6. TQM IN ENGINEERING EDUCATION THROUGH MEANINGFUL STUDENT EVALUATION AND FACULTY APPRAISAL

*Dr.S.K.Bhattacharya**

Synopsis

Engineering Education in India has witnessed tremendous growth during the past decade. This sudden expansion has led to the problem of maintenance of desired quality. External controlling authorities have been making some effort through their "equality inspectors" having only marginal result. Internal motivation only can lead to achievement and maintenance of quality. While TQM techniques can be tried in education by taking a holistic view of the system, the critical components of the system, viz faculty development and the student evaluation system need to be given priority. Factors which would influence internal motivation have also to be looked into.

1. Introduction

TQM has had its impact in Business and Industry. In Engineering Education many methods and strategies are being attempted to achieve excellence. However, since the availability of training seats have always been less than the demand, the management of Engineering education, although talk about quality is, by and large, not very serious about it. Quality is often sacrificed for lack of real motivation for it.Regulating authorities are putting lots of controls with a view to pursue institutions to comply to certain norms & standards. However these external pressures should lead to internal motivation to work towards total quality. While attempting to apply TQM techniques to Engineering Education, one has to apply "*Systems Approach*" in the sense that a holistic view of the system & its interdependent components has to be taken. It is understood that all the system components should independently, as also together work for achieving total quality. However, there are a few crucial system components which need to be given special attention. If these are designed and implemented properly, other components will get corrected by the very influencing effect of the crucial ones.

After system analysis and on the basis of personal experience, two system components, namely the Student Evaluation System & the Appraisal System of Faculty have been identified and are discussed in some details in this paper.

2.The Crucial Controllers of Quality

A system diagram with its two controllers at the input and output level has been shown in fig:1 (on page no. 47).

**Director Hindustan Institute of Technology, Greater Noida. Former Director NITTTR Calcutta and NITTTR Chandigarh.*

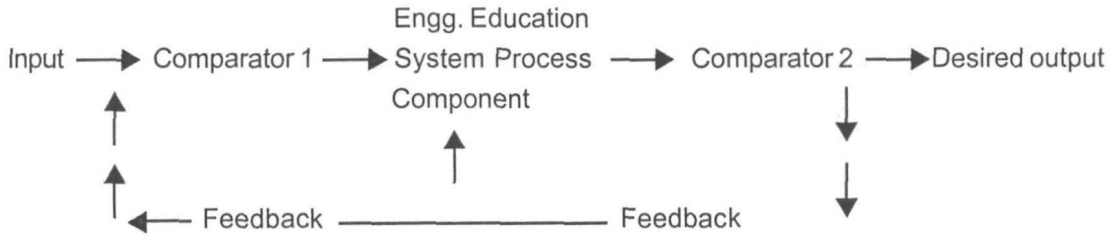

Fig. 1: Representation of a basic system model

The quality of student input to the system is controlled by comparator 1 which allows or rejects students on the basis of certain criteria.

However, more and more quality students will enter the system if the output quality, which is assessed by aspiring students and the parents alike, is maintained at a high level. It is interesting to note that if employability of students increases, the quality of students seeking admission also increases. Achieving a certain standard of employability of students does not necessarily depend on the age of the organization. It has been witnessed that a fairly newly established college attracts better students than the fairly older ones.

The second quality controller (comparator) is the student evaluation and certification system. The process component gets highly influenced by the student evaluation system. The way the students learn and the way the teachers teach depend mostly on the examination system. The evaluation tools and techniques and the acceptance criteria have to be reflecting the employability requirements.

3. Quality Improvement of the process component

The educational process is seen as meaningful interactions between students and teachers around a given curriculum . The curriculum has to be used as a means to achieve certain skills & competencies in the students.

3.1 ***The Curriculum Design Factors***: The curriculum is designed keeping in view the competency requirements of the World of Work in the particular discipline. The competencies are classified into generic, and specific.

Generic skills and competencies provide a broad base while the specific skills and competencies are built using the generic ones. Generic skills are often referred to as transferable skills i.e. the skills which one can take from one place to the other and from one job to the other. These skills, let us designate as X type of skills. The **specific skills,** may be called as Y- type, are specific to the discipline and requires to be mastered through experiences and reflection. However, the requirement of these skills and competencies go on changing with change of technology. The third type of skills which can be called as Z type, are **learning-to-learn** skills. These skills enable a person acquire new skills and competencies in the event of changes in technology or changes in the job profile. Thus the ultimate objective of any curriculum is to use it to develop in the student X Y Z components of skills in an integrated manner so that he is able to adjust in the world of changing technologies. Faculty and students have to work towards achieving the short-term and long-term educational objectives. The short-term objectives, which students value the most, is to achieve high marks in the University examinations. The long-term objectives, which the employers value the most, are to prepare students to face the uncertainities of life. Design of curriculum, therefore, should take into consideration the short-term as well as long term objectives of engineering education.

3.2 ***The Curriculum Implementation Factors***: A well designed curriculum often fails to give the desired results in terms of quality due to its poor implementation. Since curriculum implementation is a dynamic process, all the quality factors have to be evaluated on a continuous basis to respond the needs of its participants. Some of the important factors that influence quality of curriculum implementation are discussed in the following sections:

(a) Working on three pillars of success:

The three pillars of success are Result oriented strategies, Quality human capital, and Networking. If an organization works on these, the possibility of success in turning out quality manpower through the engineering education system will increase manifold.

(b) Rewarding and Reinforcing:

Reward and Reinforcement must work as big motivators for both students and teachers alike.

These should be used for enhancing motivation of students in learning and in rewarding teachers for their desired performance appraisal. A performance appraisal system designed and implemented by the author of this article in a group of institutions has been included in the Annexure.

(c) **Continuous Evaluation, Feedback and Monitoring:**

A feedback and monitoring mechanism helps in effective curriculum implementation. The focus should be on learning by the students and not on teaching. It should be understood that stereo typed feedback and monitoring mechanism will mostly be Transactional rather than Cultural & Transformational.

(d) **Faculty Training and Development:**

A self appraisal system will lead to identification of training needs. Training of faculty in subject matter updating, industrial processes and practices and in modern teaching-learning methods are to be planned at institutional level. Career development of faculty has to be linked with performance.

(e) **Integrating Teaching, Research and Development:**

Institutions should change from merely teaching ones into learning organizations. Innovations, research, development, consultation and extension activities are to be integrated with teaching. This will improve the learning culture of the institute and create a conducive learning environment. The institute will learn to adapt and change quickly to respond to the needs.

(e) **Improving Student motivation in learning:**

Motivation is like fire. One has to put fuel to the fire to keep it burning continuously. Similarly , if the students and teachers are engaged in the learning process with motivation, desirable results are bound to come. At present, too much energy is being spent on academic tuitions. However, if teachers work on inspiring students to learn, a dramatic change will occur in the institutional climate. We have to move from the world of rote learning (remember, reproduce & forget) to real learning. Real learning aims at developing understanding and getting in-sights. It aims at developing higher order intellectual abilities, i.e., the ability of analysis, synthesis, and decision making.

(f) **Industry-Institute Interfacing:**

Industry and Institutes are seen as progressing at unequal speeds and priorities although it is often said that they should be made for each other. The

isolation between these two is the main reason of their differences. The institutes have been complaining that the response from industry for collaboration is luke warm. Industry, on the other hand, complain about the inferior quality of graduates coming out of institutions . Planners and implementers of technical education system emphasise on creating partnership with industry. However, Industry feels that such partnership should be mutually beneficial, symbiotic and synergetic, based on goodwill.

If a triangular interactive relationship between industry managers, students and faculty can be established through some project activities the quality of contribution of industry to education could be improved significantly.

4. Faculty Appraisal

A comprehensive Faculty Annual Performance Appraisal Reporting (APAR) System implemented in a group of institutions has been included in Annexure. It includes self appraisal by Faculty on teaching and developmental activities, Appraisal by departmental heads,evaluation by select peer group, feedback from students and academic results of students in the University examinations. It was decided to give fifty percent weightage to APAR and the remaining fifty percent weightage on comprehensive selection interview for promotions of faculty. In addition, best performers had to be rewarded annually. The effect of introducing this APAR System has reduced attrition rate of faculty, developed their confidence in the Management and improved students performance in the University examinations. However, other contributing factors are being studied.

5. Student Evaluation System

To achieve total quality, there is lot to do with improvement of tools and techniques to be used in student evaluation and certification.

It is of common experience that the first class first of the college does not get the best job offer. What the employers look forward to, from the engineering graduates, have to be studied and incorporated in teaching-learning and evaluation system. The author of this paper carried out a random analysis of assorted question papers of three Universities of a number of subjects. The analysis showed that majority of the questions could be answered through remembering. There were very few questions on assessing student abilities of analysis, synthesis and decision making.

The correlation between students score in continuous evaluation and in University examinations was also found to be very low. However, the correlation between academic performance and job placement (in terms of pay package) is yet to be studied.

Evaluation of answer books of students by the University poses a big problem. While the University desires to declare the result within a month or so, the answer book evaluation takes more time as too many answers books are to be evaluated by individual evaluators.

All these observations lead to the design, development, and implementation of a student evaluation system which will force students and teachers improve their quality of teaching-learning and will also be meaningful to the employers. Gradual autonomy to institutions in this regard could amount to rewarding their quality.

6. Management of Quality

As indicated earlier, the objectives of an engineering institution should be to make students achieve success not only in University examinations but also to get them employed. Along with these, the management of institutions aims at increasing their financial revenue in the form of enhanced fees and income from seats allocated as management quota (for privately managed institutions). AICTE and University being the regulating authorities can

introduce incentives for quality factors. Any increase in intake strength may be linked with two factors viz pass percentage of students and employability of students above certain minimum norms. The fees to be charged could also be regulated on the above two factors. These will change the total attitute of the management and they have to work for quality. Faculty could also be remunerated suitably on the basis of students performance.

7. Conclusion

India is experiencing a huge economic boom. Rapid expansion in engineering education system in India has responded to the technical manpower needs. India needs more and more technical manpower in diversified areas. The employment opportunities have shifted from manufacturing to IT and to Telecom areas. Areas like retail, insurance, etc will also require huge manpower in the coming years.(eg. Bharti would require approximately 80,000 trained persons in retail management). Thus we need more technical colleges offering courses in diversified areas. The curriculum of such courses need to be "*competency based*" and not merely "*syllabus based*". The pedagogy need to be more of learning by doing rather than by listening.

Application of TQM, ISO certification and such similar initiatives have provided new life to many industrial and professional Organizations. Engineering institutions are being subjected to number of controls by University and AICTE. Internal motivation is somewhat lacking. Wishes are there but actions are wanting. Everyone talks about IITs and IIMs. Be sure that every institute cannot become like IIT or IIM. What institutions can aim at is to achieve quality in all activities to the extent possible. For example, examination system is controlled centrally by the Universities. It is the Universities which should be influenced to respond to the needs. Unfortunately Universities lack infrastructure and skilled manpower. The systems they follow are mostly outdated. Mostly they do crisis management. The need is therefore to make institutions autonomous under the Universities so that they are free to innovate and experiment and at the same time are responsible. Total Quality Management will be possible only if the institutions have fairly good amount of freedom to innovate, experiment and implement to achieve success. Success depends on how fast you are, how efficient and effective you are, and how smart you are.We must be quick in responding to the call for quality, either through TQM or through any other means.

Appendix : A Sample Annual Performance Appraisal Reporting (apar) System.

SECTION A : SUMMARY OF FACULTY APPRAISAL

Date		Sem / year	
Name of the Faculty member	:		
Designation	:		
Department	:		
Date of joining the college	:		

	Evaluation	Raw score	Weight	Weighted Score
1	Student feedback		0.30	
2	Performance of student in the university examination		0.30	
3	Peer Feedback		0.20	
4	Evaluation by HOD & Principal		0.20	
	Composite Performance Index (CPI)			

Remarks of the Principal

(a) Does the Faculty member need counselling/ training.
If yes, describe areas of weakness

YES	NO

(b) Does the faculty member need to be commended for good work.
If yes, mention significant achievements:

YES	NO

(Signature of the Principal)

Remarks of the Faculty Member being appraised

I agree with my CPI
If no please detail reasons below :

YES	NO

(Signature of the Faculty Member)

Date:.....

APAR-2

SECTION B (I) : SELF APPRAISAL BY THE FACULTY

(To be completed by individual faculty : subject wise)

Fill in the data or tick boxes as appropriate (Use separate sheets for each subject)

Date		Sem / Year	

Date		Your Department	
		Allocated Hours	L T P

No of Lectures	Scheduled	Taken	No. Tutorials / Practicals	Scheduled	Taken
No. of Students					
Average Attendance					

Your responses to the following are important :

	Items for your Response	Yes	No
1	Are you teaching the course for the fist time?		
2	Is the course being offered for the first time?		
3	Have you taught the course earlier?		
4	Have you taught the course for more than three years?		
4a	Did you prepare a course plan and announced it in the class at the beginning of the semester?		
5	Is the course within your area of specialization ?		
6	Were the students enthusiastic in attending your classes ?		
7	Did you conduct more than three internal tests?		
8	Did you conduct additional class tests?		
9	Did you give more than five class assignments?		
10	Did you discuss the evaluation results with the students in the class?		
11	Did you use any 'Audio Visual aids' for use in the class?		
12	Did you dictate 'Notes' to students for more than 35% of time?		
13	Did you recommend text books to explore the subject further?		
14	Did you give the students a question bank relating to your subject?		
15	Did you generally adhere to the lesson plan?		
16	Was the subject thrust upon you by the department?		
17	Did you spend more than 30% of time outside of allocated hours with students?		
18	Did you like teaching the present class of students?		
19	Were the students interactive in the class?		
20	Were you satisfied with the way you have taught the subject?		

Your Comments and Suggestions

Please remember : This feedback is not meant for criticism but aims at improvement for the future.

APAR-3

SECTION B (II) : SELF APPRAISAL BY THE FACULTY
CONTRIBUTION TO DEVELOPMENTAL ACTIVITIES

Name of the Faculty : _____ Academic Year : _____

Designation : _____ Department: _____

Please indicate against one or more fo the following your specific contribution to developmental activities during the year nder review supported by specific evidence.

Activities	Details (to be filled in by faculty)	Max Marks	Score (to be awarded by HOD)
Outcome of the project undertaken			
Participation in National conference			
Participation in International conference			
Publication of papers in National Journals			
Preparation of project reports, research reports, case studies etc.			
Development of teaching and learning material			
Specific contribution in setting up of laboratory and/or workshop			
Securing of an working on sponsored projects			
Consultancy work secured and undertaken			
Transfer of Technology, organization of skill development training programs etc. undertaken			
Training programs attended			
Seminars attended			
Organisation of training and placement activities			
Academic management (in qualitative terms)			
Individual or group project			
Seminars conducted			
SSTPS conducted			
Any ohter			
		Total Score	
		Section B(ii) : Percentage Achievements (Score /Max Marks) *100 Performance against benchmark	

The highest marks scored by any faculty will be taken as the benchmark. Individual faculty score will be accordingly converted in terms of percentage.

APAR-4

SECTION C : APPRAISAL BY HOD

Date			Sem / year	
Name of the Facultymember	:			
Designation	:			
Department	:			
Date of joining the college	:		Age	

The HOD will award scores on the parameters in (A) and (B) taking into consideration information in APAR 2 and APAR 3 and also on the basis of his judgemet.

A. PERFORMANCE ASSESSMENT

S.No.	Performance Parameter	Appraisal on 5 points scale				
		5 outstanding	4 Very good	3 good	2 average	1 below average
1	Contribution to research					
2	Contribution to academic administration					
3	Competence as a teacher					
	Grand Total					

B. PERSONAL ATTRIBUTES

S.No.	Performance Parameter	Appraisal on 5 points scale				
		5 outstanding	4 Very good	3 good	2 average	1 below average
1	Attitude to learning					
2	Capacity to lead					
3	Commitment to Quality Education					
4	Amenability to discipline					
5	Perseverance					
6	Interpersonal relations					
7	Integrity					
	Grand Total					

Section C : Aggregate Score	(Grand total of A and B*100)/5x10	

APAR-5

SECTION D (I) EVALUATION OF FACULTY BY THE SELECT PEER GROUP
(Select peer group will include members from his own department as well as from other departments)

Year .....

Name of the Faculty :_____

Designation :_____ **Department:**_____

To be filled in by "Select peer team" on the basis of actual observations.

S.No.	Items for Peer Evaluation	Grading					
		5	4	3	2	1	Score
1	Classroom instructions (using evaluation proforma)						
2	Laboratory instructions (Actual observations)						
3	Development and use of "Audio Visual Aids'						
4	Development of co-curricular Activities						
5	General attitude towards 'Academic Activities of the deptt.						
6	General attitude towards Academic Activities of the Institute / College						
7	Design and development of curricular and learning material						
8	Effectiveness as a student counselor						
9	Participation in extra curricular activities						
10	Invigilation and Examination work						
	Section D(i) : Overall Grading in Percentage (Score/50)*100						

If a faculty is not graded on all items in the above table, percentage may be calculated on the basis of responses to the items for which grading has done. The faculty has to be evaluated on at least seven out of ten items.

Name and Signature of Select Peer Group Members.

_____ _____

_____ _____

_____ _____

APAR-6

SECTION D (II) EVALUATION OF TEACHING EFFECTIVENESS (SELECT PEER GROUP)

Name of the Faculty : _____

Topic : _____ **Department:** _____

Class : _____ **Date & Time** _____

	Attitude	Perspective	Marks Poor (1) to Excellent (5) S	Weightage	Total (S X W)	Strength & Weakness
1	Depth of Knowledge	Preparation of lecture, relevance of topic, subject knowledge		6		
2	Delivery of lecture	Communication and presentation skills, confidence level, time management, body language and eye contact, sense of humour , creating students interest		5		
3	Exploring beyond syllabus	Practical examples, innovative ideas, motivational power, techno friendliness		3		
4	Handling students queries	Patience and presence of mind, listening skills, reasoning ability, troubleshooting capability		3		
5	Overall Personality	Attitudes, open mindedness, impartiality, tenacity, discipline of class, dress sense				
	Aggregate Score	Grand Total				
	Section D (ii) : Aggregate Score in %		**Grand Total / 100**			

Names and Signature of members of "Select Peer Group"

1.
2.
3.

APAR-7

SECTION E : ACADEMIC RESULTS
(To be filled in by the faculty)

Name of the Faculty : _____

Branch : _____ **Semester :** _____

Subject Taught : _____

Result analysis

Name of the subject taught during the semester	% age of pass without any back paper in the subject: A	Aggregate %age of pass without any back paper for top 20 institutions under the University: B**	IF		
			A=B	A>B	A<B
			Average	B 15% higher than A:Good B 20% higher than A: Very Good	B 10% lower than A: Below Average B 20% Lower than A:Poor
Section E: Aggregate score in %			**(Total Score/5 X No. of papers)*100**		

** Examination branch will circulate this information subject wise immediately after the declaration of results. Reasons for 'Average' and 'Poor Results' (if it be so.)

_____

_____

Grade Awarded : Very Good-5, Good-4, Average-3, Below Average-2, Poor-1

APAR-8

SECTION F : STUDENT FEEDBACK
(To be filled in by the faculty)

Name of the teacher : _____

Name of the Subject class : _____

Dear Student,

Part A: Please answer all questions with sincerity and honesty:

(i) What has been your attendance in the class?
Less than 60%[] Between 60-70%[] Between 70-80% [] More than 90%[]

(ii) Why was your attendance lower than 90%?

(iii) What can the college authorities do to improve student attendance?

(iv) Did you find the tutorials and assignments given to you useful? Did you honestly complete the tutorials and assignment in time? If, not, why did it become necessary for you to copy other's tutorials and assignments?

Part B : You are requested to give your honest responses to the following questions. You may not write your name, if you so desire. The idea is to monitor and improve effectiveness of teaching and not to use the feedback for any other administrative purpose.

Sr. No.	Question	Mostly	Quite often	At times	Hardly	Never
		5	4	3	2	1
1	Did you find the teacher well prepared to teach you in the class? Was there clarity in presentation considering language, voice and black board writing?					
2	Was the teacher regular and punctual in taking classes?					
3	Were the presentations interesting to you?					
4	Did you find the teacher fair and impartial in awarding grades/marks?					
5	Did you find the teacher enthusiastic in teaching the subject?					
6	Did the teacher give real life example while teaching to improve relevance?					
7	Did the teacher encourage you to ask questions?					
8	Were you satisfied the way the teacher provided answers to the questions posed by the students?					
9	Did the teacher give you references for further study and encourage you to study more?					
10	Was the quality of assignments interesting? Were the assignments logically arraged from simple to the difficult?					
	Total Score					
	Section F: Aggregate score in %	(Total score/50)*100				