



A Statistical Evaluation of Civil Engineering Education in Turkey in terms of Value Engineering Concepts

Gülçağ Albayrak^{a*}, İlker Özdemir^a, Uğur Albayrak^a

^a*Eskişehir Osmangazi University, Faculty of Engineering, Department of Civil Engineering*

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Abstract

The studies that have been made to ensure the quality of engineering education accelerate all over the world and also in Turkey. Not only the cheapest or the most profitable solutions but also the optimal solutions which respond to demands of the students, who can be defined as customers of teaching activities, should be investigated for more valuable and qualifying engineering education. For this reason, the student's needs and consequently teaching strategies within the scope of value engineering have to be evaluated. In this study a survey was applied on 301 undergraduate students from 6 different civil engineering departments. Scientific development of the faculty and the department, quality of lectures and transportation opportunities of the city etc. were investigated. Surveying results were statistically evaluated and the assessments have been made about the higher education institutions utilizing by value engineering principles. According to the results, civil engineering education seems to be lacking suitable basis, physical places and equipment, except for a few qualified universities.

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1. Introduction

The shape and size of the problems of the universities are changing with globalization and technological development. Therefore, authorities discuss whether it is contemporary and high quality engineering education in today's world. There is a need for questioning of civil engineering education, examining of the current and near-future status of civil engineering education and searching for the solution of problems (Altın, 2009). The civil engineering construction covering aspect of knowledge is very broad and the discipline is following the new knowledge, new technical, the new craft, the new material in project application, but in terms of rapid expansion, this requests civil engineering construction class talented person must have the broad aspect of knowledge and the new knowledge structure (Gao, 2011).

The aim of this study is to determine the quality with subjective value engineering criteria under various titles which appear in civil engineering education. Value engineering is a technique and a part of a process which directs to

* Corresponding Author: G. Albayrak, e-mail: galbayrak@ogu.edu.tr

determine the function "best value" or "value and the relationship between the cost of the best" (Dale, 1993). Higher education institutions (as enterprises), students instead of customers and civil engineering education (as product) are adapted to the scope of value engineering. The studies in this area were not adequate in the literature. The process of civil engineering education was examined in this study. "Process" is an operation which creates value for students. This process that begins with an input targets to produce a specific output. In civil engineering education, the "input" is a student who have completed secondary education and provided conditions that have been determined. "Output" is a civil engineer who will continue his working life in construction industry (Asan, 2009).

Firstly, input must be selected well to obtain high performance in civil engineering education. After then, output is able to provide conditions that are expected and this quality must be sustainable. In today's competitive environment, success indicators should be monitored and compared. For this reason, students' conditions should be determined; level of student satisfaction should be investigated and these data must be expressed in numeric values.

When investigating the indicators of success in this study, we benefited from the definition and principles of value engineering. In general these indicators can be classified as input, output, outcome (benefits), efficiency, effectiveness, and quality.

An activity's input has no meaning alone. However, it is important to show initial conditions. Department of civil engineering is preferred by the students for whom qualified means that the input is quality.

"Output" indicators provide information about the quantity of services that are produced. But it cannot show the effectiveness of production process. The number of students graduating from the department, academic publications and scientific researchers can be listed as examples.

"Result" factor is the main indicator on realization of the objectives. In other words, result is the benefit. For example, graduates are hired easily after civil engineering education.

"Efficiency" is related to bring the highest point of an activity's result. It is important to achieve output with a minimum cost in whole teaching process. It indicates performance and success. The budget which is allocated in higher education should be considered as optimal use. Exceeding the determined period of the civil engineering education by student leads to misuse of the resource. At the same time, the efficiency and success reduce.

"Effectiveness" examines the consequences of the outputs. It is an indicator of effectiveness that civil engineering students who graduated from the department are preferred widely.

The universities should ensure students' expectations. The reached level of this is called "quality". These are examples of quality indicators in civil engineering education: civil engineers can find work as soon as possible; trainees can be requested by the private sector, etc.

It is important to see civil engineering education as a process and pay attention to what is written above. Thus, education may access targets. The Council of Higher Education, universities, Association for Evaluation and Accreditation of Engineering Programs, Chamber of Civil Engineers and many other institutions have responsibility on evaluation, accreditation and improvement of this process. If this process can be managed well with collaboration, our country's civil engineering education will become more successful.

2. Methods

There The Chamber of Civil Engineers conducted a research called "Reality of Turkey in Civil Engineering Education" and it was published in 2008. This study examined the current state of civil engineering education in Turkey.

A survey was applied to Kocaeli University Civil Engineering Department's 3rd and 4th grade students (Engin et al. 2009). The points of view of the students in civil engineering education were examined by this survey.

Birinci (2009) studied civil engineering education in Turkey in terms of physical conditions, laboratories, internships, status of student, duration of education, distribution of lecture and lectures' contents.

Value engineering can be used as a tool for the solution of problems that universities encountered. In this study, the students' points of view are considered. The survey (shown in Appendix) method was chosen to collect data in this investigation and the quintet Likert grading scale was preferred. The options which were presented to the participants were calculated in the following format:

"1 = very poor, 2 = below average, 3 = average, 4 = above average, 5 = excellent"

Initially for a civil engineering program; the preference factor, the status of department and faculty, quality of courses and internships, the department's scientific capacity and city/transport facilities were seen significant in terms of "value" concept. The survey limited 20 questions under these main topics.

The survey could be delivered only to the students of 6 universities due to constraints of time, cost, transportation and etc. Participants were 2 or 3 year students. In this context 6 universities were classified as "developed", "developing" and "newly established". Firstly, universities' rankings in previous years, the number of publications, award-winning projects, the number of students and faculty members were researched in electronic media and then those with similar features of the universities were brought together in the same group.

The number of collected opinions is shown in Table 1.

Table 1. Distribution of the participants according to their level of universities

Level	Frequency	Percent
Developed	94	31.2
Developing	98	32.6
Newly Established	109	36.2
Total	301	100.0

In this paper, IBM SPSS Statistics Version 20 was used to analyze utilizing statistical methods. This program was seen commonly in the references of this study, so it was preferred in order to obtain reliable results. The level of statistical significance was 5 % in all tests of this study. The most common proof of the reliability is Cronbach's alpha coefficient in Likert type scale surveys. However, alpha factor is not enough alone. In order to make an informed evaluation, contribution of the coefficient must be investigated to each problem in the factor. As a result of transactions with IBM SPSS, Cronbach's alpha coefficient is 0.806. The survey seems to be quite reliable. Question 20 reduces the alpha coefficient of each section of the questionnaire. If this question is removed, it turns out that the alpha coefficient increases. It indicates that there is a problem in understanding the question by participants. Therefore, this question was excluded from evaluation. Factor analysis was applied to data of survey and questions were collected under the following factors (Table 2).

Table 2. Factor analysis

Factors	Preference of the Department	Level of Development of the Department	Quality of Courses and Internships	Scientific Capacity of the Department	City and Transportation
Questions	1, 3, 19	2, 5, 6, 7, 8	4, 9, 10, 11,12	13, 16, 17, 18	14,15

In order to choose the appropriate method of analysis of the survey data in IBM SPSS Kolmogorov-Smirnov Test and One-Way ANOVA were applied. According to the results, the non-parametric data analysis methods can be used. These methods are Mann-Whitney U test and Kruskal-Wallis H test.

Mann - Whitney U test is used for two different groups with non-parametric data. The averages of certain variable are compared owing to this test. Independent two groups tested the hypothesis that groups occur from the main masses with the same distribution.

In this study, both "Developed"- "Developing" and "Developing"- "Newly Established" (the data which is in binary form) are tested with Mann-Whitney U test in SPSS. Asymp. Sig. (Asymptotic significance) values are obtained and they are below the limit value of 0.05. It is understood that "Developed" and "Developing" universities' participants have different answers which considered statistically significant both of five question groups of survey. According to results, "Developing" universities' Mean Rank values were lower than "Developed" universities for each of the five groups. As a result, "Developed" universities' students prefer mostly their department than other students and they find their department and faculty more improved. "Developed" universities' students think that the quality of their courses and internships is better. In the same way, they characterize the scientific capacity of their department higher level and they show that they are more satisfied in terms of city and transportation.

Mann-Whitney U test was applied to the data of "Developing" and "Newly Established" universities. There are quite different situations where the results mentioned in the previous paragraph. 1st, 2nd and 5th question groups remain below the level of statistical significance of 0.05. It means that the answer averages of "Developing" and "Newly Established" universities' students are very different from each other. This difference is in favor of "Developing" universities. "Developing" universities' participants reported superior visibility than "Newly Established" universities' participants about topics of choosing their department, sophistication of their faculty and city/transportation. Surprisingly, questions about the quality of courses/internships and scientific capacity of department are answered equally by these universities in terms of statistical significance limit.

If you have more than two groups in the absence of the normal distribution of the data, Kruskal-Wallis H test is used. Application of this test is similar with Mann-Whitney U test.

Firstly, in that regard five different hypotheses were created:

1) H0: There is no significant difference in preference of the participants in terms of the level of their universities according to data from participants.

2) H0: There is no significant difference in sophistication of their faculty and department in terms of the level of the universities according to data from participants.

3) H0: There is no significant difference in quality of courses and internships in terms of the level of universities according to data from participants.

4) H0: There is no significant difference in scientific capacity of the universities in terms of universities level according to data from participants.

5) H0: There is no significant difference in city and transportation in terms of universities level according to data from participants.

Kruskal-Wallis H test was used with SPSS and Asymp. Sig. values resulted in 0.000 for each five group of questions. For this reason all of H0 hypotheses are rejected. This can be interpreted that there is a statistically significant difference between the views of all universities' participants about issues of preference of departments, sophistication of departments, quality of courses and internships, scientific capacities and city/transportation.

In this paper, only the scientific capacities of the departments are examined.

Table 3: The scientific capacity of their departments in terms of "Developed" universities participants

DEVELOPED UNIVERSITIES	
The Number of Students	94
Average	3.4
Standard Deviation	1.168

What is the level of scientific capacity of your department?

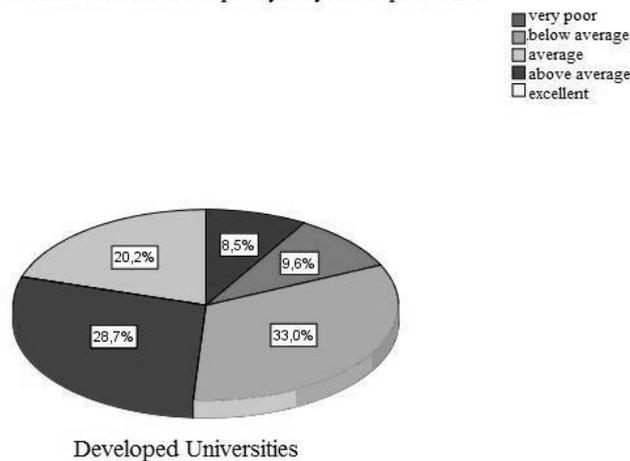


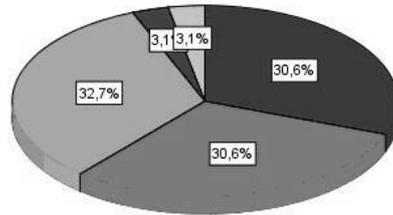
Figure 1. The graphic of "Developed" universities participants' ratings

Table 4. The scientific capacity of their departments in terms of "Developing" universities' participants

DEVELOPING UNIVERSITIES	
The Number of Students	98
Average	2.2
Standard Deviation	1.005

What is the level of scientific capacity of your department?

- very poor
- below average
- average
- above average
- excellent



Developing Universities

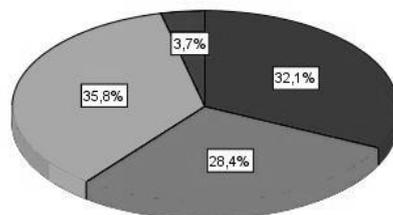
Figure 2. The graphic of "Developing" universities participants' ratings

Table 5. The scientific capacity of their departments in terms of "Newly Established" universities' participants

NEWLY ESTABLISHED UNIVERSITIES	
The Number of Students	109
Average	2.4
Standard Deviation	0.906

What is the level of scientific capacity of your department?

- very poor
- below average
- average
- above average



Newly Established Universities

Figure 3. The graphic of "Newly Established" universities participants' ratings

3. Results

The following results were reached from the data obtained in this survey.

Table 6. Averages of survey responses

	The Status of Preferring Department	Level of Development of the Department	Quality of Courses and Internships	Scientific Capacity of Department	City and Transportation
Developed	4.1	3.9	3.2	3.4	3.7
Developing	3.7	2.9	2.9	2.2	2.9
Newly Established	3.2	2.5	2.8	2.4	2.4

4. Discussion

In recent years, when civil engineering education spread across the country, the quality has decreased contrarily. Lately, the word "quality" is used for not only products and services but also for education. Quality can be considered as "customer satisfaction". In this study, students have been identified as customers. When providing the students satisfaction, the use of limited resources must be taken into account. According to value engineering principle, education policies should aim to get the highest efficiency at the lowest cost. Planning which promotes individuals and gives priority to quality can make solving the educational problems in Turkey easier.

5. CONCLUSION

When establishing a university, faculty or department, there is only political approaches and it has led to the proliferation of institutions without infrastructure. According to the results of research, two important conclusions can be reached with the presence of a large number of civil engineering departments. First, except for a small number of qualified universities, civil engineering education is provided with lack of physical environment, unsuitable environment and insufficient equipment. The latter, if employment problem is not solved, all young graduates are candidates for being unemployed. In addition, there is no doubt that the expenditure which used for teaching of more redundant engineers is such an excessive cost for state budget. It can be used training facilities with higher level course for a smaller number of engineers needed.

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Survey for civil engineering students	1	2	3	4	5
1) How much did you prefer your department?					
2) How is your department's level in your university in terms of being an effective department?					
3) Is it a right decision that you chose this department?					
4) Is your program's curriculum up-to-date actual and adequate?					
5) How do you evaluate your department's scientific sufficiency compared with other civil engineering departments?					
6) What is your department's level in your faculty in terms of priority compared with other departments?					
7) Are there a lot of departments in your faculty?					
8) Is the number of academicians in your department sufficient?					
9) Does your department attach importance to practice in the courses and laboratories?					
10) Are there sufficient lessons that include theoretical and scientific methods?					
11) How much do you understand the topics that you are taught?					
12) Is professional and institutional internship important in your university?					
13) Are the materials such as books, internet, and computer laboratories etc. adequate.?					
14) Does your city support your department?					
15) How is your city in terms of transportation and accommodation?					
16) Is your department's the number of publication (journal, article, project, research) sufficient in a year?					
17) How is your academicians' participation in mobility programs for education and research?					
18) How is your department's participation level in evaluation and accreditation foundations like MUDEK, ADEK and ABET etc.?					
19) How is your employment opportunity after graduation?					
20) Are there a lot of deficiencies in your department?					
(Not write name, surname or comment. Only grade your opinion.)					
Evaluation criteria:					
(1): Very poor, (2): Below average, (3): Average, (4): Above average, (5): Excellent					