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Evaluation of Internship Programs for Educational Improvements: A Case Study for Civil Engineering*

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The main goal of this paper is to evaluate civil engineering internship programs for educational improvements by doing statistical analyses on comprehensive survey data gathered from inquiry sheets. A web base online survey tool was prepared and 251 inquiry sheets were statistically analyzed. Univariate analyses were performed to describe the interns' population and their needs. Levene's test was used to test equality of variances and the t-value was used for equality of means. The One-Way ANOVA procedure was used to test the hypothesis that the means of groups are not significantly different. Finally, binary logistic regression was conducted to identify factors that predict the students' satisfaction level. A positive, statistically significant relationship was identified between internship satisfaction level, future carrier planning, multidisciplinary team working, learning theoretical and practical applications, food service during the internship period and worksite internship. This study proved that the civil engineering students are keen to participate in practical training programs during their period of education and also that civil engineering departments should update the theoretical courses taking into consideration the practical applications.

Keywords: engineering education; civil engineering internship; statistical analyses; logistic regression

1. Introduction

Civil engineering is the oldest engineering discipline concerned with providing public infrastructure and services [1]. Civil engineering is an interdisciplinary field, and most of the projects designed and built represent very complex systems, both during the construction phase and in the building phase [2]. Civil engineers shape the infrastructure of the world including design, construction and maintenance of all physical assets. In considering the challenges of the future engineering profile, civil engineers must gain the necessary technical competencies but should also be trained with a stronger emphasis in engineering science to make them flexible enough to be involved in several engineering disciplines [3].

According to ASCE (The American Society of Civil Engineers), civil engineering education must provide students with the ability to comprehend and adapt to continuing changes in scientific, technological, economic, social and political arenas of a diversified global society. The involvement of practitioners in the formal education process will improve civil engineering education, while demonstrating the challenge and the satisfaction of civil engineering [4]. Tapia *et al.* [5] stated that civil engineering was essentially a practical career where the theoretical knowledge has to always be accompanied by practical applications. Abudayyeh *et al.* [6] presented the results of two surveys conducted by ASCE. In this research, practitioners were asked what could be done to avoid the 'black-box' experience by recent civil engineering graduates. Two major themes developed from the responses. The first was that practitioners wanted students to be taught the theory. The second was that students needed to have practical, real-world, hands-on experiences prior to graduation. Many of the practitioners suggested that internships and co-ops should be required elements of the undergraduate program. King and Duan [7] stated that the cultivation of professional ability for undergraduate civil and construction engineering students was very important to help them meet the challenges that await them in the fast changing world. Newport and Elms [8] showed that many of the qualities associated with effective engineer behavior were learnable and could be taught within an education program. Xisheng and Zegen [9] mentioned that civil engineering strongly requires production practice, which was the most important part of the practical teaching. In order to enhance the practical ability of students, on-site engineering production practice must be considered during the formal education. Practical teaching is the effective way to teach professional knowledge and enhance the students' capabilities and it plays a unique role in high-quality civil engineering personnel training. Hanna and Sullivan [10] researched the benefits of a three credits design experience course that was part of the graduation requirements at the University of Wisconsin-Madison. They found that the ability to work in groups and with professionals was an excellent learning experience. Also, the students were able to apply their engineering education to solving a real-world problem. This real-world problem exposed students to the design process and the constraints and complications involved. As pre-

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sented by Davis [11], internships were great opportunities to meet many different kinds of people. The intern can meet people whose experiences help the intern to broaden his or her interests.

2. Civil engineering in Turkey

The Council of Higher Education (YOK) is responsible for all higher education institutions in Turkey. YOK is a fully autonomous supreme corporate public body that is responsible for planning, coordination, governance and supervision of higher education [12]. The students are selected for higher education by a nationally unified entrance examination. There are two-stage centrally administered university entrance examinations, which are called 'transition to higher education exam' and 'placement exam' [12, 13].

With regard to civil engineering education in Turkey, civil engineering departments consists of six main divisions, which are transportation engineering, structural engineering, geotechnical engineering, hydraulics, construction management, and construction materials. The Bachelor of Engineering in civil engineering comprises four years full-time academic study. The course plan in civil engineering is given in Table 1 with course title, course hours (theory and practice) and ETCS (the European Credit Transfer and Accumulation System) credits.

The first year of the program is mainly dedicated to the compulsory courses in the basic curriculum, such as mathematics, physics, chemistry, computing and basic engineering courses. The compulsory courses are given in the second, third and fourth years. The third and fourth years consist of specia-

Table 1. Course plan in civil engineering

1st Semester course plan			**2nd Semester course plan**		
Course title	**Credit hours**	**ETCS**	**Course title**	**Credit hours**	**ETCS**
English I	2+0	2	English II	2+0	2
Principles of Atatürk and history of Turkish rev. I	2+0	2	Principles of Atatürk and history of Turkish rev. II	2+0	2
Turkish language I	2+0	2	Turkish language II	2+0	2
Chemistry	3+2	6	Linear algebra	2+0	2
Engineering drawing	3+1	4	Mathematics II	4+0	6
Mathematics I	4+0	6	Physics II	3+2	6
Physics I	3+2	6	Computer programming	2+1	3
Introduction to Civil Engineering	2+0	3	Geology	2+1	3
			Statics	4+0	4
3rd Semester course plan			**4th Semester course plan**		
Course title	**Credit hours**	**ETCS**	**Course title**	**Credit hours**	**ETCS**
Differential equations	4+0	6	Adv. Strength of materials	4+0	6
Building information and construction techniques	2+1	5	Fluid mechanics	3+0	5
Dynamics	2+0	4	Material of construction	3+0	4
Material science	3+0	5	Numerical methods in engineering	3+0	5
Probability and statistics	3+0	4	Structural analysis I	3+0	6
Strength of materials I	4+0	6	Surveying	2+1	4
5th Semester course plan			**6th Semester course plan**		
Course title	**Credit hours**	**ETCS**	**Course title**	**Credit hours**	**ETCS**
Highway engineering	3+0	4	Dynamics of structures	3+0	6
Hydraulics	4+0	5	Laboratory	0+2	3
Hydrology	2+0	3	Railway I	3+0	5
Reinforced concrete I	4+0	6	Reinforced concrete II	4+0	5
Soil mechanics I	4+0	5	Soil mechanics II	3+0	5
Structural analysis II	4+0	5	Steel structures I	4+0	4
Social selective I	2+0	2	Social selective II	2+0	2
7th Semester course plan			**8th Semester course plan**		
Course title	**Credit hours**	**ETCS**	**Course title**	**Credit hours**	**ETCS**
Civil engineering design	2+0	5	Engineering economics	3+0	6
Construction management	3+0	5	Final year project	0+4	12
Foundations	3+0	4	Elective 3	–	3
Water resources	4+0	5	Elective 4	–	3
Water supply and environment health I	3+0	5	Elective 5	–	3
Elective 1	–	3	Elective 6	–	3
Elective 2	–	3			

lization courses and elective courses as well as compulsory courses. The academic calendar consists of two 16-week semesters, including registration and final examination periods. The summer school module may be offered when needed. All courses are in Turkish. However, some courses are in English for the students in the one year English preparation course. The graduation project is undertaken in the fourth year of study and it is submitted as a thesis.

With regard to internship programs in civil engineering, the students have to spend a total of six weeks in three different industries, which are construction, transportation and hydraulics at the end of the 4^{th} and 6^{th} semesters. While the construction internship is compulsory, transportation and hydraulic internships are selective. Each internship program lasts twenty working days. The students have to complete a forty working days internship program in order to graduate from the university. The internship commission is responsible for organizing, admission and finally approving the internships. After the students complete the internship programs, they are required to submit an internship report following the specifications outlined in the internship guide prepared by the commission. The students have to provide a day-to-day diary of the internship activities. The students are invited to join an oral assessment exam. The relevant internship commission member asks some questions of the student. At the end of the assessment exam, the commission member accepts the internship report partly or completely. Basically, the following questions should be answered by the students;

- What skills and qualifications you think that you gained from the internship?
- How do you think the internship will influence your future career plans?
- The students should also answer technical, theoretical and practical questions mentioned in the internship report.

This paper focuses on engineering internship programs to improve the engineering education. A case study for civil engineering is given and the results are presented. For this purpose, a web base online survey tool was prepared and 251 inquiry sheets were statistically analyzed. The materials and methods are comprehensively presented in the following sections and, finally, a conclusion is made.

3. Materials and methods

Sample: Two hundred and fifty one students who were studying in the civil engineering department were eligible to participate in this study. The questionnaires, taking into account the opinions of different parties, professors, students and industries, were designed to gather the most important information.

Data collection: The data used in this study were gathered from the students' responses to the questionnaires. The questionnaires were designed to gather the most important information on the internship programs. The primary focus of the questionnaire was to gather perceptions regarding the contribution of the lectures to the internships, the contribution of the internships to the students and the satisfaction factors for the students. As stated by Walker and Palmer [14], it is important to realize that, no matter how the administration may choose to use the results, the evaluation surveys provide a valuable resource for teachers and tutors who wish to reflect on their teaching.

The questions described twelve aspects of the process of internship to which respondents indicated their level of satisfaction with the quality of internship provided on a six point scale where 0 = Disagree, 1 = Poor, 2 = Average, 3 = Good, 4 = Agree and 5 = Strongly agree. In addition, some questions were described as Yes/No type to find out the respondents' satisfaction factors. In an attempt to obtain information from all the students, a web base online survey tool was prepared and the students were asked to fill in the questionnaire.

Variables: The satisfaction level of the interns including five level of measures (i.e. Very bad, Bad, Average, Good and Great) was selected as the dependent variable. The independent variable was the measure of information needs met. They were selected from the inquiry sheet scored by the interns.

Statistical procedures: First, univariate analyses were performed to: (i) describe the interns' population; (ii) evaluate the relative importance of different types of information to meet interns' needs; and (iii) determine which information was seen as important by interns. Levene's test was used to test equality of variances and the t-value was used for equality of means. The One-Way ANOVA procedure was used to test the hypothesis that the means of groups are not significantly different.

Second, a multivariate analysis was performed to determine the satisfaction level of the interns. For this purpose, logistic regression was used to determine factors that influenced the internship satisfaction of students. Logistic regression is useful for situations for predicting the presence or absence of a characteristic or outcome based on values of a set of predictor variables. It is similar to a linear regression model but it is suited for the models where the dependent variable is measured at one of two nominal levels. Logistic regression coefficients can be used to estimate odds ratios for each of the independent variables in the model. In this study, the statistical package SPSS 18 was used to identify the logistic regression model that 'best' fits the data, and to estimate the logistic regression coefficients [15].

4. Data analyses and results

4.1 Descriptive statistics

Table 2 shows the descriptive statistics of the interns' characteristics. The satisfaction levels were prepared on a five level string scale with Very bad, Bad, Average, Good and Great. These string variables were turned into numerical variables where 0 = Very bad, 1 = Bad, 2 = Average, 3 = Good and 4 = Great. The satisfaction levels for each group were also included in Table 2 in percentage values.

The independent t-test was used to compare the means between two unrelated groups on the same continuous dependent variable, which was satisfaction level. For this purpose, Levene's test was used to test equality of variances and the t-value was used for equality of means. According to Levine's test, equal variances were found for gender (p = 598), type of instruction ($p = 0.571$), type of company ($p = 0.942$) and number of completed internships ($p = 0.535$). According to the t-test, equal means were found for gender ($t(249) = 0.44$, $p = 0.965$), type of instruction ($t(249) = -1.119$, $p = 0.264$), type of company ($t(249) = -0.177$, $p = 0.860$) and number of completed internship ($t(249) = 0.196$, $p = 0.845$). These results proved that there was no statistically significant difference between the groups and their satisfaction levels.

For the internship place group , the independent t-test results were found to be; $t(249) = 4.836$, $p = 0.000$ and mean difference = 0.692. Since the p-value of the test was less than 0.05, the satisfaction level of students practicing at worksites was higher than those practicing in offices.

For the type of internship group, a One-Way ANOVA procedure was used to test the hypothesis that the means of the groups (construction, transportation and hydraulics) were not significantly different [16]. The ANOVA output gave that $F(2, 248) = 0.189$, $p = 0.946$, $MS_{\text{error}} = 0.027$ and $a = 0.05$. The p-value (0.946) associated with the F ratio was greater than the a level (0.05). In this case, the null hypothesis, which was that all the means for the satisfaction level were equal, was accepted.

Table 3 gives the satisfaction questions describing twelve aspects of the process of internship to which respondents indicated their level of satisfaction with the quality of internship provided on a six point scale. The mean and standard deviation values were computed for each question and are presented in Table 3. The Friedman Test was used to determine whether there was a statistically significant difference in student's opinions [16]. According to Friedman Test results, $\chi^2(19) = 891.801$ and $p = 0.000$, there was a statistically significant difference in perceived answers depending on the students' opinions about the internship programs.

Table 4 shows the evaluation of Yes/No questions, presenting the frequencies and percentage

Table 2. Interns' characteristics and their satisfaction levels (n = 251)

			Satisfaction level				
Demographics	**Number**	**Percentage**	**Very bad (%)**	**Bad (%)**	**Average (%)**	**Good (%)**	**Very good (%)**
Gender							
Male	190	75.7%	0.0%	1.1%	13.7%	52.6%	32.6%
Female	61	24.3%	0.0%	0.0%	18.0%	47.5%	34.4%
Type of instruction							
First instruction	144	57.4%	0.0%	1.4%	15.3%	52.8%	30.6%
Second instruction	107	42.6%	0.0%	0.0%	14.0%	49.5%	36.4%
Type of internship							
Construction	132	52.6%	0.0%	1.5%	15.2%	49.2%	34.1%
Transportation	90	35.9%	0.0%	0.0%	15.6%	52.2%	32.2%
Hydraulics	29	11.6%	0.0%	0.0%	10.3%	58.6%	31.0%
Type of company							
Public	71	28.3%	0.0%	0.0%	16.9%	50.7%	32.4%
Private	180	71.7%	0.0%	1.1%	13.9%	51.7%	33.3%
Number of completed internships							
One	131	52.2%	0.0%	0.8%	15.3%	49.6%	34.4%
Two	120	47.8%	0.0%	0.8%	14.2%	53.3%	31.7%
Internship place							
Office	24	9.6%	0.0%	0.0%	45.8%	54.2%	0.0%
Worksite	227	90.4%	0.0%	0.9%	11.5%	51.1%	36.6%

Table 3. Evaluation of different types of information

Please score the questions 0: Disagree 1=Poor , 2=Average , 3=Good, 4=Agree, 5=Strongly agree	Mean	Standard deviation
1. I have seen the contribution of the engineering courses during my internship.	3.14	1.140
2. Internship program(s) enabled us to see how to apply theoretical knowledge into practice.	3.51	1.147
3. Civil engineering department informed us on internship programs in advance.	2.82	1.370
4. It would be better to start internship programs after graduating from the engineering faculty.	1.58	1.788
5. Summer school has a negative effect on internship programs.	3.73	1.722
6. It is better to do our internships in different areas of specialization (Construction, Transportation, Hydraulics)	3.91	1.316
7. I had no problem in finding a suitable company offering an internship.	3.35	1.569
8. Internship had a contribution in my future carrier planning.	3.66	1.240
9. Internship had a contribution on multidisciplinary team working.	3.47	1.201
10. I developed my written and oral communication abilities during my internship period.	3.55	1.092
11. Internship contributed to gaining an ability to communicate with managers and others successfully.	3.87	0.981
12. Internship had a contribution to gaining awareness on acting ethically	3.74	1.149
13. Internship had a contribution to seeing my weaknesses and strengths, in addition internship enabled me to strengthen my weak sides.	3.65	1.198
14. Internship had a contribution to use my time efficiently and systematically.	3.49	1.208
15. I gained a wide perspective on my job's difficulties and advantages by the end of my internship period.	4.15	0.893
16. I gained the ability to identify and solve faults, errors, deficiencies and problems in application projects that arose during the production process.	3.69	1.081
17. I received enough interest and support from the company during my internship period.	3.93	1.205
18. I got the information on theoretical and practical applications from the managers or responsible experts.	3.90	0.983
19. I took part in enough lab activities at the company.	2.27	1.810
20. I think that 20 days internship period is not enough.	2.47	1.866

Table 4. Evaluation of Yes/No questions

Please answer the questions as being Yes or No:	Yes Frequency	No Frequency	Yes %	No %
1. Did you complete your internship in your home city?	187	64	74.5	25.5
2. Did you get any salary from the company?	18	233	7.2	92.8
3. Did the company offer a service to access the company?	87	164	34.7	65.3
4. Did the company offer a food service?	202	49	80.5	19.5
5. Did the company cover your accommodation?	38	212	15.5	84.5
6. Do you think that forty days internship is enough?	109	142	43.4	56.6
7. Would you like the internship programs to have a contribution to the academic graduate points?	161	90	64.1	35.9

values. Similarly, the Friedman Test was also used to determine whether there was a statistically significant difference on the students' opinion on Yes/No question types. According to Friedman Test results, $\chi^2(6) = 485.286$ and $p = 0.000$, there was a statistically significant difference in perceived answers depending on the students' opinions on Yes/No questions.

According to the descriptive statistical results, the students scored the contribution of the engineering courses to the internship as 3.14 over 5 points. Although this value is not below 3 points (the Good level), it is not considered that the engineering courses completely fulfilled the students' expectations. The students think that the civil engineering department moderately informed them on the internship program scored as 2.82 points. The students were keen to do their internship during the civil engineering education period. For that reason, they scored the 4th question in Table 3 as 1.58 point. Unsurprisingly they thought that the summer school had a negative effect on the internship programs. Maybe this is the reason that the students thought that twenty days internship period was enough scored as 2.47 points. On the contrary, 56.6% of the students thought that a forty days internship period was not enough (Table 3, 7th question). The students scored the 15th question at 4.15 points, which is the highest value in Table 3. They think that they gained a wide perspective on their job's difficulties and advantages by the end of their internship period.

The data in Table 4 shows that 74.5% of the students did (or had to do) their internship in their home city because of the following reasons: only 7.2% got a salary, 65.3% of the companies did not offer a service to access the company, 19.5% of the companies did not offer a food service and 84.5% of the companies did not cover accommodation. The students thought that they made an effort to satisfy an obligation to the university, thus 64.1% of the students wanted internship programs to have an effect on the academic graduate points.

4.2 Logistic regression

Regression methods have become an integral component of any data analysis concerned with describing the relationship between a response variable and one or more explanatory variables. Over the last decade the logistic regression model has become, in many fields, the standard method of analysis in this situation [17]. Logistic regression is a powerful analytical technique for use when the outcome variable is dichotomous [18, 19]. Logistic regression analysis has been being increasingly using by researchers. There is some important educational research in the literature. Zhang *et al.* [20] quantitatively evaluated pre-existing factors as to their impact on engineering student success. They used a database of all engineering students at nine institutions from 1987 through 2002 and focused on graduation in any of the engineering disciplines. They reported graduation rate as a function of years since matriculation, and determine the typical time-to-graduation. They fitted a multiple logistic regression model to each institution's data to explore the relationship between graduation and demographic and academic characteristics. Wait and Gressel [21] used linear and logistic regression to evaluate the Test of English as a Foreign Language (TOEFL) score relative to overall grade point average (GPA), GPA for courses in engineering and in humanities, rate of passing a Comprehensive Assessment Examination (CAE), and graduation rate. High school GPA, gender, and nationality were also included as independent variables. They found that the TOEFL score was also statistically significant in logistic regressions of CAE pass rate and graduation rate, indicating increasing probability of success with increasing TOEFL score. French *et al.* [22] examined student success and persistence within the major and university through hierarchical linear and logistic regression analyses for two cohorts of engineering students. Indicators of success and persistence were based on theoretical and empirical evidence and included both cognitive and noncognitive variables. Lichtenstein *et al.* [23] used binary logistic regression to identify factors that predict persistence among first year students and seniors in engineering. They concluded that different educational outcomes between majors were the result of programmatic differences.

The central mathematical concept that underlies logistic regression is the logit—the natural logarithm of an odds ratio [18]. The logistic regression equations follow the form in Equations (1) and (2):

$$Z = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + ... + \beta_6 X_6 + ... \quad (1)$$

$$Z = \ln\left(\frac{P_i}{1 - P_i}\right) \quad (2)$$

where P_i is the probability of event i, β_0 is the constant coefficient, β_1,, β_2, . . ., β_n are predictors coefficients.

The probability of event i may be written as follows (Equation (3)):

$$P_i = \frac{e^z}{1 + e^z} \quad (3)$$

where e is defined as the base of the natural logarithm approximately corresponding to 2.72.

In this study, a logistic regression analysis was conducted to predict the satisfaction level of internships using the data given in Tables 2, 3 and 4. The Levene's test, t-test, One-Way Analysis of Variance (ANOVA) and Friedman Test results were considered during the predictors' data selection procedures. Before logistic regression analysis, the satisfaction level scale was converted into two level scale (0, 1 and 2 scores: Unsatisfied = 0; 3 and 4 scores: Satisfied = 1). Table 5 presents the predictors' data taking into account logistic analysis. These predictors were conducted to develop a binary logistic regression model. Some of the independents were dropped from the model because their effect was not significant by the Wald statistic. In this study, the final model is presented including X_7, X_8, X_{17}, X_{23} and X_{27} variables (Equation (4)):

$$Z = \beta_0 + \beta_1 X_8 + \beta_2 X_9 + \beta_3 X_{18} + \beta_4 X_{24} + \beta_5 X_{27} \quad (4)$$

The model that included only the intercept (constant) gave the base rates of the two decision options: 84.9% (213/251) were satisfied with the internship and 15.14% (38/251) were dissatisfied with the internship. The observed odds were calculated as 5.605 (213/38).

After the variables were added into the analysis as predictors, the omnibus tests of model coefficients produced a Chi-Square of 114.269 with 5 degree of freedom (*df*) and a significance value (p-value) above 0.001. The p-value indicated that the new model was significantly more accurate.

The -2 Log Likelihood (-2LL) value was found to be 99.141. This value was 213.410 for the first model that included only the intercept. With the inclusion of the five predictors, the -2LL value was decreased. This decreasing reflected a potential gain in the model fit.

The Cox & Snell R-square and the Nagelkerke's R-square values were found to be 0.366 and 0.639 respectively. Overall, high values are better than low values here. The Nagelkerke's R-square indicated a moderately strong relationship between prediction and grouping [24].

The Hosmer and Lemeshow test table provides a formal test of whether the predicted probabilities for a covariate match the observed probabilities. While a large p-value indicates a good match, a small p-value indicates a poor match. In this study,

Table 5. Predictors' data

Predictors
X_1 : I have seen the contribution of the engineering courses during my internship.
X_2 : Internship program(s) enabled us to see how to put theoretical knowledge into practice.
X_3 : The civil engineering department informed us on internship programs in advance.
X_4 : It would be better to start internship programs after graduating from the engineering faculty.
X_5 : Summer school has a negative effect on internship programs.
X_6 : It is better to do our internships in different areas of specialization (Construction, Transportation, Hydraulics)
X_7 : I had no problem in finding a suitable company offering an internship.
X_8 : Internship had a contribution in my future carrier planning.
X_9 : Internship had a contribution on multidisciplinary team working.
X_{10} : I developed my written and oral communication abilities during my internship period.
X_{11} : Internship contributing to gaining an ability to communicate with managers and others successfully.
X_{12} : Internship had a contribution gaining awareness on acting ethically
X_{13} : Internship had a contribution to seeing my weaknesses and strengths, in addition internship enabled me to strengthen my weak sides.
X_{14} : Internship had a contribution to use my time efficiently and systematically.
X_{15} : I gained a wide perspective on my job's difficulties and advantages by the end of my internship period.
X_{16} : I gained the ability to identify and solve faults, errors, deficiencies and problems in application projects that arose during the production process.
X_{17} : I received enough interest and support from the company during my internship period.
X_{18} : I got the information on theoretical and practical applications from the managers or responsible experts.
X_{19} : I took part in enough lab activities at the company.
X_{20} : I think that 20 days internship period is not enough.
X_{21} : Did you complete your internship in your home city? (0:Yes, 1:No)
X_{22} : Did you get any salary from the company? (0:Yes, 1:No)
X_{23} : Did the company offer a service to access the company? (0:Yes, 1:No)
X_{24} : Did the company offer food service? (0:Yes, 1:No)
X_{25} : Did the company cover your accommodation? (0:Yes, 1:No)
X_{26} : Do you think that forty days internship is enough? (0:Yes, 1:No)
X_{27} : Internship place (0: Worksite, 1: Office)

Table 6. Variables in the equation

							95% C.I. for exp(β_i)	
Predictors	β_i	**Standard error**	**Wald**	**df**	**Sig.**	**Exp(β_i)**	**Lower**	**Upper**
X_8	0.528	0.213	6.132	1	0.013	1.695	1.116	2.575
X_9	0.579	0.255	5.180	1	0.023	1.785	1.084	2.940
X_{18}	1.692	0.345	24.026	1	0.000	5.429	2.760	10.679
X_{24}	–2.746	0.638	18.550	1	0.000	0.064	0.018	0.224
X_{27}	–1.320	0.616	4.596	1	0.032	0.267	0.080	0.893
Constant	–6.138	1.270	23.370	1	0.000	0.002		

the p-value was found to be large (0.191), indicating a good match [17].

The Contingency Table for the Hosmer and Lemeshow test table presented more details on the developed model. In this model, the observed and expected values for each category were found to be very close.

The overall percentage of classification was found to be 88.4% (222/251). This value was higher than the constant only model, which was 84.9%. The model correctly classified the satisfied and dissatisfied students, giving 94.8% (202/213) and 52.6% (20/38) respectively.

The variables in the equation are presented in Table 6, which is a major part of the logistic regression output. This table includes several important elements. The Wald statistic and associated probabilities provide an index of the significance of each predictor in the equation. In this case, X_8, X_9, X_{18}, X_{24}, X_{27} and the constant contributed significantly to the prediction (p-values: 0.013, 0.023, 0.000, 0.000, 0.032 and 0.000). The 'β_i' values are the logistic coefficients that can be used to create a predictive equation.

This leads to the logistic regression model given by Equation (5):

$$Z = -6.138 + 0.528X_8 + 0.579X_9 + 1.692X_{18} - 2.746X_{24} - 1.320X_{27} \quad (5)$$

The probability of satisfaction is written as follows in Equation (6):

$$P_i = \frac{e^{(-6.138+0.528X_8+0.579X_9+1.692X_{18}-2.746X_{24}-1.320X_{27})}}{1+e^{(-6.138+0.528X_8+0.579X_9+1.692X_{18}-2.746X_{24}-1.320X_{27})}} \quad (6)$$

5. Discussions

In this study, the most important goals and expectations of the students were determined by using some statistical techniques. This study proved that the civil engineering students are keen to participate in practical training to achieve the goals given in Table 3 during their internship period. On the other hand, the students think that the engineering courses do not completely fulfill the students' expectations. In addition, they think that the civil engineering department moderately informs them about the internship program. This means that the students don't know what they will do during the internship period. The conclusion is that the civil engineering department should update the theoretical courses taking into consideration the practical applications as well as the students' expectations. Additionally, the students should be informed on the internship programs and a guideline should be prepared for an effective and efficient internship period. Certainly, relations between university and industry play an important role in successful internship programs. On the other hand, the university has almost no role in organizing internships for the students. This is the reason why the students have to complete the internships in their home cities because they have to cover all the costs themselves.

It is found that the summer school has a negative effect on the internship programs. Although 56.6% of the students think that a forty days internship period is not enough, they have less chance of extending this period because they want to finish school as soon as possible, taking lectures in summer that they failed during the semesters. While the summer school seems to be an advantage for the students and the university, it has some disadvantages such as integration into the practical life in the early stages for the students, and developing university–industry relations on research or collaboration projects for the lecturers.

In current practice, the internship programs are not taken into account for academic graduate points. After the students complete the internship programs, they are required to submit an internship report following the specifications outlined in the internship guide. The students think that they made an effort to fulfill an obligation to the university, thus 64.1% of the students want internship programs to have an effect on the academic graduate points. Consequently, this expectation should be considered and the required regulations should be made to include the internship programs into the academic graduate points.

Logistic regression analysis was conducted to determine the satisfaction factors. A positive, statistically significant relationship was identified between internship satisfaction level and future career planning, multidisciplinary team working, learning theoretical and practical applications, food service during the internship period and worksite internship. This study showed that the expectations of the students of the companies are not too much, except food service, during the internship period. Substantially, they want to combine practical work with theoretical studies during their internship programs. They think that the internship will influence their future career plans, so they are keen to define their targets in the early stages. They are satisfied to be informed by managers or responsible experts who are their ideal models in their future professional life. The students are also happy to be in a multidisciplinary environment. Most probably, they define their position in professional life taking into consideration their specialist area. These findings proved that the professional life of civil engineering should be somehow included in the formal education phase. Maybe, the students are encouraged to organize some career days, inviting some managers or experts as to give presentations. In addition, practical activities such as laboratory, field tests, etc. should be a crucial part of civil engineering education. The collaboration between the university and the chamber of civil engineers should be developed and their critiques should be taken into account by the lecturers. This study may be developed including the employers and professional civil engineers' expectations from the interns and the university could organize a survey similar to this study. In addition, the students' satisfaction with the existing laboratory experience may be measured and then a balance between practical training and theoretical knowledge may be provided.

6. Conclusions

Essentially civil engineering is known as a practical profession where theoretical knowledge has to be always consolidated by practical applications. Of course, civil engineering courses include the fundamental engineering design variables. These fundamental variables should be fully understood by the students. On the other hand, it is important for the students to know how these variables are considered or used in practise. Thus, practical experience in civil engineering is an important component of civil engineering education. This study confirmed that the internship programs should be included in civil engineering education programs to enable the students to become good problem solvers throughout their professional life, in spite of the particular problem or condition. These programs allow the students to face professional life in the early stages. The conclusion is that engineering departments should include practical training programs in the engineering programs, taking into consideration the expectations of a wide range of key stakeholders such as employers, managers, professional engineers and students.

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