



Improving Academic Performance by Applying Total Quality Management Tools: A case of Bangladeshi Students

Mir Abdur Rahim,[✉] Auvishkek Modak Utsha,¹ Ishtiaq Ahmed Bhuiyan,¹
Md. Rakib Miah,¹ Md. Raquibul Haque¹

¹Department of Industrial & Production Engineering, Rajshahi University of Engineering and Technology, Bangladesh

DOI: <https://doi.org/10.15294/ijcets.v6i2.25328>

Article History

Received : September 2018

Accepted : October 2018

Published : November 2018

Keywords

Academic performance;
creativity; engineering; in-
novation; memorizing; total
quality management

Abstrak

Artikel ini menggambarkan praktik pendidikan di Bangladesh, terutama pada mahasiswa teknik yang masih belajar menggunakan pendekatan konvensional, yakni belajar dengan menghafal materi dari buku dan mengikuti ujian dengan cara menjawab persis seperti yang tertulis di buku. Hal tersebut menjadikan siswa terlalu terpaku pada buku hingga kesulitan untuk mengembangkan kreativitas dan inovasi mereka. Padahal tanpa memperhatikan pentingnya upaya untuk mengasah kreativitas dan inovasi, ilmu pengetahuan tidak akan berkembang, termasuk dalam bidang teknik. Melalui penelitian ini, pendekatan total quality management telah dikembangkan untuk mengarahkan siswa-siswa memperoleh hasil studi yang memuaskan selain juga tetap diarahkan untuk mengembangkan kreativitas, inovasi, keterampilan riset dan lainnya yang sejatinya juga merupakan tujuan utama pendidikan teknik.

Abstract

This article describes the educational practice of engineering student in Bangladesh, especially how they are still practicing the old and conventional way of learning, mainly by memorizing the entire subject they learn and push them to answer the question exactly as written in the book. This phenomenon brings the student to fixate on the book and will inhibit their creativity and innovation notions, even though without considering the effort to hone the students' creativity and innovation domain, the knowledge will not develop properly, including in engineering. Trough this research the total quality management (TQM) had been developed to lead the students to get a better and satisfying result of study without losing the effort to develop their creativity, innovation and research skills as important factor and main purpose of engineering education.

INTRODUCTION

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. Academic improvement cannot be gained overnight. A student has at least four years to improve, so Kaizen can be applied in this field (Kaizen Institute India and Africa, 2010). 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. 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 does not 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.

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, infra-structural, 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 on 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 dif-

ferent 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.

Bangladesh is a country of great potentiality. Most students have to struggle hard to study here. Problem of accommodation, food, environment, behavior etc. are all challenging factors they have to face with. Doing a better result in a challenging environment is so much difficult. University dormitories are very congested where 4 students have to live in a room. Foods are not nutritious & unhygienic also. A lot of students suffer from various diseases like Salmonellosis, Diarrhea, Gastroenteritis etc. With facing a lot of difficulties students here study & some of them can become very successful in career. But this is not the adequate for the country. In order to develop a country a sufficient skilled & well-trained manpower is required which is not producing from our universities. Our Govt. has to expend a huge amount for the public universities, but satisfactory output has not been achieved yet.

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 and Green, 1993). Bonstingl (1992) introduced to the basic ideas of Total Quality Management (TQM) in education. Ford, Joseph, & 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 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, Rezwan, Islam, & Dutta (2018) applied TQM to minimize defects significantly in a newly started crackers manufacturing system. Dahlgaard, Kristensen, & Kanji (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, Malek, & Tambi (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, Banwet, & Karunes (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 & Lozier (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 & Kumar (1997) looked at the applicability of total quality management (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 & Shutler (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 & Fisher (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 the current quality of 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, Igel, & Laosirihongthong (2006) investigated the relationship between total quality management (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 & Dutta (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 & Hossain (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.

Mosf of the studies above tried to implement and develop TQM on several context around the world. It would be important and meaningful to the field of education management if we study and present the implementation of TQM on educational context in Bangladesh. As we have mentioned above Bangladesh have lots of problems and this research is one of the effort to initiate a way to address and overcome the problems. The purpose of this study is to identify the problems of the students, analyze them & develop a continuous development procedure without changing the current education system. It is easier & cost efficient to change us rather than changing a system. Therefore this article has a huge potential contribution to the field of education management, especially by

employing TQM in Third World country like Bangladesh and the like.

METHOD

For the root cause analysis, Pareto analysis a survey was taken over 100 students of Rajshahi University of Engineering & Technology (RUET) in Bangladesh. 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" said Zehir et al. (2012). All tools used in this method are included in TQM.

Root cause analysis is a method of problem-solving for identifying the root causes of faults of the problem (Andersen and 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. 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. The Pareto diagram for Root cause analysis is given in figure-2. 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.

Table 1 Pareto Analysis Rating

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		

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

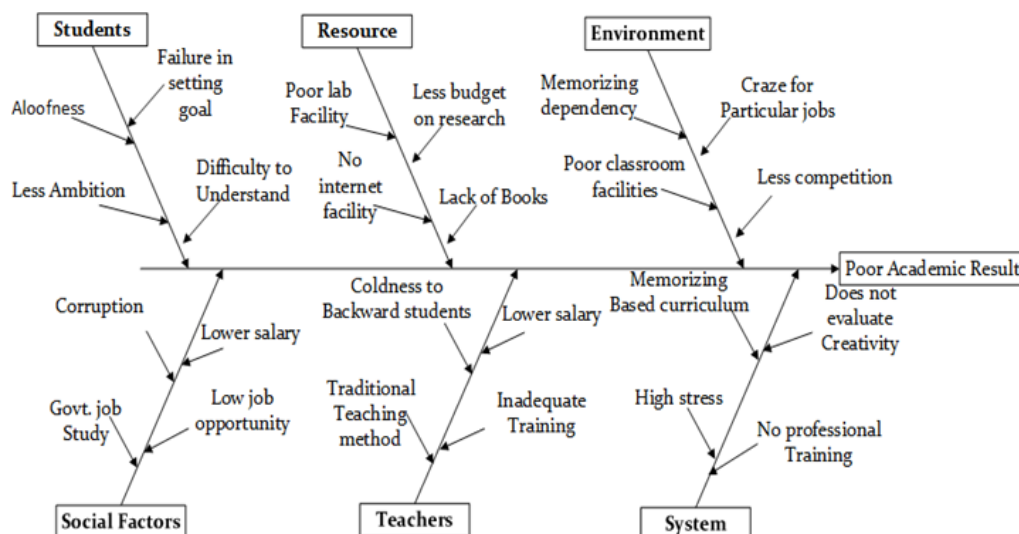


Figure 1 Cause-effect diagram for poor Academic Result

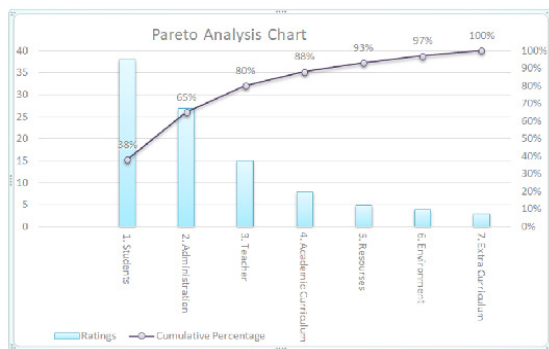


Figure 2 Pareto Analysis Chart Showing vital causes

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 (1) plan, it consist of defining objectives, identifying possible causes, and come up with ideas to solve the problem, (2) do, it consist of perform trial and find solutions, (3) check, it consist of verify result, monitoring and decision, and (4) act in which consist of corrections, implement in large scale and review.

PDCA cycle can be applied to improve academic performance. Figure 3 shows the PDCA flow chart schematic.

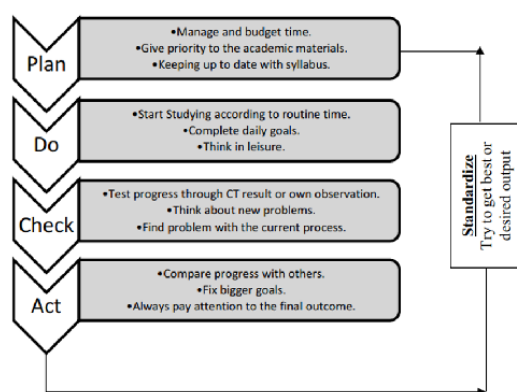


Figure 3 The PDCA Cycle Process

A proper planning can be achieved by asking some questions of him/herself. For instances, what is his/her desired result? On answering this question you should set a result goal according to the future plan, what is the lacking that

resists getting the desired result? For this question you could find the reasons that hamper your study or demotivate you, and at least how much time is required to prepare the daily study goal? According to this question you should make this decision according to your memorizing and understanding capability.

Furthermore, 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. The following paragraphs will explain the basic concept of the cycle in short.

First, plan. First note 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.

Second, 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.

Third, 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.

Table 2 The Time Chart for an Experimented Course Plan

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

Fourth, 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. 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 table 2.

RESULT AND DISCUSSION

Through the survey, we took the current 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 5.

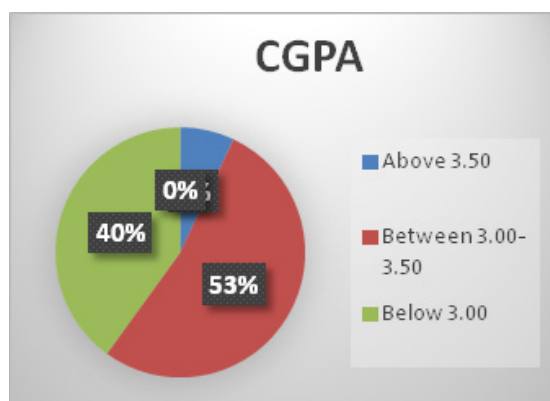


Figure 5 Category of students on the basis of CGPA

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 6.

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 7.

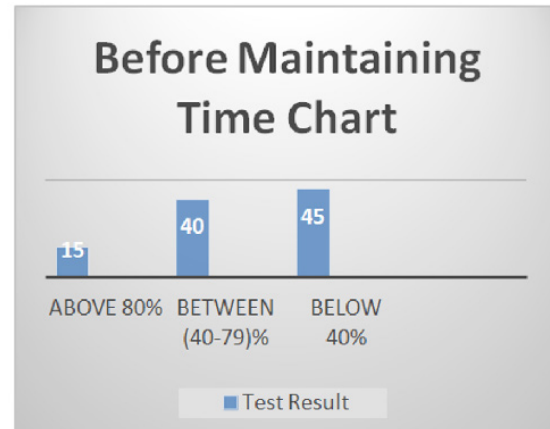


Figure 6 Test result before maintaining time chart

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.

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

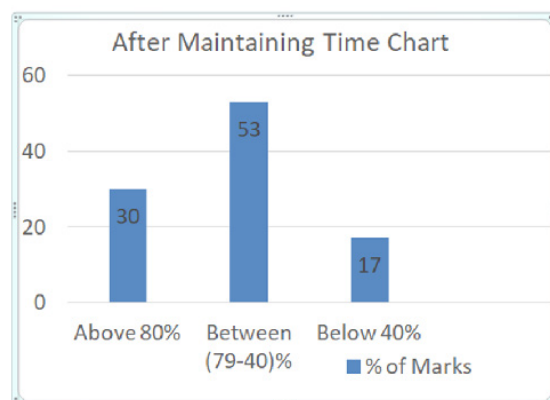


Figure 7 Test result after maintaining time chart

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.

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 the budget and planning to improve the 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 development is sustainable and there is no side-effects of it.

ACKNOWLEDGMENT

The authors would like to acknowledge Professor Md. Mosharrof Hossain (Head of the Dept. of Industrial & Production Engineering, RUET), Md. Asadujjaman (Assistant Professor, Dept. of Industrial & Production Engineering, RUET), Md. Mohibul Islam (Assistant Professor, Dept. of Industrial & Production Engineering, RUET) & Shahed Mahmud (Assistant Professor, Dept. of Industrial & Production Engineering, RUET) for their co-operation.

REFERENCES

- Andersen, B., & Fagerhaug, T. (2006). *Root cause analysis: simplified tools and techniques*. Milwaukee: ASQ Quality Press.
- Barnett, R. (1992). *Improving higher education: Total quality care*. Bristol: Open University Press.
- Bonstingl, J. J. (1992). *Schools of quality: An introduction to total quality management in education*. Association for Supervision and Curriculum Development, Alexandria, VA.
- Crawford, L. E., & Shutler, P. (1999). Total quality management in education: problems and issues for the classroom teacher. *International Journal of Educational Management*, 13(2), 67-73.
- Cruickshank, M. (2003). Total quality management in the higher education sector: a literature review from an international and Australian perspective. *Total Quality Management & Business Excellence*, 14(10), 1159-1167.
- Dahlgaard, J. J., Kristensen, K., & Kanji, G. K. (1995). Total quality management and education. *Total Quality Management*, 6(5), 445-456.
- Evans, J. R. (2002). Total quality management. *Information Systems and Operational Research Journal* 40(4), 364.
- Ford, J. B., Joseph, M., & Joseph, B. (1999). 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), 171-186.
- Garza-Reyes, J. A., Romero, J. T., Govindan, K., Cher- rafi, A., & Ramanathan, U. (2018). A PDCA- based approach to Environmental Value Stream Mapping (E-VSM). *Journal of Cleaner Production*, 180, 335-348.
- Harvey, L., & Green, D. (1993). Defining quality. *Assessment & evaluation in higher education*, 18(1), 9-34.
- Hasan, M. Z., & Dutta, A. (2017). Personal Skill development by Applying 'KAIZEN': An Experimental Case Study. *Asian Journal of Mathematical Sciences*, 1(6), 234-240.
- Hasan, M. Z., Rezwan, A., Islam, M. R., & Dutta, A. (2018). Defect Reduction by Total Quality Management in a Crackers Manufacturing System. *World Scientific News*, 98, 150-171.
- Hasan, Z., & Hossain, M. S. (2018). Improvement of Effectiveness by Applying PDCA Cycle or Kaizen: An Experimental Study on Engineering Students. *Journal of Scientific Research*, 10(2), 159-173.
- Higley, J. (2018). Continuities and Discontinuities in Elite Theory. In H. Best & J. Higley (Eds.), *The Palgrave Handbook of Political Elites* (pp. 25-39). London: Palgrave Macmillan.
- Kaizen Institute India and Africa. (2013, Feb 22). *Definition of kaizen* [Video file]. Retrieved from <https://www.youtube.com/watch?v=WqKMIRJUAJk>
- Kanji, G. K., Malek, A., & Tambi, B. A. (1999). Total quality management in UK higher education institutions. *Total Quality Management*, 10(1), 129-153.
- Koch, J. V., & Fisher, J. L. (1998). Higher education and total quality management. *Total Quality Management*, 9(8), 659-668.
- Motwani, J., & Kumar, A. (1997). The need for implementing total quality management in education. *International Journal of Educational Management*, 11(3), 131-135.
- Sahney, S., Banwet, D. K., & Karunes, S. (2004). Conceptualizing total quality management in higher education. *The TQM magazine*, 16(2), 145-159.
- Sallis, E. (2014). *Total quality management in education*. London: Routledge.
- Sherr, L. A., & Lozier, G.G. (1991). Total quality management in higher education. *New Directions for Institutional Research*, 71, 3-11.

- Thai Hoang, D., Igel, B., & Laosirihongthong, T. (2006). The impact of total quality management on innovation: Findings from a developing country. *International journal of quality & reliability management*, 23(9), 1092-1117.
- Zehir, C., Ertosun, Ö. G., Zehir, S., & Muceldilli, B. (2012). Total quality management practices' effects on quality performance and innovative performance. *Procedia-Social and Behavioral Sciences*, 41, 273-280.