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SHORT COMMUNICATION

## **Performance Improvement Procedure of Engineering Students of Bangladesh Applying Total Quality Management: A Review**

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### **ABSTRACT**

The main focus of this paper is to integrate the application of Total Quality Management & Kaizen in improvement of Engineering students. Most Engineering students get depressed when they can't understand the topics & fail to cut a good figure in the semester final exam as well as their CGPA becomes poor. 80-90% students blame the curriculum & system but it is not easy to change the system rapidly. The irony is, in Bangladesh most of the time is spent to memorize books for good academic performance. The Engineering Education Curriculum is mainly memorizing based. Students have to learn a lot of theory & write them in the exam as given in reference books to get good marks. This system makes students bookish & discourages them from creativity & innovation. The evaluation system in this educational system only represents how much a student spends time for academic studies not the creativity, intelligence, passion & dedication etc. This makes frustrated who are involved in innovative projects, research or contests. Without creativity & innovation it is not possible to advance the science & technology which is the main purpose of Engineering. In this research a structured & detailed process of TQM & Kaizen has been discussed & showed which is suitable to achieve which goal. One is for determining & analyzing problems & another is one of the best process to achieve a satisfactory outcome in academic & professional development process.

**Keywords:** TQM, Check Sheet, Stratification Analysis, Root Cause Analysis, Pareto Analysis, Process flow chart, Kaizen, PDCA cycle etc.

## **1. INTRODUCTION**

Bangladesh is a less developed country situated in the south-east Asia region. In our country the educational system is mainly theoretical based which emphasizes basically on memorizing the lessons, writing these alike written in books and getting good marks. Many developed countries of the world do not have sufficient man power but they can utilize their population properly because their education system emphasizes on creativity, new invention, innovative ideas, research etc. Only reading & getting marks can't build a nation. In order to be enriched in Technology & make life comfortable proper education & subjective knowledge is the first requirement of the graduates who work in different sectors of a country. But, involvement in research, projects, contests are not only the factor for poor academic result. The admission system in Engineering Universities is not clearly fair. Applicants can get themselves admitted into different programs according to their merit position & order of choice. In this system, many students can't get admitted into their desired Engineering program. It is one of the major reasons for poor academic result as well as frustration. The social medias are taking a lot of time from us. Students are teenagers & they are the main victim of social media addiction. In a nutshell, there are so many factors which are directly or indirectly involved with poor academic career of Engineering students.

In this research, a significant integration of TQM & Kaizen has been shown in the purpose of improvement of academic as well as technical performance of the Engineering students. It was not easy to differ vital causes but on the basis of statistics result & considering the condition of Bangladesh the vital causes were payed much attention in this study. Structured & sustainable slow process helped to overcome the condition easily resulting the improvement of skills also. Total Quality Management is a philosophy which focuses in involving all people of an organization in the quest of quality or quality improvement [1]. There is a strategic approach & basic tools of total quality management (TQM). This research also followed the approach strictly. Quality is a criterion, which refers to 'fitness for use' or characteristics of a product or service that defines its ability to consistently meet or exceed customer requirement. As education is a process so academic result is definitely a quality of students [2]. Bonstingl, J.J. introduced to the basic ideas of Total Quality Management (TQM) in education [3]. Ford, J.B., Joseph, M. and Joseph, B. in 1999 introduced the assessment & performance measurement with seven determinant choice criteria groupings for customer satisfaction of their higher study [4]. Quality is a factor which can be improved by applying different tools. An uncontrolled situation/process can be easily handled & easily brought in control by applying TQM tools. In 2014, Sallis, E. describes key concepts of TQM to ensure quality education & encouraged the managers & in higher education as well as for headteachers and deputy heads in the school sector to acquaint themselves with TQM [5]. In the year 2018, Hasan, M., Rezwana, A., Islam, M. and Dutta, A. applied TQM to minimize defects significantly in a newly started crackers manufacturing system [6].

In the year 1995, Dahlgard, J.J., Kristensen, K. and Kanji, G.K. introduced TQM by using a new management pyramid called the TQM pyramid. These principles are leadership, focus on the customer and the employee, continuous improvements, everybody's participation

and focus on facts. These key principles are discussed in relation to quality in education [7]. Barnett, R. clarified the nature and substance of higher education and quality in 1992 & discussed issues concerning quality of higher education, such as performance indicators, fitness for purpose, value added, peer review, total quality management, and academic audit [8]. Thai Hoang, D., Igel, B. and Laosirihongthong, T. investigated the relationship between total quality management (TQM) practices and innovation performance in the Vietnamese industry context in 2006. The findings were useful for business managers in developing countries such as Vietnam, who want to enhance business performance through implementing TQM practices that support their firm's product and services innovation efforts [9]. In 2017, Hasan, M.Z. & Dutta A. applied PDCA cycle, a concept included in TQM philosophy in order to improve personal skills of Engineering students & successfully initiated a study on students [10]. In 2009; Smadi, S. discussed Kaizen strategy and the drive for competitiveness: challenges and opportunities for business [11]. In the year 2014, Arya, Amit Kumar; Jain, Sanjiv Kumar researched on Impacts of Kaizen in a small-scale industry of India [12]. Hasan, Z. and Hossain, M.S. experimentally applied TQM tools to determine root causes & used PDCA cycle concept of TQM & successfully improved the effectiveness of Engineering students in 2018 [13].

## **2. MATERIALS AND METHODS**

### **2. 1. Total Quality Management in Education to detect & analyze Problems**

Total Quality Management refers to organization wide effort to achieve quality target. It is a philosophy which suggest to involve everyone of an organization to achieve Quality goal. The worldwide common Students Quality factor is academic performance. There is a very deep interconnection among all elements of education including from office staffs to employers. “Most scholars stress on the importance of TQM activities on performance outcomes” [14].

Tools of TQM should be used in improvement of student’s performance:

- Check sheet
- Stratification Analysis
- Histogram
- Pareto Analysis
- Process Flow Chart
- Cause-effect diagram
- Scatter Diagram
- Control Chart

“As much as 95% of quality related problems can be solved with seven fundamental quantitative tools” [15]. Before starting this methodology, a clear concept of this methodology will be gained from the following table.

#### **Check Sheet**

This is a collection of defects or non-conformities. Poor academic result or lower than 3.00 grade can be termed as non-conformities here. A typical check sheet for all departments has been shown below:

**Table 1.** Common format of non-conformities record for all departments in semester final Exams.

Performance Record		
Dept.:		Course Title:
Class:		Course No.:
Total Students:		
Failures	Quantity	Fraction
Fail		
Marks between 40-45		
Marks between 45-50		
Marks between 50-55		
Marks between 55-60		

$$[N.B. \textit{Fraction} = \frac{\textit{Quantity of failure}}{\textit{Total students}}]$$

The fraction will be used for control charts to understand whether the situation is in control or not. Non-conformities can be failure to achieve any skill or failure to learn a software also. But, this is very difficult to describe in quantity.

### Stratification Analysis

It is the process of sorting a large database into meaningful subsets, classifications, groups etc. From the check sheet record the all non-conformities record can be easily stratified into semesters, courses, years, Range of marks, course advisor etc. In case of professional or skill development software, specialization level, course source, duration, number of students take the course etc. can be stratified. The stratified data will be very useful to take further steps to eliminate the causes & achieve target of improvement.

### Histogram

The fractions of the failure in different stratified data can be plotted in a graph & from this the nature of statistics & distribution of the data will be easily identified. From the shape of distribution further steps of solution can easily be taken. The advantage of histograms is the change of process is easy to identify with the shape of the distribution curve. It is easy to understand what to do & nature of data by seeing the graphical representation.

### Pareto Analysis

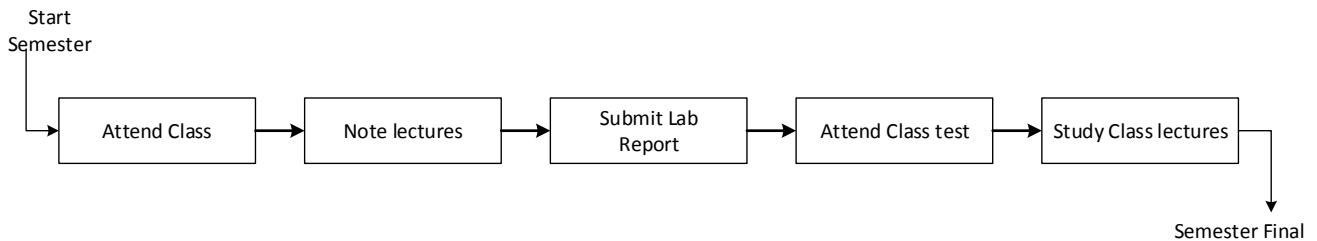
Italian Economist Vilfredo Pareto observed & stated that “about 80% of the country’s wealth is occupied by about 20% of the population” [16]. This famous rule named as Pareto 80-20 rule later. Though it is a rule described for wealth distribution of a society Researchers

found that this rule can be applied in different fields including quality control. In Quality control about 80% defects or non-conformities are caused by about 20% reasons. But, it is not the actual numerical value. Sometimes 30% cause may responsible for 70% non-conformities. The main focus of this rule is that very few causes are responsible for many non-conformities. The 20% causes are called as ‘vital few’ & rests 80% causes are called as ‘trivial many’.

With the help of Pareto analysis, the vital few reasons for trivial many failure of students should be identified. Statistics & Fuzzy logic or rating may be used to detect the top vital reasons.

**Process Flow Chart**

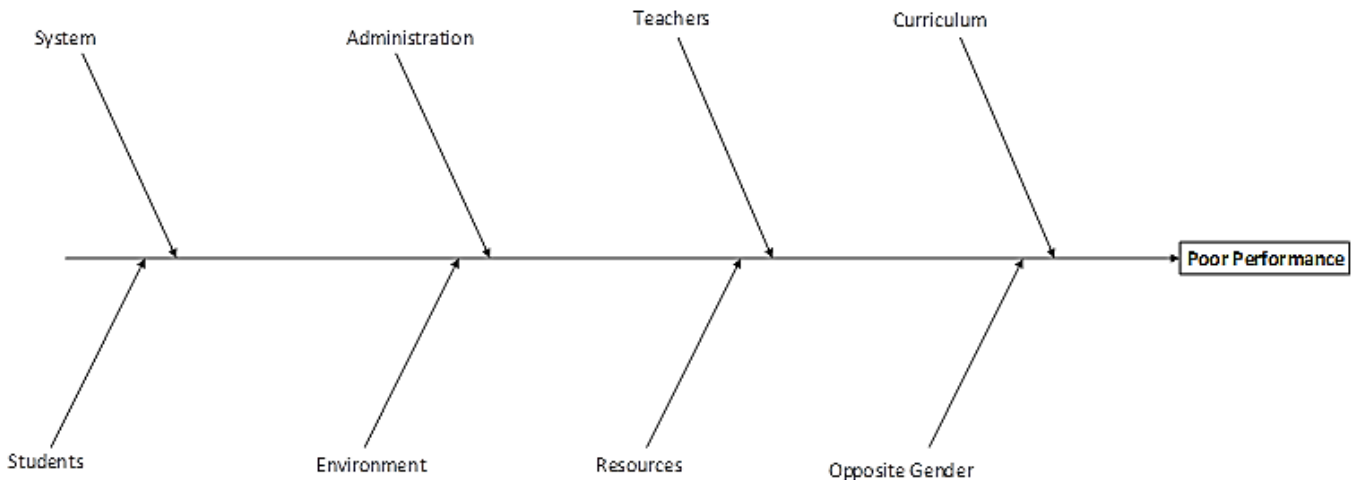
It shows the steps of a process. The life of a student is a process where he is transformed into a valuable asset of the society. An Engineering student has to do a lot of activities in the university such as class, lab, assignments, class test, quiz, presentation, semester final, viva exam etc.



**Figure 1.** A typical flow chart of a semester of Engineering students

Process flow chart is a useful diagnosis tool of a system & can be used to identify and improve a particular step of a system. A strictly followed process chart can prevent non-conformities a lot by controlling all activities in desired ways.

**Cause Effect Diagram**



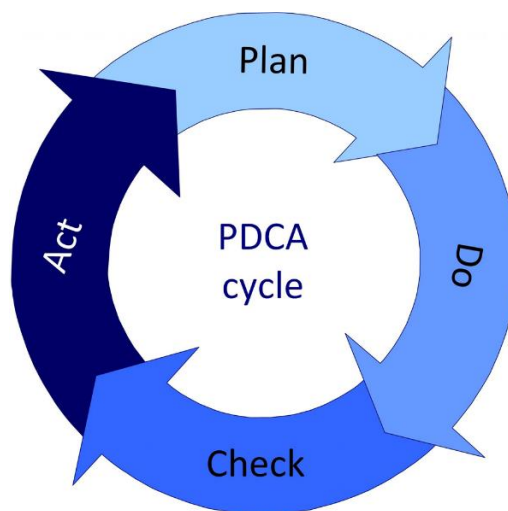
**Figure 2.** A general format of “Cause-Effect” diagram of poor performance

Cause-Effect diagram is a tool to analyze & illustrate a process by showing main causes & sub causes. It is also known as “Ishikawa Diagram” or “fishbone diagram”. The main purpose of this diagram to detect the roots of the cause of non-conformities. It is very easy to find a permanent solution & grow a preventive system & also it is very economical.

Finding root causes is a very difficult process & required Brainstorming. Without root cause analysis it is not possible to find a permanent solution.

## **2. 2. Kaizen in Education to solve problem**

Kaizen is a Japanese hybrid word. “Kai” means change and “Zen” means good. Basically, Kaizen is for small incremental improvements, but carried out on a continual basis. According to Imai (1986), “KAIZEN” is the key to improve through Competitive Success. Moreover, it means continuing improvement in personal life, home life, social life and working life [17]. KAIZEN has been applied which is a continuous improving strategy towards a large achievement permanently. It can be applied in personal life, social life, home life, professional life & all spheres of activity. Kaizen is a process which can be applied where improvement is necessary [18]. A very effective procedure of Kaizen is PDCA cycle. The four stages of PDCA cycle are Plan, Act, Check, Do.



**Figure 3.** PDCA cycle Process

The benefits of Kaizen are a lot. Kaizen practices the concept of zero defects in all sphere of activity, improve effectiveness of all equipment & eliminate loss/non-conformities. So, Kaizen is the best solution in educational development to achieve sustainable goal with a very low investment.

## **3. CONCLUSIONS**

The primary duty of a student is to study regularly of his academic studies & then develop their skills & research for solving problems & to become a useful person for the country. But when the system and administration have no attention on students they fail to achieve their goals because Engineering study is one of the most difficult courses all over the

world. Without proper guide a teenaged student can not know how to study, how to do research or how to learn/what to learn, how to build career, what to do during academic period. This problem is a common in developing or less developed countries. Total quality management is a process where quality is achieved involving all person in an organization. It is also very cheap process & prevention of non-conformities. So, by applying TQM & Kaizen a sustainable development in education can be achieved easily though it will be a slow process but very much effective.

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#### **References**

- [1] Powell, Thomas C. Total quality management as competitive advantage: a review and empirical study. *Strategic management journal* 16.1 (1995) 15-37.
- [2] Harvey, Lee, and Diana Green. Defining quality. *Assessment & evaluation in higher education* 18.1 (1993) 9-34.
- [3] Bonstingl, John Jay. Schools of quality: An introduction to total quality management in education. Association for Supervision and Curriculum Development, 1250 North Pitt Street, Alexandria, VA 22314 (Stock No. 611-92152, \$14.95), 1992.
- [4] Ford, John B., Mathew Joseph, and Beatriz Joseph. Importance-performance analysis as a strategic tool for service marketers: the case of service quality perceptions of business students in New Zealand and the USA. *Journal of Services marketing* 13.2 (1999) 171-186.
- [5] Sallis, Edward. Total quality management in education. Routledge, 2014.
- [6] Hasan, Md, et al. Defect Reduction by Total Quality Management in a Crackers Manufacturing System. *World Scientific News* 98 (2018) 150-171.
- [7] Dahlgaard, Jens J., Kai Kristensen, and Gopal K. Kanji. Total quality management and education. *Total Quality Management* 6.5 (1995) 445-456.
- [8] Barnett, Ronald. Improving higher education: Total quality care. Open University Press, 1900 Frost Rd., Suite 101, Bristol, PA 19007, 1992.
- [9] Thai Hoang, Dinh, Barbara Igel, and Tritos Laosirihongthong. The impact of total quality management on innovation: Findings from a developing country. *International journal of quality & reliability management* 23.9 (2006) 1092-1117.
- [10] Hasan, Md Zahid. Personal Skill development by Applying 'KAIZEN': An Experimental Case Study. *Asian Journal of Mathematical Sciences* 1.06 (2017).
- [11] Al Smadi, Sami. Kaizen strategy and the drive for competitiveness: challenges and opportunities. *Competitiveness Review: An International Business Journal* 19.3 (2009): 203-211.

- [12] Arya, Amit Kumar, and Sanjiv Kumar Jain. Impacts of Kaizen in a small-scale industry of India: a case study. *International Journal of Lean Six Sigma* 5.1 (2014): 22-44.
- [13] Hasan, Z., and M. S. Hossain. Improvement of Effectiveness by Applying PDCA Cycle or Kaizen: An Experimental Study on Engineering Students. *Journal of Scientific Research* 10.2 (2018): 159-173.
- [14] Zehir, Cemal, et al. Total quality management practices' effects on quality performance and innovative performance. *Procedia-Social and Behavioral Sciences* 41 (2012): 273-280.
- [15] Ishikawa, DJLT Kaoru. What Is Total Quality Control? The Japanese Way (Business Management). Prentice Hall Trade, 1985.
- [16] Higley, John. Continuities and Discontinuities in Elite Theory. *The Palgrave Handbook of Political Elites*. Palgrave Macmillan, London, 2018. 25-39.
- [17] Cherrafi, A., Elfezazi, S., Hurley, B., Garza-Reyes, J.A., Kumar, V., Anosike, A., Batista, L. (2018), Green and Lean: a Gemba–Kaizen model for sustainability enhancement, *Production Planning & Control: The Management of Operations* (2018).
- [18] Garza-Reyes, Jose Arturo, et al. A PDCA-based approach to Environmental Value Stream Mapping (E-VSM). *Journal of Cleaner Production* 180 (2018) 335-348.