance of students in the competitive examinations. Very low scores of employer's feedback in self-financing colleges compared to other categories of colleges point out the importance of experience factor in education sector. As the self-financing colleges are comparatively younger, they may not be in a position to maintain good rapport with industries, which in turn reduces the quality and quantity of feedback from the industrial sector.

Same level of teaching-learning process and different levels of student performance indicate the influence of some other factors in the performance. The major one may be the student quality. As the best quality students are getting admitted to autonomous and government engineering colleges, the student performances of those colleges are also naturally high. The other criteria like faculty, management may also have influence in the student performance. Association of teaching-learning process and student performance shows a drastic decrease as the analysis progresses from government colleges to aided and self-financing colleges. This result might be an indication of the fact that for an effective teaching-learning process, both the constituents – the teacher and the learner- should be of good quality.

6. Conclusions

One of the major disciplines of learning organization, the 'Personal mastery', is addressed through the analysis of teaching-learning process and student performance of undergraduate engineering programmes in India. For the assessment of learning in organizations, longitudinal data is needed. Presently most of the engineering colleges are not maintaining properly organized longitudinal data. Hence the analysis was based on the cross sectional data of NBA, which is a limitation

of the present study. Another important feature of learning organization, 'System thinking', is also not taken care of in the present assessment methods and working patterns of engineering programmes. With out considering the dynamic complexity and effect of feedback loops, the study would not be complete, which can be thought of as a future course of research work.

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Table 1. NBA Criteria for accreditation

Criteria	Weights
1. Mission, Goals and Organization	100
2. Financial & Physical Resources and their Utilization	100
3. Human Resources: Faculty& Staff	200
4. Human Resources: Students	100
5. Teaching – Learning Processes	350
6. Supplementary Processes	50
7. Industry – Institution Interaction	70
8. Research & Development	30
TOTAL	1000

Table 2. Categorization of variables for measurement of learning from NBA criteria

Level	Learning disciplines of Learning organization	NBA Criteria	NBA Variables
University	Nil	Nil	Nil
College Management	Mental Models	I Mission, Goals and Organization	1.1A.Mission & goals 1.1.C.Attitude 1.1.D.Planning & monitoring 1.2.A.Leadership 1.2.B.Motivation
	Shared Vision	I Mission, Goals and Organization	1.1.B.Commitment 1.1.E.Incentives 1.1.F.Effectiveness 1.2.C.Transparency 1.2.D.Decentralization & delegation 1.2.E.Involvement of faculty 1.2.F.Efficiency
Department (Programme)	Shared Vision	III HR - Faculty& Staff	3.1.E.Attitudes &commitment 3.2.D.Attitudes & Involvement
	Team Learning	VII Industry Institute Interaction	7.1.B.Continuing education 7.1.C.Consultancy 7.1.D.Industrial Visits and 7.1.E.Training 7.1.F.Project Work 7.1.F.Extension Lectures 7.1.G.Placement
		VIII Research & Development	8.1.A.Institutional Budget for R & D 8.1.B.Academic/Sponsored/Industrial R & D 8.1.C.Publications and patents
Faculty and Staff	Personal Mastery	III Human Resources - Faculty& Staff	3.1.F.Faculty development - Faculty 3.1.G.Performance appraisal- Faculty 3.2.E.Skill Up gradation - Staff 3.2.F.Performance appraisal - Staff
Students	Personal Mastery	IV Human Resources - Students	4.1.D.Academic Results 4.1.E.Performance in competitive Examinations 4.1.F.Admission to Post Graduate Courses 4.1.G.Employment in past year 4.1.H.Employer's Feedback

Table 3. Number of programmes under the four categories of colleges

Category of Engineering Colleges	Number of Programmes
1.REC & other Autonomous Colleges	40
2.Government Colleges	25
3. Aided Colleges	17
4. Self – financing Colleges	80
Total	162

Table 4. Process-Output association in Autonomous colleges

Output Variables	Process components		
	Learning Facilities	Instruction Evaluation and Feedback	Academic Calendar
Academic Results	0.518**	0.375*	-0.169
Performance in Competitive exams	0.217	0.28	0.105
Admission to PG courses	0.585**	0.513**	0.174
Employment in last year	0.048	0.066	0.107
Employers Feedback	0.403**	0.305	0.008

Table 5. Process-Output association in Government colleges

Output Variables	Process components		
	Learning Facilities	Instruction Evaluation and Feedback	Academic Calendar
Academic Results	0.59**	0.631**	0.525**
Performance in Competitive exams	0.455*	0.788**	0.624**
Admission to PG courses	0.558**	0.784**	0.441*
Employment in last year	0.171	0.427*	0.188
Employers Feedback	0.188	0.393	0.332

Table 6. Process-Output association in Aided colleges

Output Variables	Process components		
	Learning Facilities	Instruction Evaluation and Feedback	Academic Calendar
Academic Results	0.249	0.231	0.27
Performance in Competitive exams	0	0	0
Admission to PG courses	0.491	0.603*	0.078
Employment in last year	0.559*	0.426	0.144
Employers Feedback	0.306	0.316	0.539*

Table 7. Process-Output association in Self-financing colleges

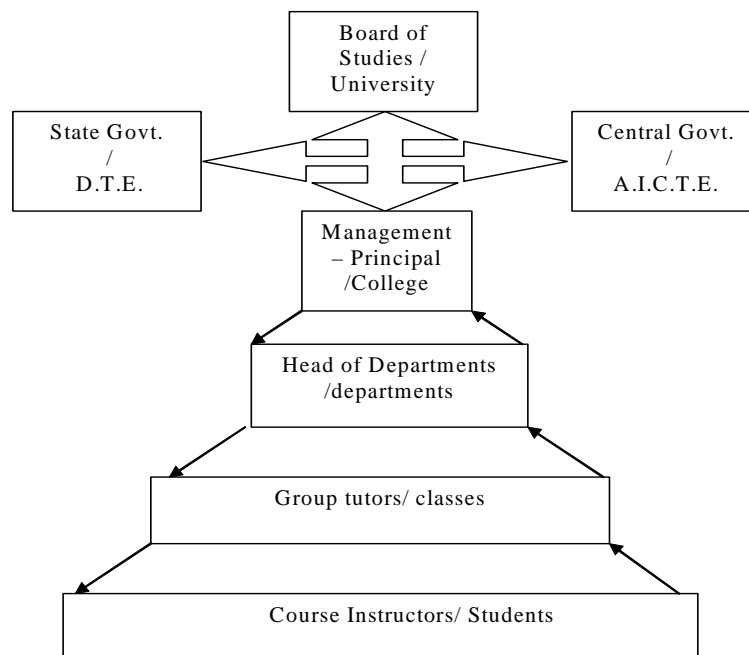| Output Variables	Process components		
	Learning Facilities	Instruction Evaluation and Feedback	Academic Calendar
Academic Result	0.206	0.353**	-0.094
Performance in Competitive exams	0.154	0.022	0.228*
Admission to PG courses	0.266*	0.14	0.001
Employment in last year	-0.244	-0.097	-0.039
Employers Feedback	0.11	0.246*	0.217

Figure1. Engineering education system as learning organization