

**Azilah Anis**

**Rafikul Islam**

## **IMPROVING TEACHING EFFICIENCY: AN APPLICATION OF QFD AND AHP**

### **Abstract**

HSBL University College is one of the privately run institutions of higher learning in Malaysia which offers, among others, various programs in Economics, Accounting and Business Administration. A recent survey conducted by the Faculty of Business (FB) of HSBL found that the students were not fully satisfied with the teaching and learning system of the college. The present work has been carried out to identify the FB students' requirements to improve the efficacy of the teaching and learning system. Having identified the requirements, a number of lecturers were contacted to extract the design requirements that would address the students' needs. The novelty of the paper is that Quality Function Deployment and Analytic Hierarchy Process both have been applied to derive the priorities of the design requirements. The results obtained by the above two methods have shown close resemblance.

### **Keywords**

Quality in higher education, ranking, Quality Function Deployment, Analytic Hierarchy Process.

## **Introduction**

Quality in education is important to ensure an adequate supply of qualified, highly skilled and well trained manpower [Doherty, 2008]. Quality in higher education has attracted greater interest and wider discussion as society has come to realize the crucial importance of trained manpower to its socio-economic development and well being. Higher education plays an important role in providing quality, trained manpower, which is crucial to an economy in creating and maintaining a competitive edge over its competitors [Hwarng and Teo, 2000]. Quality education means adding value to students and ultimately to the society, so that students are enriched not only in their knowledge, skills and techniques but also in intellectual growth and development [Hwarng and Teo, 2001].

In Malaysia, a number of initiatives have been taken to ensure quality in education. In 1996, the Ministry of Education launched a customer charter, formalizing the inception of Total Quality Management (TQM) in the Malaysian education sector. The ministry formed a policy and quality section to monitor the implementation of the country's education policy at all levels, based on the TQM principles, with a vision that all schools and universities will eventually adopt the TQM principles. To control the standards of public higher education institutions, the National Higher Education Council was formed in 1996. A grading system was put in place to assess the effectiveness of each department and faculty. In 1997, the ministry launched the National Accreditation Board (LAN) to assess the quality of higher education institutions. On 1 November 2007, the Malaysian Qualification Agency (MQA) was established that enforced its own Act (Malaysian Qualification Agency Act 2007). The MQA is responsible for monitoring and overseeing the quality assurance practices and accreditation of national higher education. The establishment of MQA saw LAN dissolved and its personnel absorbed into the MQA.

Currently the ISO 9001 has been widely implemented by most of the universities and colleges to assure good performance and the customers of higher education are being well served (Sohail et al., 2003). Currently, there are a number of universities and university colleges in Malaysia that have already been certified with the ISO 9001 and one university college which is on the list is the HSBL University College.

Even though the HSBL University College has already obtained the ISO 9001, there are certain issues that are worth mentioning.

- Most of the students enrolled in HSBL University College have minimum entry requirements. The lecturers encounter difficulties to deliver their lectures due to the low ability of the students to understand, apply and conceptualize the theory and practical issues that are being taught. The lecturers keep on complaining on this matter, but there is no formal action plan to find solutions to improve the situation. As such, opinions and comments from both parties (lecturers and students) are important in developing effective strategies for the teaching and learning process.
- In order to improve the quality of teaching, a teaching evaluation is conducted at the end of every semester. The evaluation provides comments on lecturers' effectiveness for every module that has been taught. However, the existing evaluation system does not have a good impact on the lecturers since the feedback that is given by the respective department is not precise and actionable enough.
- Faculty of Business (FB) in HSBL University College lacks core programs to offer to the market, thus the number of students in FB was decreasing from year to year. In June 2004, drastic changes were made and various programs were offered. This effort resulted in increasing the number

of students and academic staff, but not as much as the FB was expecting. Besides the weak marketing strategies, one of the factors is the negative word of mouth among students about the poor teaching methodologies.

It shows that from the issues raised above, the main area seems to be the teaching effectiveness of the lecturers. Thus, based on the previous discussions, this paper will focus on: *How the students' voices play its role in contributing feedbacks to improve the teaching effectiveness among lecturers, particularly in the Faculty of Business, HSBL University College.*

The identification of the problem statement above has led to constructing the main objective of this paper which is: *To develop policies to be implemented by HSBL University College in order to improve the students' satisfaction by improving the lecturers' teaching effectiveness.*

## 1. Quality Function Deployment

Quality Function Deployment (QFD) is a quality assurance tool that helps ensure that the voice of the customer is heard and followed in the development of a product or service [Pitman et al., 1996]. Ermer [1995] emphasized that QFD is a design tool that matches customers' requirements with the necessary system design elements. This structured approach gives increased focus to understanding customers' requirements. According to Hwarng and Teo [2001], QFD is a methodology for the development or deployment of features, attributes, or function that give a product or service high quality. QFD can be very useful in answering the question on how to deliver quality products and services based on the needs of customers. It is simply a planning tool that begins with market research that identifies what the customers like, which is called the Voice of Customers (VOC). It is through the QFD process that the VOC is translated into system and part requirements.

QFD found its first use at Mitsubishi's Kobe shipyard site in 1972. Today QFD is used successfully by manufacturers of electronics appliances, clothing and construction equipment firms such as General Motors, Ford, Mazda, Motorola, Xerox, Kodak, IBM, Procter and Gamble, Hewlett-Packard, AT&T, etc. [Evans and Lindsay, 2005, p. 387]. QFD is also proved to be an effective tool in improving quality in higher education. One of the earliest uses of QFD in education was by Emer at the Mechanical Engineering Department of the University of Wisconsin in 1991 where the department chairman used it to assess and respond to the needs of his department. Other applications of QFD in higher education are reported by Jaraiedi and Ritz [1994], Pitman et al. [1996], Hilmer et al. [1995], Sandvik and Hakun [1996], Mohamad and Aspinwall [1998], Lam and Zhao [1998], Hwarng and Teo [2001], Peters et al. [2005], Bier and Cornesky [2001] and Salih et al. [2003].

According to Pitman et al. [1996], the fundamental tasks of the QFD are:

- To identify the customers.  
In identifying the customers, the organization must objectively determine the group that best describe its current and/or desired customer base. After the customer base has been identified, the *wants* of the customers are determined.
- To identify what the customers' wants.  
These wants are commonly referred to as the *whats*, and can be derived by using a wide variety of methods. When collecting these *whats*, it is critical for the organization to use the terms, phrases and languages of the customers. After collecting the *whats*, the QFD team works with the customers to determine priorities of the *whats*.
- To identify the design requirements that can fulfill the customers' requirements.

Once the *whats* are identified, the QFD team determines the mechanism that would satisfy the *whats*. These mechanisms are commonly referred as the *hows*. The *whats* are expressed in customers terms, whereas the *hows* are expressed in technical, corporate terms.

With the *whats* and *hows* in place, the QFD team establishes relationship between them. Evans and Lindsay [2005, p. 573] noted that the purpose of the relationship is to show whether the final technical requirements (*hows*) have adequately addressed customers requirements. In indicating the relationship between the *whats* and the *hows*, the QFD team assigns a strength value of none, weak, medium or strong to each relationship.

After the relationship matrix has been developed, there is a need to place a priority on each issue that was considered in the design process [Peters et al., 2005]. By using the value of 9 (high), 3 (medium) and 1 (low) and 0 (none) as weights, a design issue's importance weighting measure can be calculated by taking the weighted sum of its relationship i.e.,  $\sum[(\text{value of relationship strength}) \times (\text{customer importance rating})]$ . Thus, the value of the weighting measure will indicate the rank of the design issue. The highest weighting measure will indicate the importance of the design issue in fulfilling the voice of customers and vice versa.

The translation process uses a series of matrices, commonly known as the House of Quality (HoQ) as shown in Figure 1. Normally, a HoQ diagram consists of the following information:

- What's? (Voice of Customers),
- How's? (Design Requirements),
- Relationship Matrix,
- Correlation Matrix,
- Customers' Assessment,
- Technical Assessment.

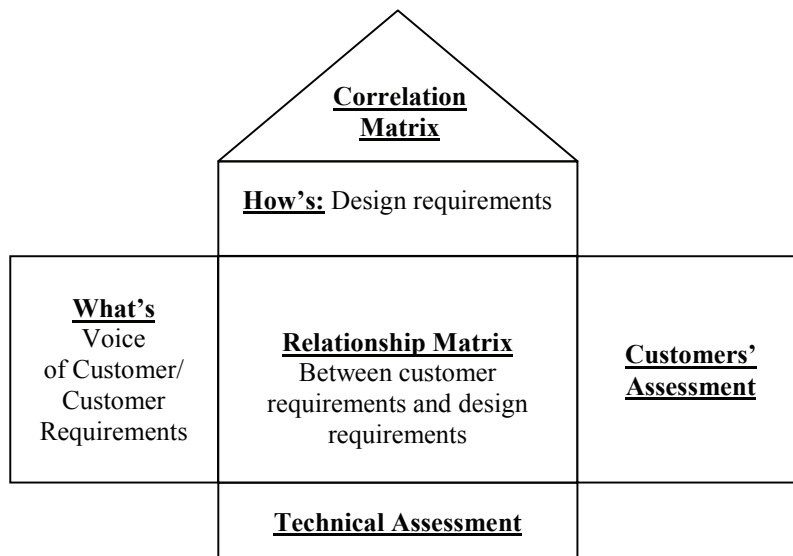


Figure 1. Framework of House of Quality

## 2. Analytic Hierarchy Process (AHP)

According to Lam and Zhao [1998], AHP is a decision making method for prioritizing and selecting decision alternatives when multiple decision-making criteria are considered. The AHP offers a methodology to rank alternative courses of actions based on decision maker's judgments concerning the importance of the criteria and the extent to which they are met by each alternative. The Analytic Hierarchy Process (AHP) was introduced by Saaty in 1977 and solves a multiple criteria decision making problem using three steps:

- (1) Find out the overall goal, criteria, subcriteria, and alternatives and form a linear hierarchy involving all of them in several levels,
- (2) Form pairwise comparison matrices for all the criteria, subcriteria and alternatives and compute their weights by using a suitable weight determination technique,
- (3) Synthesize all the local sets of weights to obtain a set of overall or global weights for the alternatives. A pairwise comparison matrix in Step 2 has the form:

$$\mathbf{A} = \begin{array}{c|cccc} & F_1 & F_2 & \dots & F_n \\ \hline F_1 & a_{11} & a_{12} & \dots & a_{1n} \\ F_2 & a_{21} & a_{22} & \dots & a_{2n} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ F_n & a_{n1} & a_{n2} & \dots & a_{nn} \end{array}$$

where  $F_i$ 's are the factors (meaning either criteria or alternatives whose weights are to be determined),  $a_{ij} = w_i / w_j$ , for all  $i, j$ , and  $w = (w_1, w_2, \dots, w_n)^T$  is the underlying weight vector for the  $n$  factors. Each entry  $a_{ij}$  of  $A$  is the answer to a typical question, "Given two factors  $F_i$  and  $F_j$ , which is more dominant (or preferable or important) and what is the degree of this dominance?" The answers are usually given verbally, for instance:  $F_1$  is weakly (or strongly) more dominant over  $F_j$ . Later, these verbal qualitative phrases (weakly or strongly more) are quantified by means of the (1/9-9) ratio-scale. For example, if  $F_1$  is strongly more dominant over  $F_2$ , then  $a_{12} = 5$ . The interpretation of all the numerical judgments of the (1/9-9) scale is given in the Table 1.

Table 1

AHP verbal Scale

Verbal Judgment of Preference	Numerical Rating
Equal importance	1
Equal to moderate importance	2
Moderate importance	3
Moderate to strong importance	4
Strong importance	5
Strong to very strong importance	6
Very strong importance	7
Very strong to extreme importance	8
Extreme importance	9

Note: If any factor  $F_i$  has importance strength over  $F_j$  as any of the above nonzero numbers, then

$F_j$  has the reciprocal importance strength with  $F_i$ , i.e.,  $a_{ji} = 1 / a_{ij}$ .

From the foregoing discussion, it is intuitively clear that if  $F_1$  is 5 times more important than  $F_2$ , then  $F_2$  is 1/5 times more important than  $F_1$ . It has been stated that each  $a_{ij}$  is the ratio of the two weights  $w_i$  and  $w_j$ . Now, if we multiply A by the weight vector w from the right, we get

$$Aw = nw \tag{1}$$

where n is the order of the matrix, i.e., the number of factors compared. So, we can recover the weight vector w from (1), provided  $(A-nI)w = 0$  has non-trivial solution, i.e.,  $|A-nI| = 0$ , i.e., n is the eigenvalue of A. We also note that  $a_{ij} = (w_i / w_k) (w_k / w_j) = a_{ik} a_{kj}$ , which is known as *cardinal consistency relation*. If all the elements of A satisfy this relation, then we say that the matrix is consistent, otherwise that it is inconsistent. In reality, especially within the framework of the AHP, the matrix A is hardly consistent. In the inconsistent case, Equation (1) becomes

$$A'w' = \lambda_{\max} w' \tag{2}$$

where  $\lambda_{\max}$  is the largest eigenvalue of  $A'$ . Here the matrix A has been perturbed to  $A'$  and the consistency relation is violated at least once. For simplicity, the primes are omitted in the following notations and expression. To find out the weights, first we determine the largest eigenvalue  $\lambda_{\max}$  of A. Then the weights  $w_i$ 's are determined by solving the following system of linear simultaneous equations:

$$w_i = \frac{1}{\lambda_{\max}} \sum_{j=1}^n a_{ij} w_j, \quad i = 1, 2, \dots, n \tag{3}$$

For uniqueness, we normalize the set of weights so that  $\sum_{i=1}^n w_i = 1$ .

In practice, Expert Choice software is used to compute the weights from the pairwise comparison matrices.

### 3. Teaching Effectiveness

Lecturers are directly entrusted with providing education to the students. Therefore, quality in education is substantially dependent on lecturers' commitment. Quality lecturers produce quality students. Excellent lecturers will be able to provide more satisfaction, exceeding the expectation of the students [Wan Jaafar, 1996].

The definition of teaching effectiveness varies from researcher to researcher. Abrami [1989] recognized that the nature of effective teaching could vary across instructors, courses, and students. But since this paper pertains to the ways through which the lecturers are going to fulfill their students' needs, therefore, the area that will be covered for teaching effectiveness is only on the lecturers' side and the categories considered are the following [Rosenshine and Furst, 1973; Swan et al., 2003].

- a) *Clarity*: It involves cognitive clearness of a lecturer's presentation. A lecturer with greater clarity presents points that are clear and easy to understand, explains concepts clearly and answers questions with clear and good organization [Swan et al., 2003]. It describes the ability of the learners to clearly see, hear and understand what is being said. Clarity was found to be the number one factor leading to improved learning [Rosenshine and Furst, 1973].
- b) *Variability*: A lecturer's ability to use a variety of materials. High variability lecturers use a variety of instructional materials, teaching devices, types of tests and different level of learners' task [Swan et al., 2003]. Some students learn better by listening, some by seeing and some by doing. Regardless of the best mode of learning, it helps students if the lecturer covers the material in a variety of ways [Rosenshine and Furst, 1973].
- c) *Enthusiasm*: This refers to a lecturer's enthusiasm. Highly enthusiastic lecturers use movement, gesture, voice inflections and questioning of interpretation of test [Swan et al., 2003]. The enthusiasm of a lecturer is contagious. If the lecturer shows interest in a topic, students are more likely to be interested. If the lecturer apologizes for how boring a topic is, do not expect the students to stay awake and listen to the lecturer [Rosenshine and Furst, 1973].
- d) *Task orientation*: This relates to a lecturer's degree of task orientation, achievement-orientedness. People tend to learn better when they are engaged in a task. Lecturers who keep guiding their students back to the topic have a better chance of achieving their objectives. Checklist, procedure sheets and other aids may help students stay on the task [Rosenshine and Furst, 1973].
- e) *Opportunities for students to learn additional material*: The degree of opportunities of a lecturer provides the students with opportunities to practice what is being taught. A positive relationship exists between the material learned in the course and student achievement on a certain test [Swan et al., 2003]. Students should be given the opportunity to engage with the materials. This could mean that the lecturer remains silent at times



to allow the students to digest what they have learnt. Or, perhaps, there is an activity where the student writes something or discusses with the person next to them.

## 4. Data Collection

According to the requirements of QFD, data have been collected from the following respondents:

- Students – to gather the voices of customers (stated as students’ needs).
- Lecturers – to obtain the design requirements (mentioned as lecturers’ designs).

### 4.1. Voices of Customers (Students’ Needs)

The voices of customers were obtained through focus group interviews and discussion with 18 students from semester 4, 5 and 6. Most of them are diploma holders with years of experience in learning process. Thus, they are more determined to get their needs and expectations fulfilled. The students articulated their requirements for effective teaching. The voices of customers were then synthesized to identify genuine needs, as opposed to unnecessary wants of the students. All the items of students’ needs were grouped based on similar characteristics to finalize FB students’ needs. The students’ needs were then classified into five categories: clarity, variability, enthusiasm, task orientation, and opportunities to learn. The details of their needs are presented in Table 2.

Table 2

Students’ needs towards improving lecturers’ teaching effectiveness

<p><i>Clarity</i></p> <ul style="list-style-type: none"> <li>– Detailed explanation</li> <li>– Detailed notes</li> <li>– Clear and understandable English</li> <li>– Examples</li> </ul> <p><i>Enthusiasm</i></p> <ul style="list-style-type: none"> <li>– Energetic</li> <li>– Efforts</li> </ul> <p><i>Opportunities to learn</i></p> <ul style="list-style-type: none"> <li>– Questions and answer session</li> <li>– Discussions</li> </ul>	<p><i>Variability</i></p> <ul style="list-style-type: none"> <li>– Variety of materials</li> <li>– Case studies</li> </ul> <p><i>Task Orientation</i></p> <ul style="list-style-type: none"> <li>– Questioning</li> <li>– Handouts</li> </ul>
-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

The following is the description of the students' needs towards lecturers' teaching effectiveness:

1. Clarity:

- Detailed explanation – ability of the lecturers to explain the content of the subject systematically and precisely. The explanation should consist of introduction, e.g. definition, main body, e.g. methods, steps, theories, concepts, examples and conclusion, e.g. summary of the content.
- Detailed notes – the notes given to the students should be properly structured in guiding them to understand the content easily. It will help the students to find the exact answer for their quizzes, tests, assignments and final examination questions.
- Clear and understandable English – lecturers use simple English in delivering the content.
- Examples – ability of the lecturers to relate the theories and concepts to the real world environment or any recent local and international scenarios.

2. Variability:

- Variety of materials – lecturers are able to hand in various forms of materials that are related to the subject, e.g. diagram, figure, graph, pictures, articles and others for the students to understand the subject better.
- Case studies – any scenarios, business situation or relevant data/numbers that are required for students to discuss and think critically in accordance with the case given.

3. Enthusiasm:

- Energetic – lecturers' passion, movement and voice reflexion in transferring the knowledge and making their students understand the content of the subject.
- Efforts – passion and action that are shown by the lecturers in terms of time spent to prepare and deliver the content to the students.

4. Task orientation:

- Questioning – lecturers ask questions frequently to get the students' attention and at the same time, to assess the students' comprehension on the content delivered.
- Handouts – extra information in form of a diagram, figures, graph to capture the students' attention and to help them comprehend the subject.

5. Opportunities to learn:

- Q & A session – lecturers allocate several minutes for the students to ask questions regarding the material delivered.

- Discussion – lecturers allocate time and allow the students to express their opinion, ideas and experiences related to the subject. Lecturers will act as moderators in controlling the flow and scope of the discussion.

A questionnaire survey was then conducted and distributed to 140 students to obtain importance ratings of various students’ requirements (presented in the QFD: Figure 2). For the AHP approach, the importance of rank has been identified by means of pairwise comparison of students’ needs with teaching effectiveness as a factor to be evaluated. Two students with excellent academic performance had been selected to make the comparison.

**4.2. Technical Design (Lecturers’ Design)**

To gain information on lecturers’ designs, interviews were conducted with the lecturers. Lecturers’ designs need to be defined in fulfilling the requirements of the students. To complete this task, three senior lecturers, one associate professor and one professor with more than ten years of teaching experience were contacted. The selected lecturers were asked to answer the following question: *How each of the students’ needs towards teaching effectiveness best be fulfilled?* The lecturers provided the answers in reference to the students’ needs according to the teaching effectiveness categories and they are shown in Table 3.

Table 3

Lecturers’ designs to satisfy the students’ needs towards teaching effectiveness

1. Preparation	2. Assignments
3. References	4. Presentation
5. Resourcefulness	6. Subject Matter Expert

Below is the description of the lecturers’ design in fulfilling the students’ needs towards lecturer teaching effectiveness at the FB.

1. Preparation. The process of preparing the material, obtaining the knowledge and information to be delivered confidently by the lecturers during lecture hours. Thus, the delivery process can be smoothly implemented and students are able to understand the content easily.

2. Assignments. They can be categorized into individual and group assignments, consisting of simple to complex questions, conducted during or after the class hour.
3. Presentation. The skill of transferring the knowledge and information to the students during the class hour. It consists of lecturers' voice, eye contact, body language, movement, activities conducted in the class. The creativity of the lecturers in structuring the content to the form related diagram or mechanism can be considered as presentation, too.
4. References. Text book, articles, newspaper clippings, magazines that can be used by the lecturers in delivering lecture and information related to the subject.
5. Resourcefulness. The degree of knowledge and understanding possessed by the lecturers on the subject. It depends considerably on the references used and preparation done by the lecturers.
6. Subject Matter Expert. The ability of the lecturers in mastering the subject assigned to them. It has a strong correlation with the educational background and the level of education of the lecturers, number of years teaching the subject, prior industrial experiences related to the subject and books or references used by the lecturers.

The students' needs and lecturers' design are presented in the House of Quality, as shown in Figure 2.

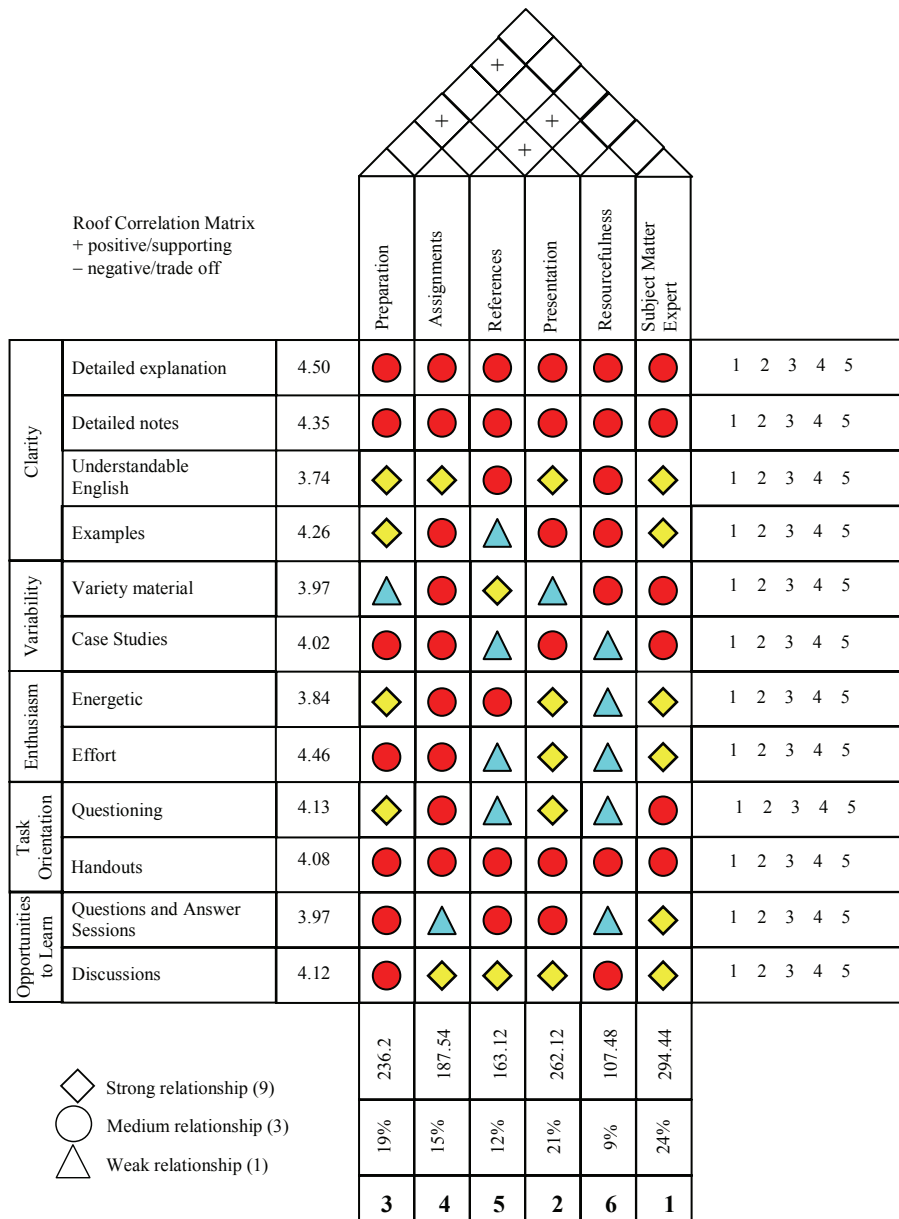


Figure 2. Complete HoQ

## 5. Data Analysis

The details of the data analysis are provided in Table 4.

Table 4

Analysis of the data by QFD and AHP

Type of data	Analysis
<b>What's?</b> (Voice of Customers) – to identify and prioritize the customer requirements.	<p><i>QFD Approach:</i> A five-point Likert-Scale was used and the mean scores for each students' need were calculated in order to obtain their importance rating. A questionnaire survey was conducted and distributed to 140 students to obtain importance ratings of various students' requirements (presented in the QFD: Figure 2).</p> <p><i>AHP Approach:</i> To calculate the priorities of students' requirements, pairwise comparisons of students' needs with teaching effectiveness as a factor to be evaluated were conducted. Two students with excellent academic performance had been selected to make the comparison. The priorities of the <i>whats</i> obtained by AHP are shown in Table 4</p>
<b>Relationship Matrix</b> – to identify the relationship between students' needs and lecturers' design	<p><i>QFD Approach:</i> It is based on the judgments obtained from selected lecturers as required by the QFD. In this case, the lecturers involved have to indicate the relationship of how the lecturers' design is able to fulfill students' requirements by using the symbols of '◇' (with the value of 9) for the strong relationship, while medium relationship was indicated by 'O' (with the value of 3) and the weak relationship, by the symbol of '△' (with the value of 1) to determine the relationship between students' needs and lecturers' design. The relationship is exhibited in Figure 2.</p> <p><i>AHP approach:</i> AHP was used to determine the relationship between students' needs and lecturers' designs in the following manner:</p> <ol style="list-style-type: none"> <li>1. Define the problem – to improve teaching effectiveness.</li> <li>2. Structure the hierarchy of teaching effectiveness, which is presented in Figure 3. The top level consists of the goal which is improving teaching effectiveness, the second level represents the criteria of teaching effectiveness, namely: clarity, variability, enthusiasm, task orientation and opportunities to learn. The next level consists</li> </ol>

Table 4 contd.

Type of data	Analysis
	<p>of the sub-criteria and the lowest level of the hierarchy shows the alternatives which are the lecturers' design requirements.</p> <p>3. Construct the pairwise comparison matrix for the lecturers' designs based on the students' needs, as presented in Appendix 1.</p> <p>4. Obtain judgments required to develop the set of matrices in step 3. In indicating this particular relationship, selected senior lecturers and professor had been involved. Pairwise comparison of lecturers' design was constructed with students' need as the factor to be evaluated (refer to Appendix 1).</p> <p>5. Construct pairwise comparison matrix, calculate the priority values and consistency ratio for each students' need. The outcome is presented as in Appendix 1, too.</p> <p>6. Perform steps 3, 4 and 5 for all the students' needs</p>
<p>Technical Assessment – to identify and prioritize lecturers' designs according to the students' needs</p>	<p><i>QFD Approach:</i> Peters et al. [1996] demonstrated the calculation in a formula which is as follows: Lecturers' design importance = <math>\sum (\text{customer importance rating}) \times (\text{strength of relationship})</math> Customer importance rating was identified by using the mean score for each students' need, while the strength of the relationship was determined by selected lecturers.</p> <p><i>AHP Approach:</i> The lecturers' design priorities were calculated by multiplying the importance rating for the students' needs with the priority value of the individual design requirement and summing across each of the lecturers' design. The highest score of the lecturers' designs indicate the most important one in fulfilling the students' needs towards improving teaching effectiveness [Lam and Zhao, 1998].</p>
<p>Correlation Matrix – to identify the relationship between each lecturer's design</p>	<p>The purpose is to complete the roof of the HoQ diagram by examining the relationship between each pair of design issues [Peters et al., 2005]. A positive correlation between two designs indicates that the two designs are likely to reinforce each other. A negative correlation indicates that two designs are likely to negatively affect each other, while empty cells represent the fact that no correlation exists between the pairs [Hwang and Teo, 2001]</p>

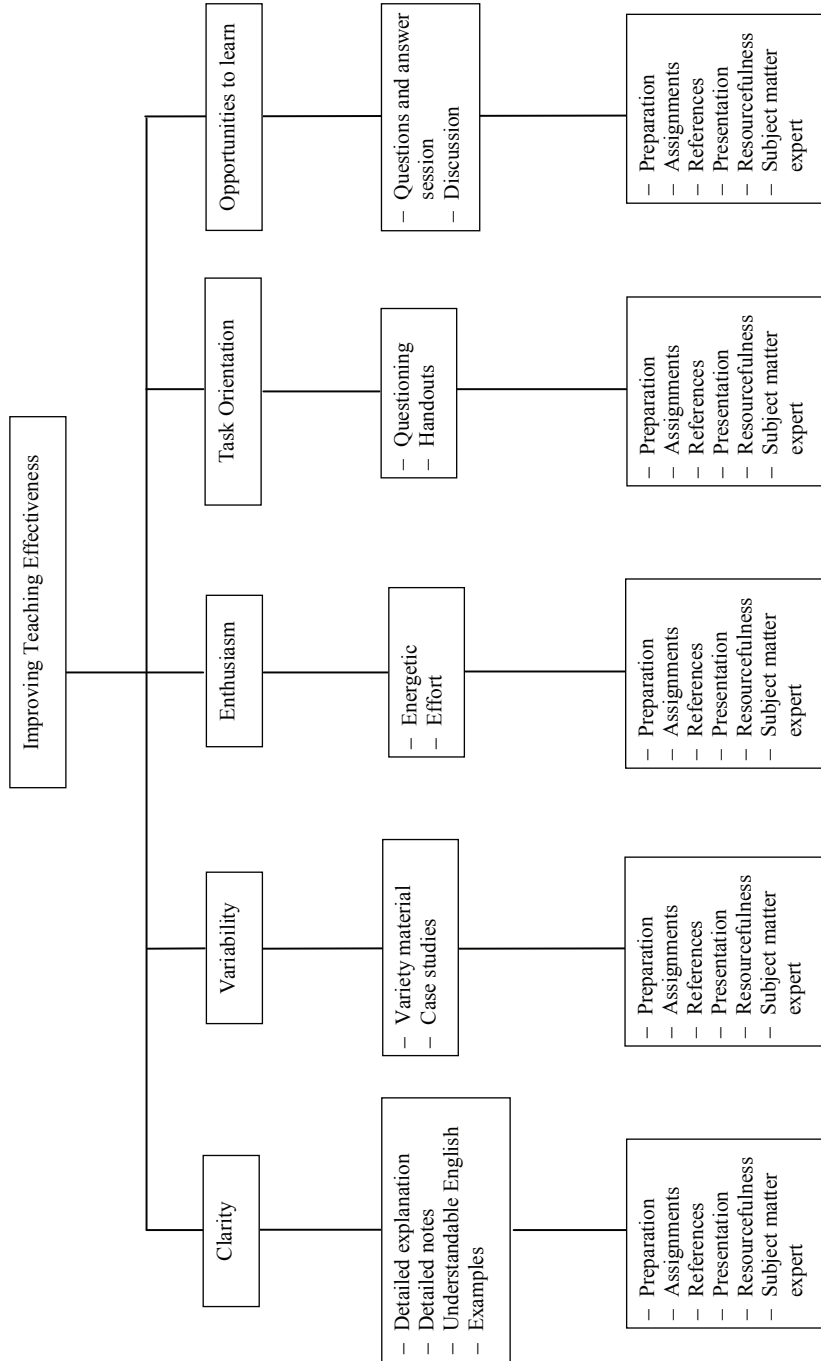


Figure 3. The AHP hierarchy representing the criteria and alternatives for improving teaching effectiveness



### 5.1. Identifying and Prioritizing Students’ Needs towards Lecturers’ Teaching Effectiveness

*QFD Approach:*

By referring to the information in the complete HoQ which is presented in Figure 2, it was found that *Explain in detail* was most important need with the mean value of 4.50, followed by *Making efforts to ensure that students understand well* with the mean 4.46 and *Provide detailed notes* holds the third rank. The least importance was placed on *Use easy and understandable English* with the mean value of 3.74.

*AHP Approach:*

The priorities of the students’ requirements determined by the AHP are shown in Table 5.

Table 5

The priorities of the students requirements determined by AHP

Attribute of effective teaching	Priority value
Detailed explanation	0.1424
Detailed notes	0.1600
Understandable English	0.0344
Examples	0.0766
Varied material	0.0474
Case study	0.0621
Energetic	0.0409
Effort	0.1407
Questioning	0.1260
Handouts	0.0658
Q & A session	0.0308
Discussion	0.0730

The consistency ratio = 0.0964.

Since the consistency ratio was 0.0964 which is less than 0.1, therefore it can be concluded that the priorities of the students requirements calculated are acceptable. The results show that *Detailed explanation* was ranked as the most important of students need followed by *Detailed notes* and *Understandable English* with the priority value of 0.1424, 0.1600 and 0.0344 respectively.

## 5.2. Relationship between Students' Needs and Lecturers' Designs

### *QFD Approach:*

The information presented in Figure 2 shows the relationship between lecturers' designs and students' needs based on the judgments of selected lecturers. As mentioned before, the symbol '◇' (with the value of 9) denotes strong relationship, medium relationship was indicated by 'O' (with the value of 3) and weak relationship was indicated by the symbol '△' (with the value of 1).

### *AHP approach:*

First and foremost, a four-level decision hierarchy for teaching effectiveness was constructed. The top level consists of the goal of the problem, which is improving teaching effectiveness. The second level describes the criteria to be considered for teaching effectiveness, namely: clarity, variability, enthusiasm, task orientation and opportunities to learn. The next level consists of the students' needs which can be considered as the sub-criteria according to the categories of teaching effectiveness. The lowest level of the decision hierarchy consists of the alternatives. The hierarchy of lecturers' teaching effectiveness is presented in Figure 3.

By using pairwise comparisons and a (1-9) scale, pairwise comparison matrix for each students' need was constructed, followed by determining the priority value and consistency ratio for each of the students' needs. The consistency ratio (CR) was computed to measure the consistency of the decision maker's responses. In general, if the CR is less than 0.1, then the decision maker's answers are considered acceptable. The summary of priority values and consistency ratio (CR) for the lecturers' design requirements with respect to each of the students' needs are provided in Table 5. As it is shown in the table, the values of CR for each of the students' needs was less than 0.1, therefore it can be said that the evaluation for the 12 students' needs for FB lecturers was acceptable.

By using the AHP synthesis rule, the global priorities of the Lecturers' design requirements were determined, as shown in Table 6.

Table 6

The AHP priority value of the design requirements and CR for each students' need

Students' needs	Preparation	Assignments	References	Presentation	Resourcefulness	Subject Matter Expert	CR
Detailed Explanation	0.2960	0.1105	0.0642	0.2905	0.0601	0.1787	0.08317
Detailed notes	0.2639	0.1017	0.0880	0.1934	0.0756	0.2867	0.08439
English	0.2151	0.0909	0.1245	0.1539	0.1134	0.3022	0.08009
Examples	0.2242	0.0751	0.1165	0.0493	0.1617	0.3732	0.08967
Variety material	0.1698	0.0892	0.2781	0.0601	0.2781	0.1247	0.09281
Case studies	0.1559	0.1369	0.1241	0.0595	0.1753	0.3482	0.08163
Energetic	0.1716	0.0584	0.0989	0.3382	0.0989	0.2341	0.09027
Effort	0.2351	0.1242	0.0596	0.2906	0.0888	0.2017	0.08023
Questioning	0.1704	0.1252	0.0672	0.3371	0.0672	0.2329	0.09101
Handouts	0.2906	0.1242	0.0888	0.0596	0.2017	0.2351	0.08023
Q & A sessions	0.3448	0.1920	0.0591	0.1237	0.0883	0.1920	0.09249
Discussions	0.0861	0.1314	0.0694	0.1979	0.1701	0.3451	0.09192

### 5.3. Priorities of the design requirements

#### *QFD approach:*

By referring to Figure 2, the importance of rank for the lecturers' designs had been identified and prioritized. It shows that *Subject Matter Expertise* was ranked at the top of the lecturers' designs (294.44) followed by *Presentation* (262.12) and *Preparation* (236.2). *Resourcefulness* was ranked at the bottom (107.48) of the lecturers' designs list.

#### *AHP approach:*

From Table 7 we find that the element '*Subject Matter Expertise*' (0.2517) was the most important lecturers' design in fulfilling the students' needs. *Preparation* was at the second position (0.2300) followed by *Presentation* (0.2073). *References* was the last lecturers' design requirement (0.0909) in fulfilling the FB students' needs.

Table 7

Global priorities of the design requirements

Students' needs	Importance rating	Lecturers' Design requirements					
		Preparation	Assignment	References	Presentation	Resourcefulness.	Subject Matter Expert
Detailed Explanation	0.1424	0.2960	0.1105	0.0642	0.2905	0.0601	0.1787
Detailed notes	0.1600	0.2639	0.1017	0.0880	0.1934	0.0756	0.2867
English	0.0344	0.2151	0.0909	0.1245	0.1539	0.1134	0.3022
Examples	0.0766	0.2242	0.0751	0.1165	0.0493	0.1617	0.3732
Variety material	0.0474	0.1698	0.0892	0.2781	0.0601	0.2781	0.1247
Case studies	0.0621	0.1559	0.1369	0.1241	0.0595	0.1753	0.3482
Energetic	0.0409	0.1716	0.0584	0.0989	0.3382	0.0989	0.2341
Effort	0.1407	0.2351	0.1242	0.0596	0.2906	0.0888	0.2017
Questioning	0.1260	0.1704	0.1252	0.0672	0.3371	0.0672	0.2329
Handouts	0.0658	0.2906	0.1242	0.0888	0.0596	0.2017	0.2351
Q & A sessions	0.0308	0.3448	0.1920	0.0591	0.1237	0.0883	0.1920
Discussions	0.0730	0.0861	0.1314	0.0694	0.1979	0.1701	0.3451
Global weights →		0.2300	0.1129	0.0909	0.2073	0.1144	0.2517
Rank →		<b>2</b>	<b>4</b>	<b>6</b>	<b>3</b>	<b>5</b>	<b>1</b>

#### 5.4. Comparison of Lecturers' Design requirements for the QFD and AHP Approaches

The ranks obtained by both approaches are shown in Table 8. The Table shows a slight difference in the ranks of lecturers' designs for both approaches in fulfilling students' needs towards lecturers teaching effectiveness. For both approaches, *Subject Matter Expertise* ranks at the top of the lecturers' designs list, which proves the value and importance of this element for teaching effectiveness.

Table 8

Comparison of ranks of design requirements obtained by QFD and AHP Approaches

Lecturers' Design Requirements	QFD Rank	AHP Rank
Subject Matter Expert	1	1
Presentation	2	3
Preparation	3	2
Assignments	4	4
References	5	6
Resourcefulness	6	5

## Conclusions

This study demonstrates the application of QFD and AHP in fulfilling students' needs towards teaching effectiveness at the Faculty of Business, HSBL University College. A survey was conducted among the FB students in an attempt to determine their requirements/expectations from the lecturers. All the attributes have been placed at the left side of the House of Quality.

Interviews with lecturers were conducted for the purpose of satisfying the students' needs. The survey was then carried out to obtain the relationship between each lecturer's design. Once the students' needs and lecturers' designs were established and properly placed, the next step was to build the relationship between these two types of requirements by using the judgment of selective lecturers as required by the principle of QFD and the analysis of AHP. By using both approaches, the most effective lecturers' designs have been identified. Although the findings for both approaches are slightly different due to the students' rank of importance, however *Subject Matter Expertise* emerges as the most important lecturers' design in fulfilling the students' needs in FB.

As for extension of the study, one can consider applying ANP to address the inner dependency among the elements at various levels of the AHP hierarchy.

## Appendix

Sample pairwise comparison matrices and the priority values of the lecturers design requirements for each students' need.

Detailed explanation	Prep.	Assign.	Referen.	Present.	Resource.	SME	Priority value
Preparation	1	5	3	1	3	3	0.2960
Assignment	0.2	1	3	0.3333	3	0.3333	0.1105
References	0.3333	0.3333	1	0.3333	1	0.2	0.0642
Presentation	1	3	3	1	5	3	0.2905
Resourcefulness	0.3333	0.3333	1	0.2	1	0.3333	0.0601
Subject Matter Expertise	0.3333	3	5	0.3333	3	1	0.1787

CR = 0.08317

Detailed notes	Prep.	Assign.	Referen.	Present.	Resource.	SME	Priority value
Preparation	1	5	3	1	3	1	0.2639
Assignment	0.2	1	3	0.3333	1	0.3333	0.1017
References	0.3333	0.3333	1	1	1	0.3333	0.0880
Presentation	1	3	1	1	3	0.3333	0.1934
Resourcefulness	0.3333	1	1	0.3333	1	0.3333	0.0756
Subject Matter Expertise	1	3	3	3	3	1	0.2867

CR = 0.0843

Understandable English	Prep.	Assign.	Referen.	Present.	Resource.	SME	Priority value
Preparation	1	3	1	1	3	1	0.2151
Assignment	0.3333	1	1	1	0.3333	0.3333	0.0909
References	1	1	1	1	1	0.3333	0.1245
Presentation	1	1	1	1	3	0.3333	0.1539
Resourcefulness	0.3333	3	1	0.3333	1	0.3333	0.1134
Subject Matter Expertise	1	3	3	3	3	1	0.3022

CR = 0.0800

Examples	Prep.	Assign.	Referen.	Present.	Resource.	SME	Priority value
Preparation	1	3	3	3	3	0.3333	0.2242
Assignment	0.3333	1	0.3333	3	0.3333	0.2	0.0751
References	0.3333	3	1	3	0.3333	0.3333	0.1165
Presentation	0.3333	0.3333	0.3333	1	0.3333	0.2	0.0493
Resourcefulness	0.3333	3	3	3	1	0.3333	0.1697
Subject Matter Expertise	3	5	5	5	3	1	0.3732

CR = 0.0896

Material Variety	Prep.	Assign.	Referen.	Present.	Resource.	SME	Priority Value
Preparation	1	3	0.3333	3	0.3333	3	0.1698
Assignment	0.3333	1	0.3333	3	0.3333	0.3333	0.0892
References	3	3	1	3	1	3	0.2781
Presentation	0.3333	0.3333	0.3333	1	0.3333	0.3333	0.0601
Resourcefulness	3	3	1	3	1	3	0.2781
Subject Matter Expertise	0.3333	3	0.3333	3	0.3333	1	0.1247

CR = 0.0928

Case Studies	Prep.	Assign.	Referen.	Present.	Resource.	SME	Priority value
Preparation	1	1	3	3	0.3333	0.3333	0.1559
Assignment	1	1	1	3	1	0.3333	0.1369
References	0.3333	1	1	3	1	0.3333	0.1241
Presentation	0.3333	0.3333	0.3333	1	0.3333	0.3333	0.0595
Resourcefulness	3	1	1	3	1	0.3333	0.1753
Subject Matter Expertise	3	3	3	3	3	1	0.3482

CR = 0.0816

**32 Azilah Anis, Rafikul Islam**

<b>Energetic</b>	<b>Prep.</b>	<b>Assign.</b>	<b>Referen.</b>	<b>Present.</b>	<b>Resource.</b>	<b>SME</b>	<b>Priority value</b>
Preparation	1	3	3	0.3333	3	0.3333	0.1716
Assignment	0.3333	1	0.3333	0.3333	0.3333	0.3333	0.0584
References	0.3333	3	1	0.3333	1	0.3333	0.0989
Presentation	3	3	3	1	3	3	0.3382
Resourcefulness	0.3333	3	1	0.3333	1	0.3333	0.0989
Subject Matter Expertise	3	3	3	0.3333	3	1	0.2341

CR = 0.0927

<b>Effort</b>	<b>Prep.</b>	<b>Assign.</b>	<b>Referen.</b>	<b>Present.</b>	<b>Resource.</b>	<b>SME</b>	<b>Priority value</b>
Preparation	1	3	3	1	3	1	0.2351
Assignment	0.3333	1	3	0.3333	3	0.3333	0.1242
References	0.3333	0.3333	1	0.3333	0.3333	0.3333	0.0596
Presentation	1	3	3	1	3	3	0.2906
Resourcefulness	0.3333	0.3333	3	0.3333	1	0.3333	0.0888
Subject Matter Expertise	1	1	3	0.3333	3	1	0.2017

CR = 0.8023

<b>Questioning</b>	<b>Prep.</b>	<b>Assign.</b>	<b>Referen.</b>	<b>Present.</b>	<b>Resource.</b>	<b>SME</b>	<b>Priority value</b>
Preparation	1	3	3	0.3333	3	0.3333	0.1704
Assignment	0.3333	1	3	0.3333	3	0.3333	0.1252
References	0.3333	0.3333	1	0.3333	1	0.3333	0.0672
Presentation	3	3	3	1	3	3	0.3371
Resourcefulness	0.3333	0.3333	1	0.3333	1	0.3333	0.0672
Subject Matter Expertise	3	3	3	0.3333	3	1	0.2329

CR = 0.0910



Handouts	Prep.	Assign.	Referen.	Present.	Resource.	SME	Priority value
Preparation	1	3	3	3	3	1	0.2906
Assignment	0.3333	1	3	3	0.3333	0.3333	0.1242
References	0.3333	0.3333	1	3	0.3333	0.3333	0.0888
Presentation	0.3333	0.3333	0.3333	1	0.3333	0.3333	0.0596
Resourcefulness	0.3333	3	3	3	1	1	0.2017
Subject Matter Expertise	1	3	3	3	1	1	0.2351

CR = 0.080231

Q & A session	Prep.	Assign.	Referen.	Present.	Resource.	SME	Priority value
Preparation	1	3	3	3	3	3	0.3448
Assignment	0.3333	1	3	3	3	1	0.1920
References	0.3333	0.3333	1	0.3333	0.3333	0.3333	0.0591
Presentation	0.3333	0.3333	3	1	3	0.3333	0.1237
Resourcefulness	0.3333	0.3333	3	0.3333	1	0.3333	0.0883
Subject Matter Expertise	0.3333	1	3	3	3	1	0.1920

CR = 0.092486

Discussion	Prep.	Assign.	Referen.	Present.	Resource.	SME	Priority value
Preparation	1	0.3333	1	0.3333	1	0.3333	0.0861
Assignment	3	1	3	0.3333	0.3333	0.3333	0.1314
References	1	0.3333	1	0.3333	0.3333	0.3333	0.0694
Presentation	3	3	3	1	1	0.3333	0.1979
Resourcefulness	1	3	3	1	1	0.3333	0.1701
Subject Matter Expertise	3	3	3	3	3	1	0.3541

CR = 0.09192

## References

- Abrami P.C. (1989): *How Should We Use Student Rating To Evaluate Teaching*. "Research in Higher Education", Vol. 30, No. 2, pp. 221-227.
- Bier I.D., Cornesky R. (2001): *Using QFD to Construct a Higher Education Curriculum*. "Quality Progress", Vol. 34, No. 4, pp. 64-68.
- Doherty G.D. (2008): *On Quality in Education*. "Quality Assurance in Education", Vol. 16, No. 3, pp. 255-265.
- Ermer D.S. (1995): *Using QFD Becomes an Educational Experience for Students and Faculty*. "Quality Progress", Vol. 28, No. 5, pp. 131-136.
- Evans J.R., Lindsay W.M. (2005): *The Management and Control of Quality*. 6<sup>th</sup> ed. South Western, Cincinnati, Ohio.
- Hilmer S.C., Hilmer B.H., Wilson B., Yochim J. (1995): *Applying Quality Function Deployment to Improve MBA Education*. In: *Academic Initiatives in Total Quality for Higher Education*. Edited by H.V. Roberts. ASQC Quality Press, Milwaukee, Wis.
- Hwarng B.H., Teo C. (2000): *Applying QFD in Higher Education*. "Quality Congress ASQ's Annual Quality Congress Proceedings", pp. 255-264.
- Hwarng B.H., Teo C. (2001): *Translating Customers' Voice into Operations Requirements – a QFD Application in Higher Education*. "International Journal of Quality and Reliability Management", Vol. 18, No. 2, pp. 195-226.
- Jaraiedi M., Ritz D. (1994): *Total Quality Management Applied to Engineering Education*. "Quality Assurance in Education", Vol. 2, No. 1, pp. 32-40.
- Lam K., Zhao, X. (1998): *An Application of Quality Function Deployment to Improve the Quality of Teaching*. "International Journal of Quality and Reliability Management", Vol. 15, No. 4, pp. 389-413.
- Mohamad S.O., Aspinwall E.M. (1998): *An Application of Quality Function of Deployment for the Improvement of Quality in an Engineering Department*. "European Journal of Engineering Education", Vol. 23, No. 1, pp. 105-115.
- Pitman G., Motwani J., Kumar A., Cheng C.H. (1996): *QFD Application in an Educational Setting: A Pilot Field Study*. "Journal of Quality and Reliability Management". Vol. 13, No. 4, pp. 99-108.
- Peters H.M, Kethley B.R, Bullington K. (2005): *Course Design Using the House of Quality*. "Journal of Education for Business", Vol. 80, pp. 309-315.
- Rosenshine B., Furst N. (1973): *Research on Teacher Performance Criteria*. In: *Research in Teacher Education: A Symposium*. Edited by B.O. Smith. Prentice Hall, Englewood Cliffs, NJ, pp. 37-72.
- Salih O.D., Umar M.T., Faisel M.H. (2003): *Quality Function Deployment to designing a Basic Statistic Course*. "International Journal of Quality and Reliability Management", Vol. 20, No. 6, pp. 740-750.

- Sandvik P.W., Hakun W. (1996): *Student Focused Design and Improvement of University Course*. "Managing Service Quality", Vol. 6, No. 6, pp. 434-443.
- Sohail M.S., Jagatheesan R., Nor Azlin A.R. (2003): *Managing Quality in Higher Education: A Malaysian Case Study*. "The International Journal of Educational Management", Vol. 17, No. 4, pp. 141-146.
- Swan B.G., Cano J., Washington, S.M. (2003): *Improving Your Effectiveness as a Teacher*. "NACTA Journal".
- Wan Jaafar W.E. (1996): *Measuring Total Quality at Institutions of Higher Education in Malaysia*. Universiti Kebangsaan Malaysia, Bangi.