Semantic Customer Voice Collection in House of Quality

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Abstract

This paper brings us a point of view for a new methodology in collecting the VOC named as Semantic Customer Voice Collection (SCVC). SCVC is based on structured qualitative data which is obtained from GEMBA, brain storming, interviews and so on. Concept mapping is a methodology that is used as a qualitative analysis tool for obtaining the structured qualitative data from raw data and generates significant results in especially open-ended questionnaires. If this tool is used in QFD for collecting, classifying the voice of customers and designers and analyzing relations among them, it offers some opportunities in terms of data analysis so that the requirements and serious changes in computing the requirements-design feature matrix values would be represented more clearly. This methodology is also used in determining the design features and its relevance.

In this paper, a sample study consisting of improving an evaluation form applied for the courses and instructors in a faculty will be presented. For improving the evaluation form, SCVC approach is integrated into QFD methodology through the relationship matrix.

Keywords: Semantic, Customer Voice Collection, Concept Mapping, the Course Evaluation Form

Introduction

QFD was developed in the manufacturing industry and its purpose is primarily to find out customer requirements systematically and structurally and to translate them into specific design and manufacturing requirements. Requirements are just words coming out from customer's mouth. Because of the differences in the understanding of people, the identification, analysis and documentation of customer requirements should be realized carefully. If the requirements are not understood properly, then the result is disappointment from the viewpoint of the customers.

Surveys, content analysis, interviews with customers and visits to the *gemba* are generally used in order to complete the process of gathering the Voice of the Customer (VoC). The requirements are obtained from the VoC by analyzing the verbalizations and translating them into customer needs. These requirements can be grouped into different categories by using affinity diagrams, hierarchy diagrams, etc.

This paper especially presents a combination of concept mapping and QFD in collecting the VoC named here as Semantic Customer Voice Collection (SCVC).

SCVC was based on concept mapping with structured qualitative data which is obtained from gemba, brain storming, and interviews, etc.

The paper consists of three parts. At first concept mapping is introduced briefly. Within the main part of the paper the application of concept mapping for SCVC is described in improving an evaluation form used for evaluating the context and the performances of instructor and teaching assistant of the course in a faculty of a university. The paper concludes with a short evaluation of the method and its use potentials.

Theoretical Framework

The best known instrument of QFD is the so-called House of Quality (HoQ). The HoQ is a matrix which analyzes customer requirements in detail and translates them into the designers' language. The traditional QFD house of quality matrix has the characteristics given in the Figure 1. It comprises seven main steps. The process of completing the HoQ is described by [1].

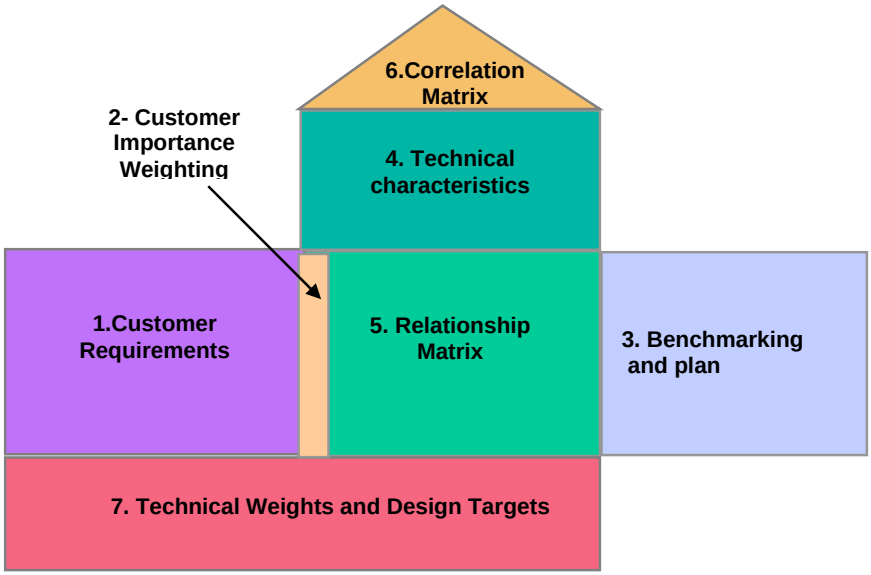

Figure 1: House of Quality

The HoQ starts with the customer needs and the customer competitive evaluations together with the level of importance that the customers assign to their needs complemented by their complaints and the way they rate the products/services of your company against those of the competitors. These needs are translated into technical features by a relationship matrix that further deploys itself into a triangular correlation matrix and competitive technical assessments with its own set of operational goals and targets

The HoQ relates simply customer requirements, technical requirements and competitive analysis. The relationship matrix of HoQ shows the correlation between the customer requirements and the technical features so it is also called as the “planning matrix”. It is crucial that this matrix be developed carefully since it becomes the basis of the entire QFD process.

Customers have values and intentions, and this simple fact is obvious, for example, when one looks at a customer making a single purchase. Their input is extremely valuable although they seldom spark true innovation. Obtaining valid customer input is a science itself [2]. Surveys, content analysis, interviews with customers and visits to the gemba are generally used in order to complete the process of gathering the Voice of the Customer (VoC). Gemba is the place where the product becomes of value to the customer [3]. Going to the gemba allows looking at things in practice. The requirements are obtained from the VoC by analyzing the verbalizations and translating them into customer needs. These requirements can be grouped into different categories by using affinity diagrams, hierarchy diagrams, etc. In determining the customer requirements, it should be also considered the relations between the verbalizations came out from the customers’ mouth as much as the verbalizations their self. The mentioned relations can be obtained by using the semantic structures.

Semantics is the study of the meaning of words, phrases, and sentences in language. It explores the minimum of knowledge about a linguistic sign or combinations of signs such that the expression can convey a specific communicative content. The relation between a sign and its meaning is called reference - when uttering an expression, speakers refer to objects, situations or abstract concepts in the world [4].

The linguistic sign itself denotes a certain meaning. The denotation of a linguistic sign is considered independently of a specific context or situation - (e.g. the noun "night" always denotes the time from dusk till dawn) while its connotation bears additional, often subjective meaning features (e.g. the connotative feature of "night" would be spooky, romantic or haunted).

The set of objects an expression can refer to is called its extension. In contrast, the intension of an expression is the abstract concept or property which determines the applicability of this very expression. For instance, both phrases "evening star" and "morning star" have the same extension:- the planet called Venus. However, their intention is distinct:

The expression "evening star" can be used to refer to the Venus in the evening only and "morning star" can be applied in the morning only.

In a narrower sense, to know the meaning of a linguistic string means to know its truth and under what conditions it is true, respectively. In truth-conditional semantics [4] an expression is mapped onto a meaning structure if the conditions that the expression describes are satisfied.

For instance, a sentence as Peter is sleeping is true - and can therefore be mapped onto a meaningful representation - if in the world there is exactly one individual called Peter who is sleeping. In this sense, the task of a semantic theory is to define truth-conditions. [5]

Concept mapping is a tool that can be also used for mapping the semantic structures.

A combination of concept mapping and QFD in collecting the VOC is named here as Semantic Customer Voice Collection (SCVC).

SCVC was based on concept mapping with structured qualitative data which is obtained from gemba, brain storming, and interviews etc.

Concept mapping is a methodology that is used as a qualitative analysis tool for obtaining the structured qualitative data from raw data and generates significant results especially in open-ended questionnaires.

Prof. Joseph D. Novak developed the concept mapping technique in the 1960s. His work was based on the theories of David Ausubel, who stressed the importance of prior knowledge in being able to learn about new concepts.

Novak believes that "Meaningful learning involves the assimilation of new concepts and propositions into existing cognitive structures". Concept mapping is a cognitive process for incorporating and organizing terms to show a graphic relationship between key concepts. It is a two-dimensional representation tool comprised of concepts, ideas and links.

Concept maps help to organize and group like ideas or thoughts. They provide learners with a visual representation of ideas or concepts [6].

A concept map is a visual tool for representing knowledge relationships.

In a concept map (see [7], p. 62, for example), lines are drawn between pairs of concepts to denote relationships between concepts. Linking words on the lines indicate how pairs of concepts are related. In this way, propositions indicating particular relationships between concepts can be discerned.

Concept mapping has frequently been used as a pedagogical tool to help students “learn more meaningfully” and form a “conceptual understanding of the subject” [8].

Concept mapping has the potential to make a knowledge discipline more “conceptually transparent” [9], and to “convey ideas that are not easily put into words” [10].

Concept meanings are constructed by determining relationships between concepts. “The network of propositions interlinking a group of concepts tells us much about the meaning of the concept from the perspective of the map makers” [11].

In concept mapping, interrelationships between concepts are an “essential property of knowledge” [12]. The flexibility of concept mapping makes it a useful tool for investigating a wide range of aspects associated with student learning in mathematics. Raymond (1997) reports that there has been little reference to the qualitative use of concept mapping in mathematical education research.

There is a need to explore the enabling or constraining aspects of concept mapping as a tool in mathematics education research [13].

This tool was used in HoQ for collecting, classifying the voice of customers and designers and analyzing relations among them. Concept mapping provided some opportunities in terms of data analysis so that the requirements would be represented more clearly and serious changes in computing the needs-design matrix values. This methodology was also used in determining the design features and its relevance in the relation matrix.

Case Study

The following application case will explain mainly the usage of concept mapping as a tool for SCVC. The improvement of a course evaluation form will serve as an example when forming the house of quality with the mentioned approach.

In the evaluation form, both the context and the performances of instructor and teaching assistant of the course are evaluated. This form which is also demonstrated in the Appendix asked each student taking the course to complete within a few minutes at the beginning of the final exam.

With its current context and implementation process, this form continuously brings the faculty administration some complaints from both the raters (students) and instructors to be evaluated, thus this form eventually needs to be developed.

Implementation of the method

A focus group is formed by gathering members from the students, instructors and assistants who are especially experienced in this evaluation process as a rater or a candidate to be evaluated.

In this focus group, students are asked to explain their thoughts about the form and its implementation process, and all their statements are completely recorded considering their exact words.

Statements of the students are debated, grouped and then labeled as the conceptual words (concepts) by the instructors and teaching assistants. These concepts are integrated on a scheme called concept map to show the relationships and interactions among them. QFD related process comes after that by using the concepts instead of the voice of the customer in determining the requirements and their potential solutions. Thus, the concepts are reconsidered and categorized as customer requirements and design features.

The relationship values between each couple of concepts are determined by assigning them a value within the scale of 0-5 (0 no relation and 5 strong relation). For each conceptual word the frequency of its occurring which is also used as an importance level for the next steps is computed.

The obtained frequency is then multiplied by the relationship value so the result would give the final relationship levels between requirements and features. Besides, contradictions among the features are retrieved from the concept map.

Finally, the relation matrix of the house of quality is completed and interpreted for improving the course evaluation form.

Computational Results

Conceptual words retrieved from the thoughts and their frequencies defined in the focus group are represented as in the Table 1 below:

Table 1. Conceptual words and frequencies

NO	CONCEPT DEFINITION	Frequency
1	Sanction	7
2	Assesment date	19
3	Final Exam	3
4	Anxiety	3
5	Mistaken fillings	5
6	Instructor	1
7	Assistant	2
8	Teaching assistant	1
9	Seperate Evaluation	1
10	Course content	1
11	Application format	1
12	Content	9
13	Capability	2
14	Actuality	3
15	Open-ended question	2
16	Concentration	1
17	Assesment results	1
18	Time range to fill	1
19	Rapid evaluation	2
20	The structure of questionnare	1
21	Privacy	1

To show the relationships visually, concept map is drawn as in the Figure 2. Concept map provides knowledge based relationships and can be interpreted more easily than ordinary statements gathered from the customers.

Customers tell anything, but they do not know whether their words represent a requirement or not. These statements or words may be a real requirement itself, or just a problem they have faced before or indicate a technical feature.

The Concept map helps at this point by showing all relationships among the concepts, and by using this map, words of the customers can be interpreted completely and successfully. The correlation value among the concepts (positive or negative) which contains some technical characteristics or product features can also be seen from the map. Thus, correlations can not be missed, such as, “low concentration increases incorrect ratings-negative correlation”, “high level of stress reduces concentration-negative correlation”, “the more the content is accurate, the more reality of the evaluation- positive correlation”.

For example, currently, this course evaluation form is filled just before the final exam and the students have more stress. The map tells final examinations cause stress and stress reduces concentration, then reduced concentration causes incorrect ratings, so the evaluation process would not be efficient.

These concepts explain a problem by means of the timing of filling the forms, and also the requirement about that. We also get the information that “stress-concentration, concentration -incorrect ratings” have negative correlations

Firstly, the concepts are reinterpreted and some of them are merged with others. The quantitative results of the final relationship values are obtained then with relationship values and frequencies, as given in Table 2. These results are calculated by using the formula given below:

$$T_{ij} = F_i * F_j * R_{ij}$$

Where

T_{ij} = Total relationship value in terms of concepts
F_i= Frequency of the concept in row i
F_j= Frequency of the concept in column j
R_{ij}= Relationship value between concept i and concept j

T_{ij} gives the final value for the relationship between customer requirement i and technical feature j in the relationship matrix. Thus, there is no need for extra calculations for importance levels and relationship values.

At this point, concepts and the relationship values between each couple of them are determined (See Figure 2 and Table 2). The next step which will take our concepts to the QFD process is dividing these concepts whether they represent a customer requirement, product feature or both (considering a problem and its solution the customers have met before). Table 2 shows all relationships, so even if we divide this table according to the requirements of the customer and product features, the values in Table 3 can be retrieved from Table 2.

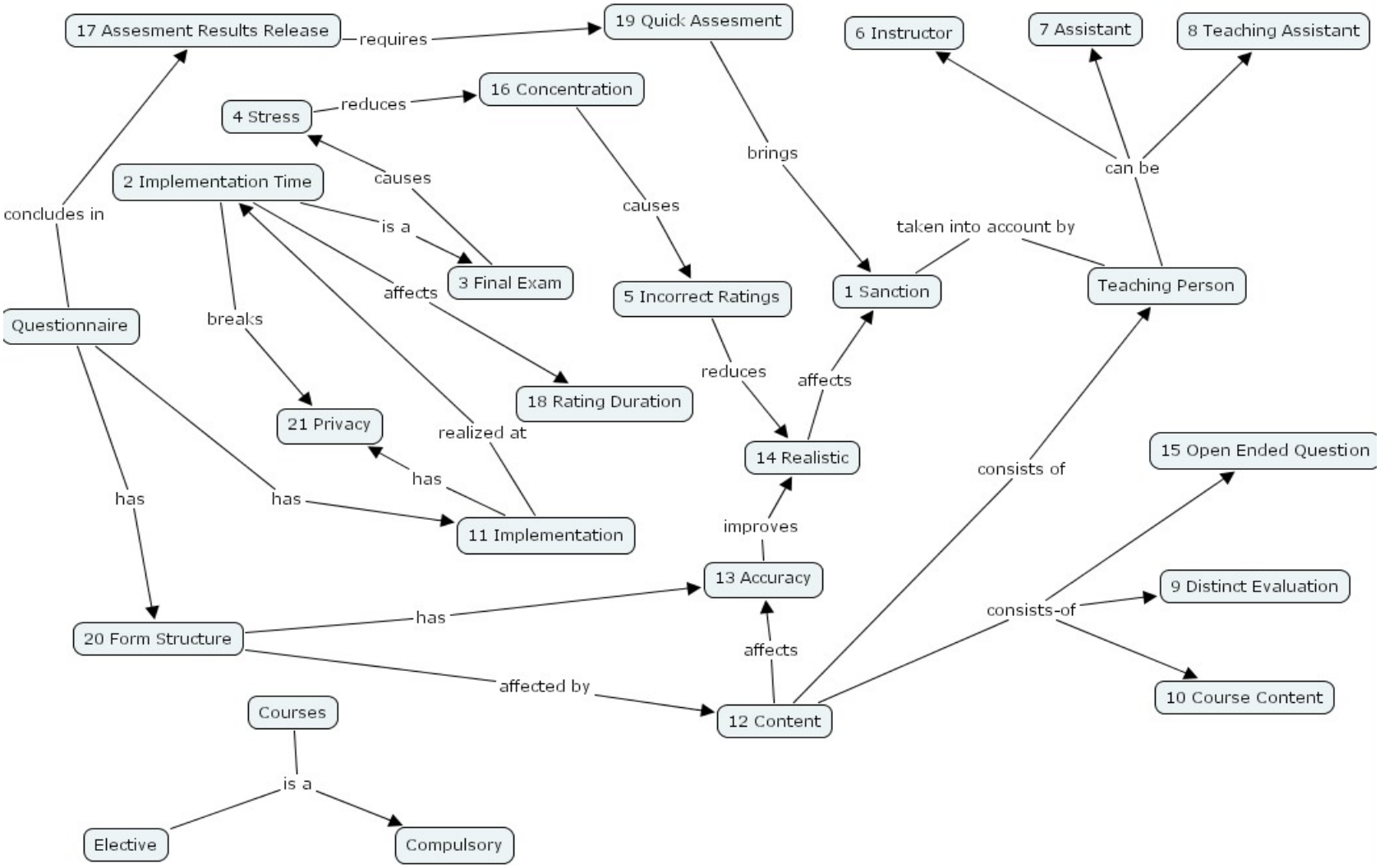

Figure 2. Concept Map for Course Evaluation Form

Table 2. Relationship Values Between Couples of Concepts

		FREQUENCY	7	19	3	3	5	1	2	1	1	1	1	9	2	3	2	1	1	2	1	1	1		
		NO	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21		
FREQUENCY	NO		Sanction	Implementation date	Final Exam	Stress	Incorrect Ratings	Instructor	Assistant	Teaching assistant	Distinct Evaluation	Course content	Application format	Content	Accuracy	Realistic	Open-ended question	Concentration	Assesment results	Time range to fill	Rapid evaluation	The structure of questionnare	Privacy	Max	Average
7	1	Sanction	0	0	0	0	105	35	70	35	35	35	35	315	70	105	70	35	35	0	35	0	21	315	49.3
19	2	Implementation date	0	0	285	285	475	0	0	0	0	0	57	0	0	285	0	95	0	190	0	19	0	475	80.5
3	3	Final Exam	0	285	0	45	45	15	0	9	3	15	9	81	6	27	0	15	0	18	0	0	0	285	27.3
3	4	Stress	0	285	45	0	75	3	6	3	3	0	9	0	6	45	0	15	0	18	0	0	9	285	24.9
5	5	Incorrect Ratings	105	475	45	75	0	5	30	5	0	0	25	45	30	15	30	25	25	50	0	15	15	475	48.3
1	6	Instructor	35	0	15	3	5	0	6	5	3	5	0	0	10	9	10	1	0	2	0	0	3	35	5.3
2	7	Assistant	70	0	0	6	30	6	0	10	6	6	0	0	20	30	20	10	0	0	0	0	6	70	10.5
1	8	Teaching assistant	35	0	9	3	5	5	10	0	3	5	0	0	10	15	10	0	0	0	0	0	3	35	5.4
1	9	Distinct Evaluation	35	0	3	3	0	3	6	3	0	1	0	27	10	9	6	0	1	0	0	3	3	35	5.4
1	10	Course content	35	0	15	0	0	5	6	5	1	0	0	27	10	15	6	1	0	0	0	0	0	35	6.0
1	11	Application format	35	57	9	9	25	0	0	0	0	0	0	9	10	15	6	5	0	6	0	5	3	57	9.2
9	12	Content	315	0	81	0	45	0	0	0	27	27	9	0	90	135	90	9	0	90	0	45	9	315	46.3
2	13	Accuracy	70	0	6	6	30	10	20	10	10	10	10	90	0	30	20	6	10	20	6	10	2	90	17.9
3	14	Realistic	105	285	27	45	15	9	30	15	9	15	15	135	30	0	30	9	15	30	15	9	9	285	40.6
2	15	Open-ended question	70	0	0	0	30	10	20	10	6	6	6	90	20	30	0	2	6	12	10	10	6	90	16.4
1	16	Concentration	35	95	15	15	25	1	10	0	0	1	5	9	6	9	2	0	0	10	0	1	3	95	11.5
1	17	Assesment results	35	0	0	0	25	0	0	0	1	0	0	0	10	15	6	0	0	0	5	3	0	35	4.8
2	18	Time range to fill	0	190	18	18	50	2	0	0	0	0	6	90	20	30	12	10	0	0	0	10	2	190	21.8
1	19	Quick assessment	35	0	0	0	0	0	0	0	0	0	0	0	6	15	10	0	5	0	0	5	0	35	3.6
1	20	The structure of form	0	19	0	0	15	0	0	0	3	0	5	45	10	9	10	1	3	10	5	0	0	45	6.4
1	21	Privacy	21	0	0	9	15	3	6	3	3	0	3	9	2	9	6	3	0	2	0	0	0	21	4.5

The values in the Table 2 above show the strength of the relationship between each concept pairs. Maximum and also average values for each concept are also calculated.
Maximum relationship value in each row is highlighted, - for example, if we consider “sanction”, it is mostly related with “content”, while students think that with the current form, sanction would not be relevant.
In the second row, it is seen that the maximum relationship of “assessment date” is “mistaken fillings” with the value 475. In the next step, it is realized that these relationship values can be considered as values in the relationship matrix of the house of quality.
All these concepts and relationship values are examined and decided to be divided into two categories as “customer requirements” and “technical features”. Some of the concepts are related with both customer requirement and technical characteristics, so in the Table 3, same concept numbers can be seen in rows and columns.

Related to these concepts given in the map, some of them are considered as requirements and some of them are features. This manipulation is arranged in the Table 3 given below:

Table 3. Arranged Requirements and Technical Characteristics Related With Concepts

		Form Structure	**Implementation Style**	**Evaluation of the results**	**Content of the form**	**Assessment Date**	**Sanction**	**Compulsory-Elective**	**On the web**
NO	**Customer Requirements**	**20**	**11**	**17**	**12**	**2**	**1**	**T**	**T**
3	Not being applied just before the exam	0	9	0	81	285	0	0	150
4	Do not increase the stress level during final exam	0	9	0	0	285	0	0	150
5	No mistaken evaluations	15	25	25	45	475	105	0	50
6	Right evaluation of the instructor	0	0	0	0	0	35	150	0
7	Right evaluation of the assistant	0	0	0	0	0	70	150	0
8	Right evaluation of the teaching assistant	0	0	0	0	0	35	150	0
9	Separate evaluation of assistant and instructor	3	0	1	27	0	35	0	10
10	Questions about the content of the course	0	0	0	27	0	35	50	10
12	Development of the content of course evaluation form	45	9	0	0	0	315	100	50
2	Better timing for evaluation	19	57	0	0	0	0	0	100
1	Realization of the feedbacks retrieved from the evaluation results	0	35	35	315	0	0	0	50
13	Adequacy of evaluation criteria for the factors under consideration	10	10	10	90	0	70	100	0
14	Reality of evaluation criteria for the factors under consideration	9	15	15	135	285	105	50	20
15	Open-ended questions	10	6	6	90	0	70	0	20
16	More concentration on evaluation process	1	5	0	9	95	35	0	100
18	More time range for the evaluation process	10	6	0	90	190	0	0	150
19	Rapid analysis and reporting of the results	5	0	5	0	0	35	0	100
21	Privacy of personal evaluation	0	3	0	9	0	21	0	150
	TOTALS	**127**	**189**	**97**	**918**	**1615**	**966**	**750**	**1110**

In addition to the conceptual words, academicians in the group decide some technical characteristics for more improved evaluation form, and the expressions with "T" marks include these characteristics. For these additional product features the focus group assign a value by considering the maximum relationship result. The numbers under the expressions show the relation concept from the list given in the Table 2.

T_{ij} *values* gives the final value for the relationship between customer requirement *i* and technical feature *j* in the relationship matrix. Thus, there is no need for extra calculations for importance levels and relationship values. These values include frequency multiplications as the importance levels. Results show that the most important technical features about the course evaluation form under consideration are;

- Assessment date (1615)
- Filling on the web (1110)
- Sanction (966)
- Content of the form (918)
- And the others…

Therefore, during the revision of the evaluation form, the assessment date should especially be changed and sanction level increased. By means of content changes open ended questions should be added, assistants and instructors should be evaluated separately. Another problem with the form is privacy because of the assessment date. Privacy is less important then the several concepts given in the Table 2 because of the frequency, this indicates that students do not usually declare such a word during the focus group meeting. This point differentiates concept mapping and concept listing which is applied in the focus groups. If only concepts are listed for gathering the requirements, then privacy would have one of the least important concepts. However, the concept map (see Figure 2) tells us that privacy is highly related with the most frequent concepts. Because of the assessment date (just some minutes before the final exam) is not appropriate for the evaluation of the course, the students feel stressed, and anxious about his/her ratings that can be seen by the instructor and other students. As a result, concept mapping can reveal the requirements which are hidden behind the words.

Filling the forms on the web at any time within a predetermined time range by saving the privacy and concentration would be the best solution for the student. Some parts of the results of the evaluations should be forwarded to the students rapidly after the evaluation process has finished.

Conclusion

In this paper, a sample study consisting of redesigning an evaluation form applied for the courses and instructors in our Faculty was improved. SCVC approach was integrated into QFD methodology through the relationship matrix to improve the evaluation form. For this improvement process, concept mapping technique was adapted to collect the voice of customer because of its semantic behavior. Concept mapping provided some opportunities in terms of data analysis so that the requirements would be represented more clearly and serious changes in computing the needs-design features matrix values. This methodology was also used in determining the design features and its relevance in the relation matrix.

Results showed that the most important technical feature about the course evaluation form under consideration was "assessment date" and "filling on the web" came after that. Following this route, filling the forms on the web at any time within a predetermined time range by saving the privacy and concentration would be the best solution for the student. Some parts of the results of the evaluations should be forwarded to the students rapidly after the evaluation process has finished.

Consequently, successful results were obtained by means of making required changes on the course evaluation form. Some times importance levels and requirements may mislead the designers if they only listed in a table. Thus, the requirements should be considered as concepts and the relationships between the concepts should be examined visually. Concept mapping provides the tool needed in this situation. Concept mapping can reveal the requirements which are hidden behind the words. This study also presented practical way for the QFD executers from several industries that do not have much time for complex calculations during the applications.

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Appendix A: The Current Course Evaluation Form

DOKUZ EYLUL UNIVERSITY
FACULTY OF BUSINESS ADMINISTRATION
INSTRUCTOR AND COURSE EVALUATION

ATTENTION : *For coding please use a dark pencil. DO NOT USE a pen.*

CODE OF INSTRUCTOR				
0	0	0	0	0
1	1	1	1	1
2	2	2	2	2
3	3	3	3	3
4	4	4	4	4
5	5	5	5	5
6	6	6	6	6
7	7	7	7	7
8	8	8	8	8
9	9	9	9	9

CODE OF COURSE					
0	0	0	0	0	0
1	1	1	1	1	1
2	2	2	2	2	2
3	3	3	3	3	3
4	4	4	4	4	4
5	5	5	5	5	5
6	6	6	6	6	6
7	7	7	7	7	7
8	8	8	8	8	8
9	9	9	9	9	9

RATING
1- Poor
2- Fair
3- Good
4- Excellent

THE INSTRUCTOR

1. enjoys teaching and displays enthusiasm for the subject	1 2 3 4
2. gives examples to help me understand	1 2 3 4
3. prepares exam questions which reflect the course content	1 2 3 4
4. is fair in grading exams and assignments	1 2 3 4
5. comes to class regularly on time and for the whole period	1 2 3 4
6. encourages participation in class	1 2 3 4
7. presents the subject in an organized manner	1 2 3 4
8. has stimulated my ability for critical thinking	1 2 3 4
9. tries to make her (him) self available in and out of classroom	1 2 3 4
10. has a good command of language of instruction and speaks clearly	1 2 3 4

THE COURSE

1. contains topics which are relevant to my occupational goals	1 2 3 4
2. contains topics which are related to my academic well-being	1 2 3 4
3. deserves to be advised to other students	1 2 3 4

THE TEACHING ASSISTANT
(IF ASSIGNED FOR THE COURSE)

1. is actively involued in assisting the course	1 2 3 4
2. is available during posted office hours	1 2 3 4
3. displays interest for students questions / problems	1 2 3 4
4. demonstrates knowledge of subject matter	1 2 3 4

THE STUDENT

my performance in this course	1 2 3 4