Review Article

Academic Performance Improvement Procedure of University Students Applying Total Quality Management: A Case of Bangladesh*

Mir Abdur RAHİM[1] (iD)**, Auvishek Modak UTSHA[2]** (iD)**,**
Ishtiaq Ahmed BHUİYAN[3] (iD)**, Md. Rakib MİAH[4]** (iD)

Abstract

The main focus of this case study is developing academic performance and sustainable improvement of academic knowledge. Most Engineering students get depressed when they can not understand the topics and fail to cut a good figure in the semester final exam. It is an alarming reason why their Cumulative Grade Point Avarage become poor. About 80-90% of engineering students in Bangladesh blame the curriculum and system but it is not easy to change the system rapidly. The irony of fact is that memorizing books is the most effective way for good academic performance in Bangladesh. The Engineering Education Curriculum is mainly memorizing based. Students have to learn a lot of theory and write them for the exam as given in reference books to get good marks. This system makes students bookish and discourages them from creativity and innovation. The evaluation system in this educational system only represents how much a student spends time for academic studies not the creativity, intelligence, passion and dedication etc. This makes frustrated who are involved in innovative projects, research or contests. Without creativity and innovation, it is not possible to advance the science and technology which is the main purpose of Engineering. A way or method is required to improve performance and result in the existing condition. In this research, a structured method has been developed to achieve a satisfactory academic result besides other innovative activities.

Keywords: Academic performance, sustainable improvement. quality management, university students.

1. INTRODUCTION

In this hypothesis, the aim is to perform a Root cause Analysis by Brainstorming and develop a Pareto analysis to find out the main causes of failure of a university student to achieve the desired result. Most of the job provider prefers experience and skill but for a fresher, result is the most important way to judge him. So it is very important for a student to secure a good result but that doesnot happen every time due to some major and minor causes. According to Pareto analysis theory, little amount of causes is responsible for most of the problem of a system.

During university life, most of the students live away from home. There is a change in environment, education system and mostly in teaching method. The students who studied in English Version and who studied at Cadet College are used to study in English, but there's a large number of students who have passed Secondary School Certificate (SSC) and Higher Secondary Certificate (HSC) in their mother language. Of course, they have studied English but it is quite difficult to start studying the whole syllabus in the English suddenly. There are also many more reasons for why the result of a good student decreases. The solution can be generated if the actual cause can be found.

Pareto Analysis and Root-Cause Analysis are two basic Tools of TQM (Total Quality Management) which are used to find out the cause of defects or problems of a system.

Kaizen is a Japanese hybrid word, where "Kai" means change and "Zen" means good. Generally, Kaizen is for small incremental improvement but carried out on a continual success. Kaizen can be applied to get improvement in personal life, social life, home life and working life. Academic improvement cannot be gained overnight. A student has at least four years to improve, so Kaizen can be applied in this field.

1.1.   Literature Review

The Plan-Do-Check-Act (PDCA) cycle is like a checklist which contains four stages. To get from 'problem-faced' to 'problem-solve', one must go through all the stages. The four stages are Plan-Do-Check-Act. The idea of the PDCA cycle was developed by Walter Shewhart, who developed a statistical process control chart in the Bell Laboratories in the USA during 1930's. Generally, a student passes four years in university. Practicing the PDCA cycle from the beginning can help him/her to get the desired the result. Basically, it's just like a daily routine, which changes with the result of the previously taken action.

Bangladesh is a less developed country situated in the south-east Asia region. The educational system was founded in the Indian sub-continent by the British. After the liberation war in 1971, Bangladesh started the journey with lacking in many sectors. The overpopulation is one of the most burning problems which is a large obstacle to achieve social, economic, infrastructural, technological growth. Proper education is the main factor by which it is possible to transform our men into a blessing for our country. Many developed countries of the world do not have sufficient manpower but they can use their population properly because their education system emphasizes creativity, innovative ideas, research, etc. Only reading and getting marks cannot build a nation. In order to be enriched in Technology and make life comfortable proper education and subjective knowledge is the first requirement of the graduates who work in different sectors of a country. Technology and innovation are required to eliminate problems and sufferings of the people of the less developed or developing a country.

In this research, a continuous approach has been applied experimentally to the students who were trying hard to overcome their situation. It was not easy to differ vital causes but on the basis of statistics result and considering the condition of Bangladesh the vital causes were paid much attention in this study. Structured and sustainable slow process helped to overcome the condition easily resulting in the improvement of skills also. Total Quality Management is a philosophy which focuses on involving all people in an organization in the quest for quality or quality improvement (Evans, 2002). There is a strategic approach and 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 the academic result is definitely a quality of students (Harvey & Green, 1993). Bonstingl introduced to the basic ideas of Total Quality Management (TQM) in education (Bonstingl, 1992). Ford, Joseph (1999) introduced the assessment and performance measurement with seven determinant choice criteria groupings for customer satisfaction of their higher study. Quality is a factor which can be improved by applying different tools. An uncontrolled

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situation/process can be easily handled and easily brought in control by applying TQM tools. Sallis (2014) describes key concepts of TQM to ensure quality education and encouraged the managers and in higher education as well as for headteachers and deputy heads in the school sector to acquaint themselves with TQM. Hasan et al (2018) applied TQM to minimize defects significantly in a newly started crackers manufacturing system. Dahlgaard et al (1995) 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. Barnett (1992) clarified the nature and substance of higher education and quality and discussed issues concerning quality of higher education, such as performance indicators, fitness for purpose, value-added, peer review, total quality management, and academic audit. Kanji et al. (1999) examined how TQM principles and core concepts can be measured to provide a means of assessing the quality of institutions on various aspects of their internal processes. It is found that the measurements of TQM principles and core concepts, which are critical success factors, reflect the performance of institutions. Sahney et al (2004) showed that there is a need to identify and apply the relevant concepts of TQM to each and every aspect of academic life; that is, to the teaching, learning and administrative activities. The paper was a theoretical attempt at conceptualizing TQM in education. Sherr et al(1991) worked on the improvement of management of the higher education by emphasizing values regarding the importance of people, knowledge and continuous improvement and stated that TQM values are more compatible with higher education than many existing managerial systems. Motwani et al (1997) looks at the applicability of TQM in education and some of the concerns addressed in the literature and Suggested a five-step programming model that any university can use for implementing TQM. Crawford et al (1999) explained that TQM as a never-ending cycle of improvement in the system of production. In the context of education, this may lead to continually improving the quality of instruction in order to encourage students to become critical and creative thinkers in a fast-changing technological world. Koch et al. (1998) explored the truly significant problems facing higher education today relate to the nature of the curriculum, uses of faculty time, how to restrain cost increases, distance learning and the use of technology, cooperative relationships with business, and governance and leadership arrangements. TQM appears to have been quite helpful to the environment that universities inhabit today. Cruickshank (2003) applied quality approaches in the higher education sector especially on higher education institutions in the US, UK and Australia to identify current quality management practices demonstrated that the degree of TQM development in education has not kept pace with that of TQM in the manufacturing and healthcare industries. Thai Hoang et al (2006) investigated the relationship between TQM practices and innovation performance in the Vietnamese industry context. The findings were useful for business managers in developing countries such as Vietnam, who want to enhance business performance by implementing TQM practices that support their firm's product and services innovation efforts. Hasan et al (2017) applied the PDCA cycle, a concept included in TQM philosophy in order to improve personal skills of Engineering students and successfully initiated a study on students. Hasan et al (2018) experimentally applied TQM tools to determine root causes and used the PDCA cycle concept of TQM and successfully improved the effectiveness of Engineering students.

1.2. Purpose of this study

The purpose of this study is to identify the problems of the students which cause them in improvement. Also analysis the root cause of the problems and give possible solutions to get rid of these problems and make improvement.

2. METHODOLOGY

For the statistical calculation, analysis and result; a survey was taken over 100 university students of Rajshahi University of Engineering & Technology (RUET) in Bangladesh. On that survey, their current academic conditions was collected, results, CT marks (collected in a second phase), the individual cause of their failure and the action they think it should be needed to take to overcome the problem.

We used Root-Cause analysis, Pareto Chart, Gant Chart, Kaizen and PDCA Cycle which are the basic and important tools of TQM to propose a proper working plan for a student, following which one can improve their result. "Most scholars stress on the importance of TQM activities on performance outcomes" (Zehir et al., 2012). All tools used in this method are included in TQM.

2.1. Root-Cause Analysis

Root cause analysis is a method of problem-solving for identifying the root causes of faults of the problem (Andersen & Fagerhaug, 2006). It is also called the fishbone diagram and is a tool of Total Quality Management, which illustrates a process by showing the root causes and their sources. A fishbone diagram is shown in Figure 1 to find out the causes of why a group of talented students failed to achieve their desired result in university.
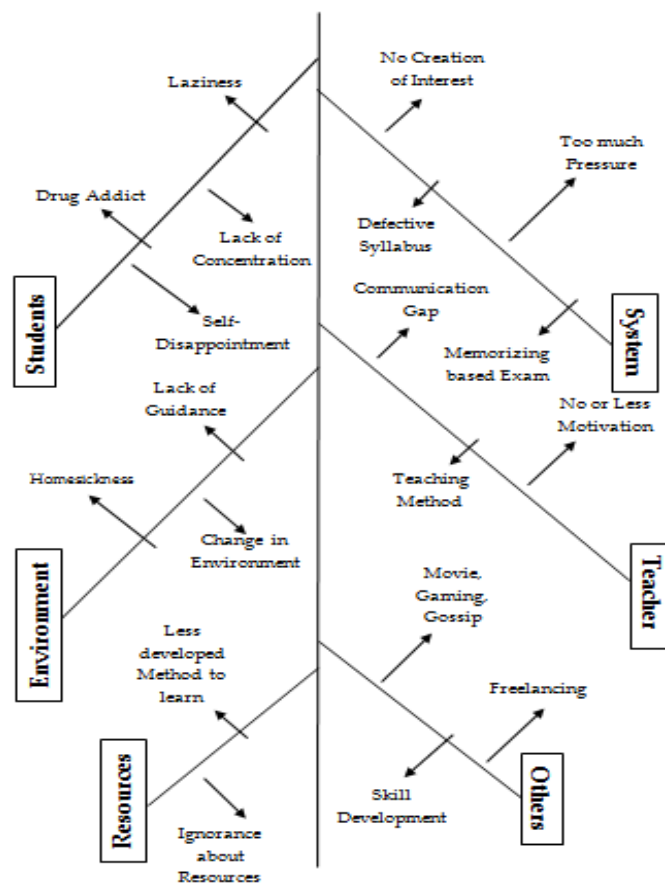
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Figure 1: Fishbone Diagram

2.2. Pareto Chart

In the early nineteenth century, the famous Italian Economist Vilfredo Pareto observed and stated that about 80% of the country's wealth is occupied by about 20% of its population. It was named as "80-20 rule". Later it was observed that this rule can be applied to any statistical situation. Such as: In bolt manufacturing company, 80% of defective products are produced due to 20% of its total cause (Higley, 2018).

In this particular, we also applied the Pareto analysis to find the most effective causes of poor academic results. We categorized all the causes that we found from the survey and the root cause analysis into 7 main categories and calculated the cumulative values. And then we found the result shown in the Figure 2.

Causes/Reasons	Ratings	Cumulative	Cumulative Percentage
1. Students	38	38	38%
2. Administration	27	65	65%
3. Teacher	15	80	80%
4. Academic Curriculum	8	88	88%
5. Resources	5	93	93%
6. Environment	4	97	97%
7. Extra Curriculum	3	100	100%
Total	100		

Figure 2: Pareto Analysis Data Table

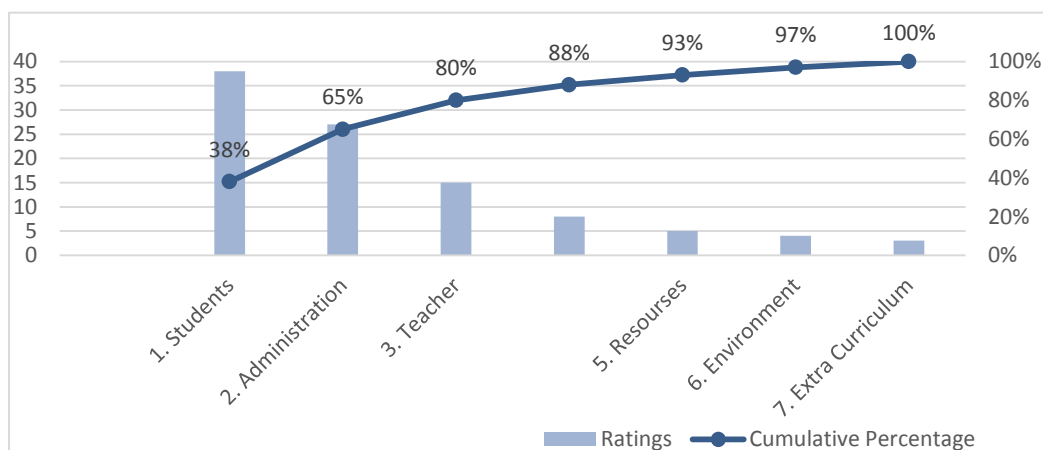The Pareto diagram for Root cause analysis is given in Figure 3

Figure 3: Pareto Diagram for Root Cause Analysis

From the diagram, we can see that 'students', 'administration', and 'teacher' these are the most effective causes that are responsible for a student's poor academic result.

3.3. Improvement of effectiveness applying PDCA cycle

Kaizen is opposite to big spectacular innovations. It requires a little investment and aims at reducing losses in the practical work sphere and affect work efficiencies by using a detailed and thorough procedure one can eliminate losses in a systematic manner using various Kaizen tools (Garza-Reyes et al, 2018). These activities are not limited to production areas alone but can be implemented in administrative areas as well.

The PDCA cycle is used to coordinate continuous improvement efforts. It both emphasizes and demonstrates that improvements program must start with careful planning, must result in effective action, and must move on again to careful planning in a continuous cycle. The PDCA cycle is a checklist of the four stages which one must go through to get from "problem-faced" to "problem-solved". The four stages are:

➢ Plan: Defining objectives, identifying possible causes, come up with ideas to solve the problem.
➢ Do: Perform trial, Find solutions.
➢ Check: Verify result, Monitoring, Decision
➢ Act: Corrections, Implement in large scale, Review.

PDCA cycle can be applied to improve academic performance. Figure 4 shows the PDCA schematic below.
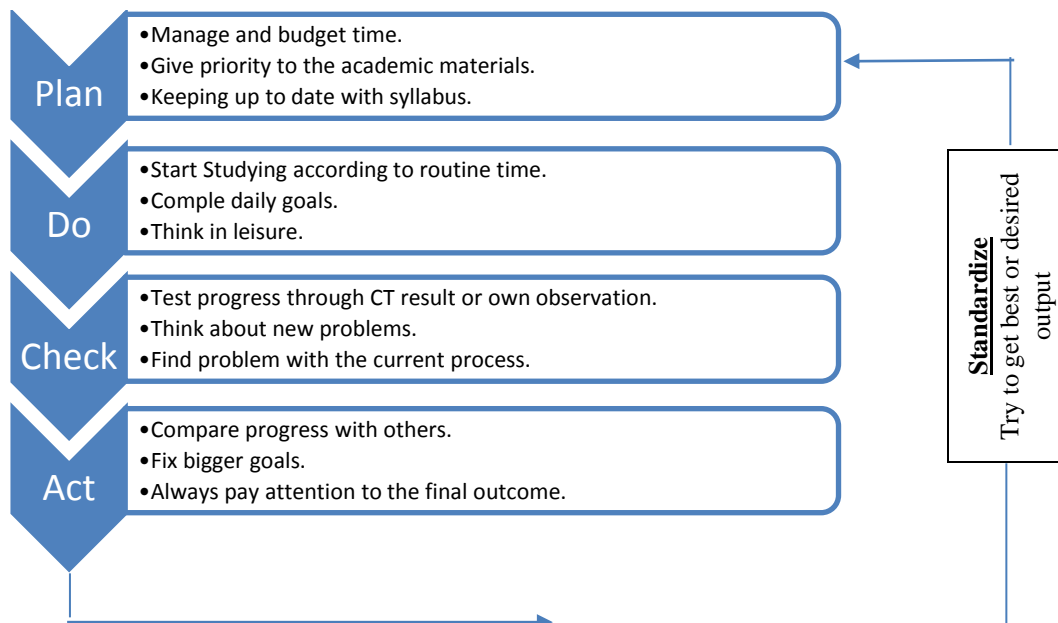

Plan
• Manage and budget time.
• Give priority to the academic materials.
• Keeping up to date with syllabus.

Do
• Start Studying according to routine time.
• Comple daily goals.
• Think in leisure.

Check
• Test progress through CT result or own observation.
• Think about new problems.
• Find problem with the current process.

Act
• Compare progress with others.
• Fix bigger goals.
• Always pay attention to the final outcome.

Standardize
Try to get best or desired output

Figure 4: PDCA cycle Process

A proper planning can be achieved by asking some questions of him/herself.

o What is his/her desired result? – Set a result goal according to the future plan.
o What is the lacking that resists getting the desired result? – Find the reasons that hamper your study or demotivate you.
o At least how much time is required to prepare the daily study goal? – Make this decision according to your memorizing and understanding capability.

Planning is the most important factor in this cycle. Planning will be modified according to the outcome. This cycle emphasizes on planning for further procedures.

➢ *Plan:* First note down the topics for that day's study. Motivate enough to pay attention until the goal is achieved. It can be done on a daily or weekly basis. The time for preparation of the practical classes should be separate. Then manage the time without affecting academic study time by reducing unproductive works such as playing games on the phone, gossiping with friends etc.

➢ *Do:* Use the full time that has been budgeted. Don't lose motivation. Get the help of "YouTube" and "Google" to get more interesting information related to the topics. And also, don't study during the break time. Think about the lessons that you've gone through in the leisure period such as before sleeping. Continue this for short period of time.

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➢ **Check:** Now take a short break and question yourself about the improvement. Analyze and compare the results of class performance before and after the "Do" step. Find out the factors that you wanted to change but still unchanged. Plan for them to repeat the process.

➢ **Act:** Discuss with some friends about efficient planning in holidays. Make partners for mutual competition. Try to solve some big problems together. Continue the process. Record the mistakes and weakness.

2.4. Time Chart

Here we proposed a time chart which aims for the proper distribution of time. Following this (along with the PDCA Cycle) one can achieve their desired result. The time chart is given in figure 5.

Activities	Time (hours)																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Study																								
Group Study																								
Attending Classes																								
Extra-Curricular Activities																								
Entertainment & Social Media																								
Meals																								
Sports, Exercise & Refreshment																								
Prayer																								
Sleep																								

Figure: 5- Time Chart for an experimented course plan

3. FINDINGS

Through the survey, we took the current Cumulative Grade Point Avarage (CGPA) and two CT marks of 100 university students. Analyzing the data that we collected from the survey, we prepared the PDCA Cycle and the Gant Chart. The cycle and the chart were provided to those 100 students and asked them to follow this for 2 months. Then again, we collected their two CT marks. There was a surprising difference.

Analyzing the survey data, we categorize the students into 3 categories. Those who got CGPA above 3.50 are in category 1, those who have CGPA between 3.00 to 3.50 are in category 2 and the students whose CGPA lies below 3.00 are in category 3. The percentage of them are 7, 53 and 40 respectively. The pie chart is shown in Figure 6.
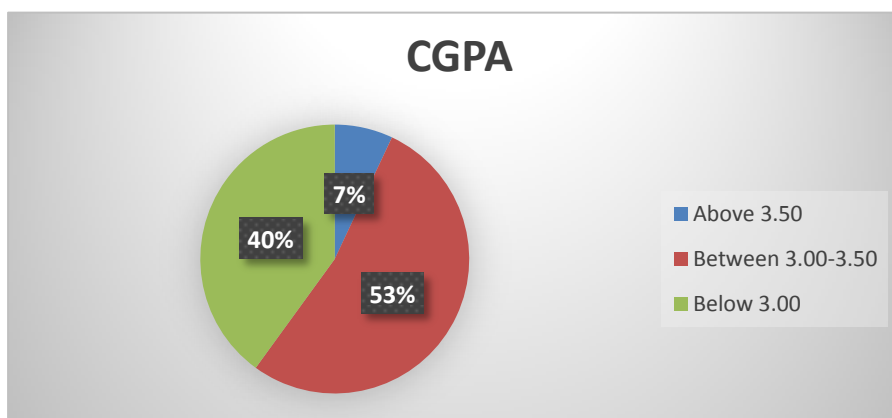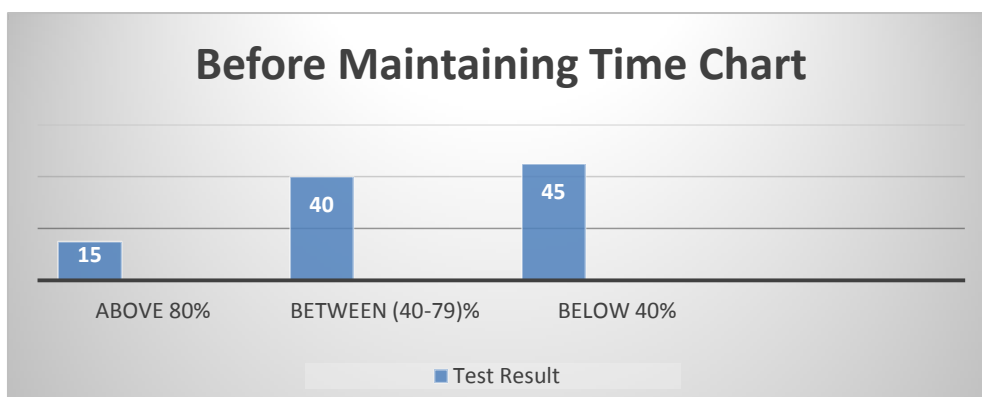

Figure 6: Category of students on the basis of CGPA

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We got their last 2 class test result and after analyzing that we saw that 15% of them got above 80% marks, 40% of them got (40-79) % marks and 45% of them got below 40% marks. The bar chart is given in Figure 7.

Figure 7: Test result before maintaining time chart

Then we provided them our time chart and said them to follow that. They followed that and after several months we again took their last 2 class test result and we got a good result. After analyzing that we saw that 30% of them got above 80% marks, 53% of them got (40-79) % marks and 17% of them got below 40% marks. And it was a great change that happened to them. The chart is shown in Figure 8.
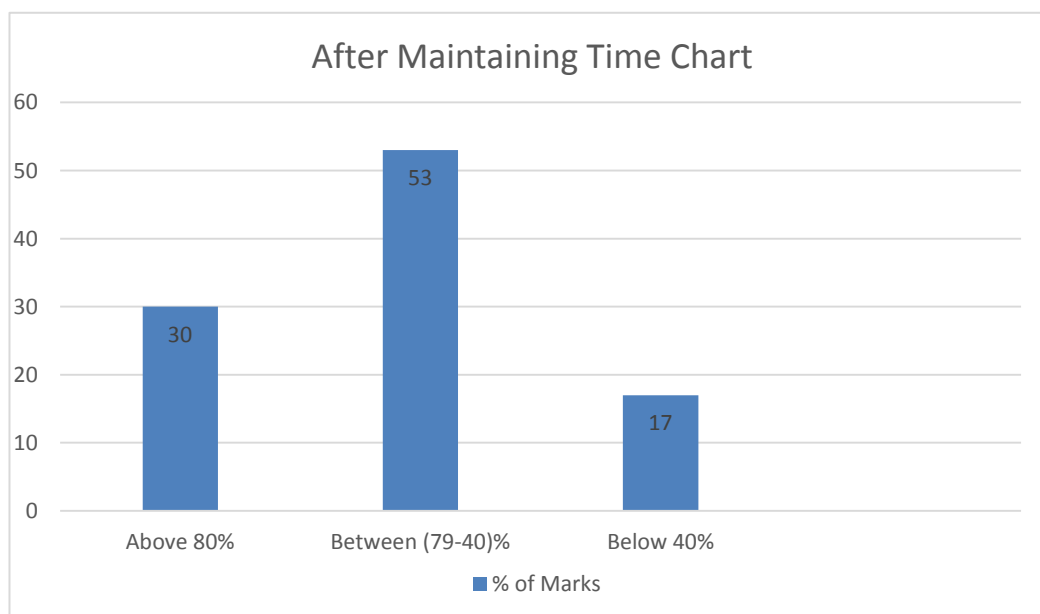
Figure 8: Test result after maintaining time chart

The number of students who got above 80% marks was increased from 15 to 30. The number of average students also increased and that is from 40 to 53. And the great achievement of this time chart was it reduced the number of students that got below 40% marks from 40 to 17.

4. DISCUSSION

Due to some restrictions, only some limited tools have been used in this research. Lean manufacturing, 5S philosophy, SMED concept could also be used to make more efficient Human. For example: Lean manufacturing concept can be used to classify value added, non-value added and necessary but non-value-added activities. From this classification, value added activities could be increased by eliminating some other activities. 5S philosophy could be applied to design the rooms of the students where better reading environment could be created. SMED technique could be used in dressing, washing and other changeover activities to reduce time. In this way more times could be found for study and different skill development. Another main focus of this research was to show that when it is harder to change improve system and curriculum of studies then TQM is one of the best ways for improvement. It is a unique philosophy that can be used in any type of improvement. Flexibility and self-improvement without changing the system is another focus of this research.

5. CONCLUSION

This research was started in order to reduce the difficulties to achieve good academic result. Department of IPE has started its journey from 2005. There are so many problems and limitations of budget and planning to improve better education and lab facilities because this discipline is new in Bangladesh. The change in curriculum and system is not easy but there are some alternative ways to improve job opportunities and build good career. In research a way or method has been highlighted to improve performance and result in the existing condition. This methodology is absolutely free of cost although the result is satisfactory. Also, a slow process developement is sustainable and there is no side-effects of it.

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