

A Quality Function Deployment (QFD) in Determining the Critical Learning Outcomes

Nora Muda^{a*}, Noor Sulawati Mat Roji^a

^aSchool of Mathematical Sciences, Faculty of Science & Technology, Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor

*Corresponding author: noramuda@ukm.my

Article history

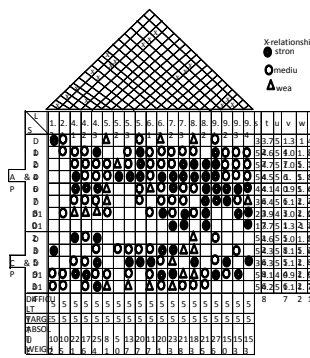
Received :21 January 2013

Received in revised form :

7 May 2013

Accepted :25 June 2013

Graphical abstract



Abstract

The industrial training plays an important role in giving exposure to students about working in the real world industry. The training can be used by Institutions of Higher Learning (IPT) in assessing the effectiveness of the programs and to identify gaps between the requirements of the industry with the needs of students to helping them obtain employment in the industry. Therefore, this study obtained voice from the students in order to determine the learning outcomes that should be given priority to the School of Mathematical Sciences (PPSM) by Quality Function Deployment (QFD). From the QFD approach, communication skills, leadership skills, management and entrepreneurship have been identified as a critical learning outcomes that should be prioritize through the house of quality. Therefore, QFD can be used in translating the voice of students to improve the quality of education services.

Keywords: Industrial training; house of quality; students skills

Abstrak

Latihan industri memainkan peranan penting dalam memberi pendedahan kepada pelajar tentang suasana bekerja dalam dunia industri sebenar. Latihan industri juga boleh digunakan oleh Institusi Pengajian Tinggi (IPT) dalam menilai keberkesanan program dan mengenal pasti jurang antara keperluan industri dengan keperluan pelajar untuk membantu pelajar mendapatkan pekerjaan dalam industri. Oleh itu, kajian ini mengambil kira maklum balas pelajar untuk menentukan hasil pembelajaran yang perlu diberi keutamaan oleh Pusat Pengajian Sains Matematik (PPSM) melalui pendekatan Fungsi Kualiti Penempatan (QFD). Daripada pendekatan QFD, melalui hasil dapatan rumah kualiti, didapati kemahiran komunikasi, kemahiran kepimpinan, pengurusan dan keusahawanan telah dikenal pasti sebagai hasil pembelajaran kritikal yang harus diberi keutamaan. Oleh itu, QFD boleh digunakan dalam menterjemahkan suara pelajar untuk meningkatkan kualiti perkhidmatan pendidikan.

Kata kunci: Latihan industri; rumah kualiti; kemahiran pelajar

© 2013 Penerbit UTM Press. All rights reserved.

1.0 INTRODUCTION

The era of globalization has transformed the scenario in which human resources are important assets for developing country. Human resources who has knowledgeable, skills of high competence, innovative and creative are the key factors in increasing the productivity of a country. Therefore, the introduction of industrial training at all levels of higher education can helping the human resources to be more competitive and highly skilled at same level with other developed countries such as United States, Japan and Singapore.

Industrial training (LI) is a component of learning program that provide an opportunity to the students learning in the working environment in order to let them ready with the real working

environment. Besides, it will also enhance students competency as well as working experience to increase the marketability of the students. Starting on session 2010/2011, all the Universiti Kebangsaan Malaysia (UKM) undergraduate students including international students are required to perform LI on their final semester; third semester on their final year at certain period, while the postgraduate students are encourage to do industrial training. This is to allow the UKM students with the real working environment as well as to practice their knowledge and enhance the skills according to their profesion. On the other hand, the industrial training also aim to produce students with the competency needed by the industries as well as giving the entrepreneur experience to the students.

LI is the best mechanism that can be used by Institutions of Higher Learning (IPT), especially at the university to assess the effectiveness of the programs that have been offered. So, the LI has give disclosure to students about the real working environment and they also can relate the theory and practical lessons from classes through the task entrusted by the organization.³ Besides that, the LI can help university to have a good relationship with the industry. The cooperation and good relationship between the university and the industries are very important as it will help this LI program become easier and successful by providing a workplace for the students, providing the facilities and helping in supervising the students.¹⁴ Indirectly, it will helps the government to reduce the problems of unemployment among the graduates. In addition, there is a need to revise and review the training program about their beneficial to the student.³

From the survey conducted, the students were satisfied with the industrial training that they have gone through during their final semester and felt that the knowledge gained from the university are relevant and appropriate to the demand of the industry.^{10,13}

In Malaysia, there are four types of university, namely Apex University, Research University, Focus University and Comprehensive University. Each university has different aims and objectives, but they have same function; to build or generate quality human resources to meet the growing demands of the industry from time to time. Therefore, the universities were stimulated to compete with each other for improving their service quality. A product of quality is a product that can meet the appropriateness of use.⁷ The main product for the university is a student. The student also classified as a customer who receive services from the university. Therefore, the quality in the education is the talent and ability of the subject to be evaluated whether they can meet customer needs.¹ Thus, various studies in the education have been conducted by using quality tools to improve services and thus helping to produce quality graduates in order to meet industry demand.

The concept of quality such as Quality Function deployment (QFD) approach has been widely used in the service sector. The QFD is a method for developing a design quality aimed for satisfying the consumer and then translating the consumer's demand into design targets and major quality assurance points to be used throughout the production phase.¹ The QFD can also be used in the education, such as helping the university in designing the course program and restructuring the university curriculum. For example, the QFD concept has been applied to the subject of Total Quality Management (TQM) and International Business based on the voice from the students, university staff and the employers in the industry.^{6,9} While other researchers used QFD to restructure and improved their university curriculum in line with industry demands.^{8,12}

The QFD approach integrate customer voice in the house of quality to analyze problems or improve the quality of their services. Therefore, students are defined as an internal customer to the university.¹ Thus, voice from the students are very important to the university for evaluating the effectiveness of the programs or courses that have been offered. In addition, this voice can be used to enhance their skills to match the employers' need in terms of technical or communication skills. Therefore, the objective of this study is to identify which learning outcomes of industrial training course should be prioritized by the School of Mathematical Sciences (PPSM), UKM by looking at the house of quality in order to generate graduates with strong skills and become more competitive to the industry.

■2.0 MATERIALS AND METHODS

The QFD was introduced by Akao and Katsuyo in 1966 at the Matsushita Electric. It aims to satisfy customer (Quality) by translating their desire into the design and ensure that all organizational units (Function) work together to identify the characteristic of a systematic design to the more detailed information that can be disclosed and controlled (Deployment).⁹ In other words, it is a voice of the customer translated into the voice of the engineer.

■2.1 House of Quality

The QFD approach requires to use house of quality to integrate the voice of customer with a product or service specifications, technical requirements, the process of planning and the control of manufacturing operations.⁵ There are six steps in building the house of quality; namely customer needs, technical requirement, relationship matrix, technical target, planning matrix and correlation matrix (Figure 1).

Customer's need is a key input for building house of quality in the QFD process. In this study, the student is a customer of the PPSM which their voice on the industrial training is an input of customer needs. The students voice were then categorized according to the effective and psychomotor domain and the cognitive and psychomotor domain (Table 1). While the technical requirement describes the model of the 'how' for the organization to respond to 'what' the customer need for a product or service. Learning outcomes (LO) is the technical requirements set by the PPSM. The expected learning outcomes are what students know and can do after the course of their studies. The learning outcomes for the course of Industrial Training (STQL 3886) that students should be achieve are the ability of the student to adapt to the actual working environment in the related areas, be able to interact and cooperate with the employees in order to achieve or complete the work, able to communicate effectively in the public relations and be able to analyze, interpret and generate information, write a report and do oral presentations.

Relationship matrix (R_{ij}) is the 'heart' to the QFD.⁴ The purpose of this communication matrix is to indicate whether the technical requirements are met. This matrix connects the student response to learning outcomes by using a specific symbol that reflects the degree of relationship. The planning matrix is a part of the house of quality as a marketing strategy and planning decisions. The QFD team will choose some important information such as Important requirement to the student (s); which is a scale of 1-5, Performance of the student's voice (t), the target of student's voice (u) and the ratio of improvement (v), where,

$$t_i = b_i/c \quad \text{which } b = \left(\sum_i \text{number of student at } i \right) \times i \quad (1)$$

c is a total number of students,

$$v_i = u_i/t_i, \quad u \text{ is a target and } t \text{ is a performance of the student's voice.} \quad (2)$$

Besides that, the point of services/sales (w), the absolute weight of student's voice (z) were also considered in the house of quality where

$$z_i = s_i \times v_i \times w_i \quad (3)$$

The correlation matrix is a correlation or 'roof' to the house of quality.⁴ This roof shows the relationship between each

indicator in the learning outcomes set by PPSM. This relationship is used to determine whether this indication support or hinder each other. The technical target is the last matrix in the house of quality. It is determined as an absolute weight of LO indicator (x) and calculated by

$$x = \sum R_{ij} S_{ij}; i = 1, 2, \dots, n; j = 1, 2, \dots, k \quad (4)$$

where n is the number of categories of student’s voice and k is the number of indicators of all LOs.

Normally, information found in a technical target is our priority and benchmark for learning outcomes. Therefore, the indicator of the LO which has high absolute value of weight should be given priority in the process of maintaining the services and meet the needs of students.

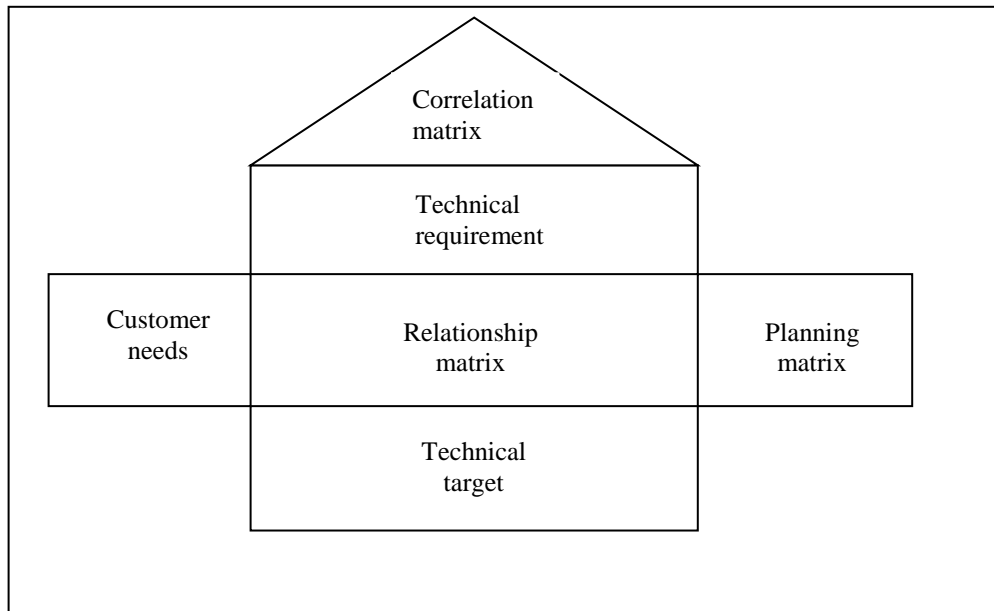


Figure 1 House of quality

Table 1 Student voice according to the domain

Domain	Voice from student	
Effective & Psychomotor	D1	Companies provide job training in the field of student learning
	D2	Students acquire new skills during their industrial training
	D4	Students are exposed to real working environment
	D6	Students are exposed to real work ethic
	D7	Students can improve their leadership skills
	D8	Students can improve teamwork skills
	D10	Employers are confidence to the students to make decisions in the organization
	D12	Schedule of work / training provided by supervisors in the organization
Cognitive & Psychomotor	D3	Students are able to enhance the skills of communication
	D5	Students can complete the task / problem well
	D9	Students are given opportunities for self development
	D13	Students are given the opportunity to provide comments related to the job
	D14	Students are given the opportunity to use the latest technology

3.0 RESULTS AND DISCUSSION

Based on the survey conducted, there were 149 respondents among the students, which 45.6% were from Statistics program, 44.3% from Mathematics program and 10.1% were from Actuarial Science program. Among them 24.2% were males and 71.1% were females. In terms of organizational sectors which provided a workplace to the students, there were 26.8% from financial sector, followed by 18.8% from service sector and 11.4% were from other sector. On the other hand, there were 136 respondents among the employers which 56.6% were from private sectors followed by 21.3% from government sectors and 19.9%

were from government agencies, only 2.2% were from other sectors.

3.1 House of Quality

Each of learning outcomes (LO) of STQL3886 has indicators that can be measured and evaluated (Table 2). The relationship between the student’s voice to each LO (if it has) or the ‘roof’ of house of quality was determined by the coordinator of the Industrial Training by denoting it as a symbol of ‘x’. The planning matrix was generated based on the equation (1) to (3), while the level of difficulty and targets for each LO was determined by the

PPSM. The equation (4) is used to obtain the absolute value of weights for each indicator in LO.

The combinations of the student's voice, learning outcomes, relationship matrix, planning matrix, relationship between learning outcomes and the technical targets have formed the house of quality (Figure 2). From the house of quality, the LO that should be given priority by the PPSM is LO with high value of absolute weight. However, the priority in determining high value cannot be determined by how much of its value, because the absolute value depends on the scale of weights used for the priority of student voice and scale of the relationship in the relations matrix. The larger the scale interval used, the higher

absolute weights for the technical requirements will be determined. Therefore, in this study, the scale of 1 to 5 for the priority of student's voice has been used and the scale of 9 (strong), 3 (moderate) and 1 (weak) for the degree of relationship in the relationship matrix has been used.

From the house of quality, we found that the indicator for LO that has the highest value of absolute weight in the house of quality, is the indicator 9.1 and the lowest is 5.2 (Figure 2). While (Table 3) shows the five indicators of LO which have the highest value that should be given priority by the PPSM.

Table 2 Indicator for learning outcomes

Learning outcomes		Indicator	
1. Ability to adapt to the actual working environment in areas related	5.1	Ability to apply knowledge to benefit the population, workers and families to improve well-being	
	7.2	Ability to restructure activities and tasks assigned	
	7.3	Ability to ensure work carried out or performance is shown to be consistent with the planning / target / objective	
	8.1	Ability to show professional integrity as required by the profession	
2. Ability to interact and cooperate with employees to achieve or complete the work	5.4	Ability to improve yourself based on comments received	
	8.1	Ability to show professional integrity as required by the profession	
	8.2	Ability to perform duties with integrity and trust	
	9.1	The ability to build teamwork to achieve the same objective (build rapport, interact with others and work effectively with them)	
	9.2	Ability to be leaders and followers	
	9.3	Ability to respect the views, opinions and beliefs of others	
3. Ability to communicate effectively in public relations	9.4	Ability to plan and manage	
	4.1	Ability ideas orally with reference to clear, organized, smoothly and consistently with the appropriate tone	
	4.3	Ability to present confidently and effectively use technology assistance (language, symbols and visual) in a consistent	
	5.2	Ability to show courteous and proper application of the requirements	
4. Ability to analyze, interpret and generate information from the work to write reports and oral presentations	1.2	The ability to use statistical knowledge (course program)	
	2.1	Ability to identify and synthesize the problem accurately	
	4.2	Ability to communicate ideas in writing a clear, organized, smoothly and consistently appropriate	
	4.3	Ability to present confidently and effectively use technology assistance (language, symbols and visual) in a consistent	
	5.3	Ability to research and write based on the results	
	6.1	Able to explore the issues / problems that require solutions independently	
6.3	Managed to combine the information to make decisions and solutions		

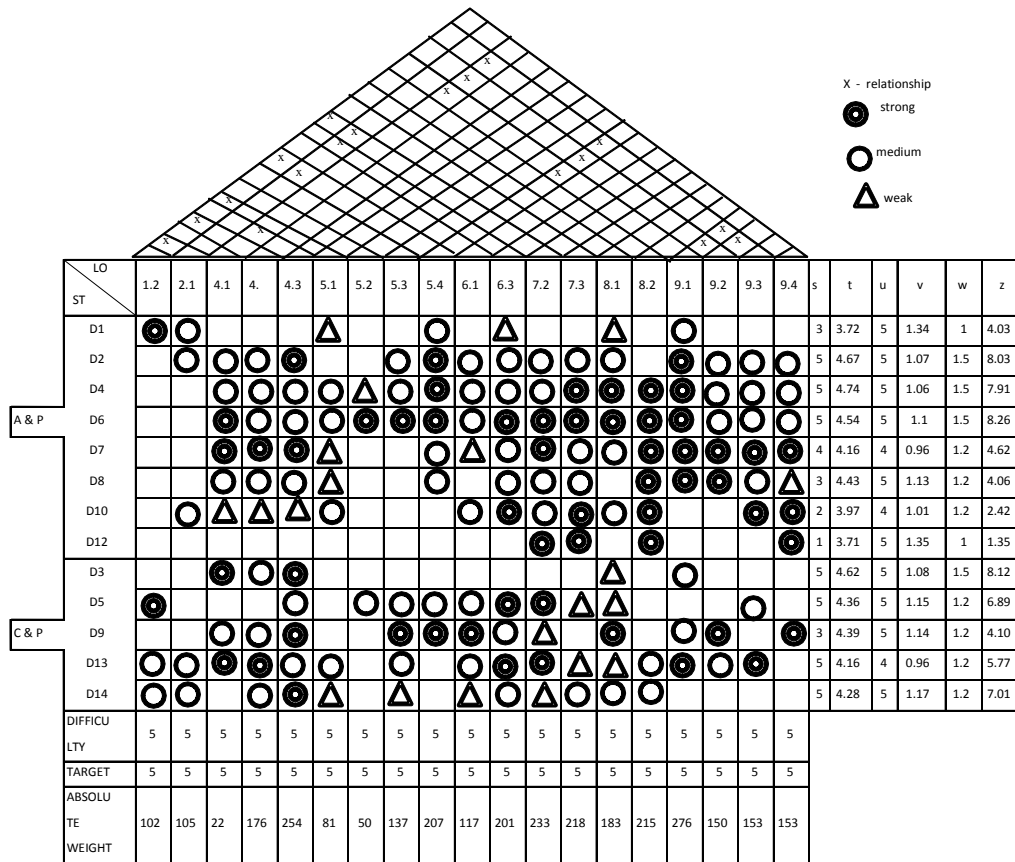


Figure 2 House of Quality from student feedback

Table 3 Priority of learning outcomes

Indicator	Learning outcomes
9.1 The ability to build teamwork to achieve the same objective (build rapport, interact with others and work effectively with them)	LO2
4.3 Ability to present confidently and effectively use technology assistance (language, symbols and visual) in a consistent	LO3 dan LO4
7.2 Ability to restructure activities and tasks assigned	LO1
4.1 Ability to communicate ideas orally with reference to clear, organized, smoothly and consistently with the appropriate tone	LO3
7.3 Ability to ensure work carried out or performance is shown to be consistent with the planning / target / objective	LO1

Thus, from the comments and feedback from the survey, it is found that the students agreed that the industrial training is helpful in providing exposure and experience to them, but they need more skills to be more competitive in the industry such as leadership, communication, management and entrepreneurship skills. Therefore, further analysis on the course of STQL3886 should be investigated to determine whether it helps the students during the LI.¹⁴ Based on the finding from the house of quality, we have found that some of the learning outcomes should be given priority during the LI in order to meet demands from the industries.

4.0 CONCLUSION

This study has applied the QFD approach in interpreting the industrial training student’s voice through the house of quality in order to evaluate the effectiveness of the offered program. Nevertheless, the industrial training would also helped the students to prepare themselves to the real working environment in the future. Thus, through the house of quality, PPSM can identify the learning outcomes that should be prioritized and find necessary skills that should be emphasized to the students so that they will meet the industrial demands. The skills needed by the

students in preparing themselves to the industry are leadership, communication, management and entrepreneurship skills. Therefore, a thorough and systematic planning should be done by the PPSM to ensure that these skills be incorporated in the learning outcome of the industrial training course (STQL3886) and integrated into the curriculum for the teaching and learning.

Acknowledgement

This study was supported by the research fund from Strategic Action Plan, UKM with grant PTS-2011-039.

References

- [1] Y. Akao, 1990. *Quality Function Deployment: Integrating Customers Requirements into Product Design*. Cambridge : Productivity Press
- [2] Y. Akao, K. Nagai, & N. Maki. 1996. *Proceeding's of ASQC 50th Annual Quality Congress*. 12: 20.
- [3] L. Chiu Khong, M. Nor Idayu, H. Shahizan, C. Abdul Razak & Y. Mohd Azlan. 2010. *Malaysia Journal of Learning and Instruction*. 133: 164.
- [4] L. Cohen. 1995. *Quality Function Deployment How to Make QFD Work for You*. Addison-Wesley Publishing Company: Unites States of America.
- [5] J. R. Evan & W. M. Lindsay. 2011. *The Management and Control of Quality*. Cengage Learning: Canada, South-Western.
- [6] M. E. Gonzalez, G. Quesada, J. Mueller & R. D. Mueller. 2011. *Journal of Internation education in Business*. 4(1): 6: 29.
- [7] J.M. Juran. 1988. *Quality Control Handbook*. New York: Mc Graw-Hill.
- [8] P. Kauffmann, A. Fernandez, C. Keating, D. Jacobs & R. Unal. 2002. *Journal of Engineering Education*. 91(2): 231: 238.
- [9] G. H. Mazur. 1993. *The Fifth Symposium on Quality Function Deployment*. 1: 17.
- [10] Mohd Safarin Nordin, D. Ling, E. Hun. 2008. Persepsi Pelajar-pelajar Tahun Empat Pendidikan Teknikal dan Kejuruteraan Terhadap Program Latihan Industri. Fakulti Pendidikan, Universiti Teknologi Malaysia.
- [11] Rodiah Idris, Siti Rahayah Ariffin & Noriah Mohd Ishak. 2009. *Malaysia Journal of Learning and Instruction*. 6: 103–140.
- [12] S.Y. Sohn & A. Kim. 2009. *Australasian Association for Engineering Education Conference 2009*. 343: 349.
- [13] Zuhairuse Md Darus, Muhammad Fauzi Mohd Zain, Noraziah Mohammad, Adi Irfan Che Ani, Azami Zaharim & Zabidi Hamzah. 2007. *Seminar Pendidikan Kejuruteraan dan Alam Bina*. 120: 127.
- [14] Nora Muda, Ummul Khair Salma Din, Noriza Majid, Rokiah@Rozita Ahmad, Faridatul Azna Ahmad Shahabudin, Azmin Sham Rambely & Nur Riza Mohd Suradi. 2011. *Procedia Social and Behavioral Sciences* 59: 598–603.