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Key Issues in Choosing a University

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Abstract. A survey on a series of important issues regarding the students' perception of the academic environment was conducted at the Technical University of Cluj-Napoca on a sample of 403 students using a random sampling procedure stratified by year of study and faculty. One of the survey objectives was to measure the role of several key issues involved in the students' decision to enrol at the Technical University of Cluj-Napoca. The survey results were analyzed and interpreted by common statistics.

Keywords: Decision analysis; Independence testing; Generalized extreme value distribution; Binomial distribution

INTRODUCTION

Students, as individuals, come to know their own attitudes, emotions, and other internal states partially by inferring them from observations of their own behaviour and/or circumstances in which this behaviour occurs (Bem, 1967). They may infer some of their own traits by observing others with whom they feel a sense of merged identity (Goldstein and Cialdini, 2007). These facts demonstrate that the students' own perception is directly related with the way other people within their close environment behave.

Motivation to learn is students' desire or willingness to engage and persist in academic activities in school (Brophy, 1986) even when they may not take school or their studies seriously (Steinberg, 1996).

Therefore, knowing more about students' outlook on the academic community is a key element for defining the objectives of strategic management in education.

If in the past higher education institutions enjoyed exceptional autonomy (Hood, 1995), nowadays they are confronted with an explosion of control measures, steering mechanisms and increasing accountability pressures (Pollitt, 1993). Thus, New Public Management advocates the adoption of private management instruments within public sector organizations in order to increase efficiency, effectiveness and quality (Hood, 1991), (Bach, 2000), and (Ferlie and Steane, 2002).

However, according to Cothran and Ennis (Cothran and Ennis, 2000), we still know little about what students think about schooling and engagement. In order for meaningful reform to take shape it becomes essential that we listen to the student perspective that may increase the likelihood of their educational engagement.

A survey on the students' perception of the academic environment was conducted at the Technical University of Cluj-Napoca, Romania in order to reveal the importance of a series of factors involved in choosing a university.

MATERIALS AND METHODS

The Technical University of Cluj-Napoca has nine faculties and approximately 13 000 students, being the second largest state university in Cluj.

During the first semester of the 2008/2009 academic year, a 30 questions questionnaire was administered to students from all the five years of study.

The survey was based on stratified random sampling. The sampled population was represented by approximately 1000 students divided into groups of 7-21 students from all faculties and years of study. Random sampling was applied to these subgroups, and 30 subgroups were selected for inclusion in the survey. Questionnaires were given to all the students in the selected subgroups. Out of 452 enrolled students, 437 were present at the moment of the survey and 403 accepted to participate.

The 6th question in the survey was *Please rate the importance of the following aspects when choosing this university.* The possible answers ranged from none to highest for five characteristics (Table 1, no cell content).

Table 1. Students' choices regarding the importance of factors when choosing a university

X		Degree of relevance				
		None	Small	Medium	High	Highest
Factor	Geographic location of the university	126	104	99	34	25
	Quality of the academic staff	26	59	97	151	56
	University infrastructure	33	59	127	133	36
	University image	17	41	88	166	76
	Admission requirements	47	57	121	99	65
	Specializations offered	31	60	111	125	63

Over 96% of the 403 students included in the survey gave a valid answer to the question: 388 chose the 'geographic location of the university', 'university infrastructure' and 'university image', 389 the 'quality of the academic staff', and 390 the 'specializations offered'.

The contingency between involvement and community were constructed from the valid answers provided (Table 1, cell content).

The main assumption was that an association between the degree of relevance and the characteristics chosen by the students existed. At same time, the hypothesis (or assumption) answered the question whether the variable with answers grouped into relevance categories had the same distribution for all the characteristics. The distribution law of the degree of relevance was an important issue. In order to obtain this distribution law, a uniform scale was assigned: 0 - None; 1 - Small; 2 - Medium; 3- High; 4 - Highest.

In order to carry out the association analysis between relevance and factors the Chi Square test was applied on the data presented in Table 1. Relevance was the variable divided into categories. The various factors influencing students' choice were observed. Under the hypothesis of independence the expected values ($E_{i,j}$, $1 \le i \le 6$, $1 \le j \le 5$) for Table 1 were given by (Fisher, 1925):

$$E_{i,j} = \left(\sum_{k=1}^{5} O_{i,k}\right)\left(\sum_{k=1}^{6} O_{k,j}\right) \Big/ \sum_{i=1}^{6}\sum_{j=1}^{5} O_{i,j} \quad (1)$$

where $O_{i,j}$ were the entries in Table 1 (*i* index encoding characteristics and *j* index encoding categories of relevance).

As far as the distribution law of the relevance was concerned, the following assumptions were checked: normal (Gauss, 1809), generalized extreme value distribution (Fisher and Tippett, 1928), and binomial (De Moivre, 1711). The agreement between the observation and the model were measured by using the Chi Square statistic (Pearson, 1900; Fisher, 1935).

RESULTS AND DISCUSSION

The result of the Chi Square statistic (X^2) included in Table 2 showed that there was a relationship between the characteristics and the students' perceptions of their relevance. The association existed for every characteristic (Table 2, $P\chi^2$ column).

Table 2. Chi Square statistic results on the contingency between factors and their relevance

X^2	None	Small	Medium	High	Highest	Σ	$P\chi^2$
Geographic location of the university	135	26.3	0.60	59.6	15.1	237	$4\cdot10^{-50}$
Quality of the academic staff	9.18	0.30	0.98	9.16	0.11	19.7	$6\cdot10^{-4}$
University infrastructure	3.96	0.28	3.75	1.96	5.67	15.6	3.6‰
University image	18.8	7.81	3.37	19.7	9.56	59.3	$4\cdot10^{-12}$
Admission requirements	0.00	0.64	1.76	3.09	2.45	7.95	9.3%
Specializations offered	5.35	0.20	0.11	0.37	1.62	7.64	11%
Σ	173	35.5	10.6	93.9	34.5	347	$2\cdot10^{-61}$

$P\chi^2(\Sigma X^2,df,2)$: probability obtained from the Chi Square distribution to observe a higher deviation from agreement than the observed one (ΣX^2)
df = 4 for every factor (Σ) and df = 20 for the entire contingency (ΣΣ)

Under these circumstances (Table 2), relevance was suitable for measuring the students' perception of the factors involved in choosing a university. The factors 'Admission requirements' and 'Specializations offered' required special attention as their probability to be observed in the independence hypothesis was higher than the common confidence level (5%, (Fisher, 1925)).

One more assumption had to be verified in order to compare the relevancies: the distribution of the relevance. Table 3 contains the results obtained under the normal distribution assumption.

Table 3. Normal assumption for the relevance of the factors involved in choosing a university

Factors	Normal (μ; σ)	X^2	$P\chi^2(X^2,4)$	Accept?
Geographical location of the university	1.299; 1.194	33	$2\cdot10^{-6}$	No
Quality of the academic staff	2.391; 1.111	22	0.21‰	No
University infrastructure	2.206; 1.080	16	2.90‰	No
University image	2.626; 1.050	27	$2\cdot10^{-5}$	No
Admission requirements	2.200; 1.231	21	0.32‰	No
Specializations offered	2.331; 1.154	12	1.74%	No

Using uniform category values (0 - None; 1 - Small; 2 - Medium; 3- High; 4 - Highest)
X^2: From Yates correction
μ and σ: population factor mean and standard deviation
μ and σ: obtained from Maximum Likelihood Estimation
$P\chi^2(X^2,4)$: probability from Chi Square distribution

The results presented in Table 3 proved that the hypothesis of normal distribution for the relevance of the factors involved in choosing a university should be rejected. Table 4 contains the results obtained under the assumption of the generalized extreme value (GEV) distribution.

Four out of six factors followed the generalized extreme value (GEV) distribution. For these factors the population mean and standard deviation were offered from the distribution parameters. Table 5 contains these values.

The results included in Table 5 showed that the 'university image' was the most influential factor that determined students to choose the Technical University of Cluj-Napoca while 'university infrastructure' proved to be a less influential factor.

Therefore, we assumed that the factors in Table 5 overlapped as 'quality of the academic staff' was expected to correlate with 'university image' and 'university infrastructure' and even with 'specializations offered'. Thus, an overlapping analysis, similar with Student's t-test (Student, 1980; Welch, 1947) was used to compare samples from the normal distribution. Table 7 contains the overlapping between the distributions and the probability space.

Table 4. GEV assumption for the relevance of the factors involved in choosing a university

Factor	Generalized extreme value (λ; β; k)	X^2	$P\chi^2(X^2,4)$	Accept?
Geographical location of the university	0.7618; 0.9306; 0	28	10^{-5}	No
Quality of the academic staff	2.1422; 1.1796; -0.5329	4.0	40%	Yes
University infrastructure	1.9347; 1.1285; -0.4752	3.1	54%	Yes
University image	2.4271; 1.1096; -0.5957	2.9	58%	Yes
Admission requirements	1.8368; 1.276; -0.3943	11	2.7%	Yes/No
Specializations offered	2.0231; 1.2114; -0.4502	1.3	87%	Yes
Using uniform category values (0 - None; 1 - Small; 2 - Medium; 3- High; 4 - Highest) λ: location; β: scale; k: shape (k<0 - Weibull distribution; k=0 - Gumbel distribution) X^2: From Yates correction μ and σ: population factor mean and standard deviation μ and σ: obtained from Maximum Likelihood Estimation $P\chi^2(X^2,4)$: probability from Chi Square distribution				

Table 5. Mean of factors and standard deviation

Factor	μ	σ
Quality of the academic staff	2.391	1.088
University infrastructure	2.206	1.050
University image	2.626	1.019
Specializations offered	2.331	1.134

Table 6. Distribution coverage

Coverage	Quality of the academic staff	University infrastructure	University image	Specializations offered
Quality of the academic staff	100%	91.6%	90.2%	**94.3%**
University infrastructure		100%	**82.1%**	93.8%
University image			100%	85.1%
Specializations offered				100%

As Table 6 shows, the highest coverage was between the ‘quality of the academic staff’ and the ‘specializations offered’, while the lowest coverage was between the ‘university image’ and the ‘university infrastructure’.

A series of statistics could be obtained from the distribution laws (Table 4). Table 7 contains these statistics: the extreme value was the highest possible value admitted by the distribution law, while mode, kurtosis and skewness had common statistical meanings.

Table 7. Statistics of the characteristics

Characteristic	Quality of the academic staff	University infrastructure	University image	Specializations offered
Extreme value	4.35	4.30	4.29	4.71
Mode	2.88	2.56	3.20	2.65
Kurtosis	3.42	3.12	3.82	3.02
Skewness	-0.72	-0.56	-0.88	-0.34

Table 7 shows that the distribution of the ‘specializations offered’ had the largest extreme value. Therefore, this factor was most appreciated by the surveyed students. Mode was considered the statistic describing the common perception. Therefore, the 'university image' was the factor with the highest value. Using third and fourth order statistics, skewness showed that all distributions were biased to the right, which indicated that these factors were crucial in choosing a university (negative skewness occurs when higher than average values are extracted from a normally distributed population). The 'specializations offered' was the only factor close to the normal distribution, thus showing that it played an important role in the students' decision.

Figure 1 depicts the probability density functions of the investigated factors.

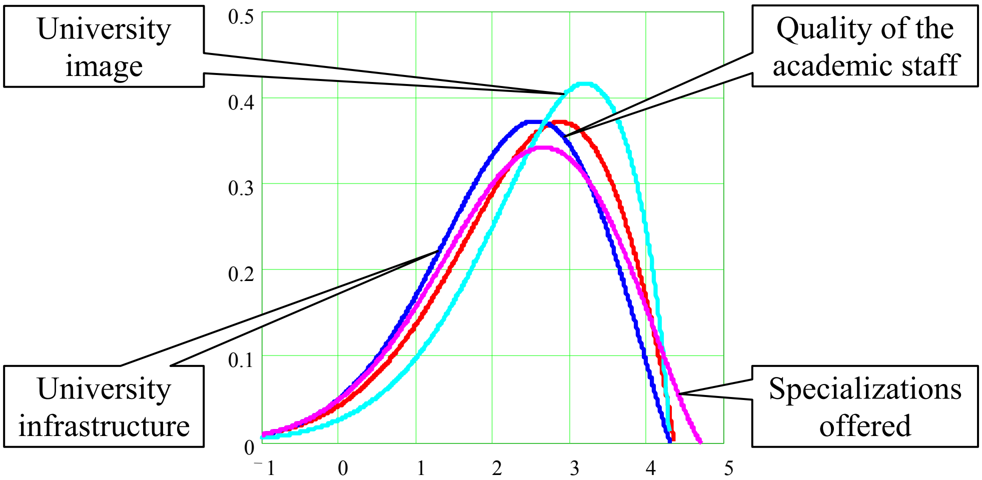

Figure 1. Distribution of four factors that influenced students' choice

The 'admission requirements' factor had an observation probability (Table 4) within the (1%, 5%) interval, thus its distribution could not be established. Moreover, the random hypothesis could not be rejected for the association between this factor and the relevance scale (Table 2) as there was a 9.3% chance of randomly observing the values observed in the experiment.

Therefore, the hypotheses of both normal and generalized extreme value were rejected. The reason was searched for within the experiment design. Three categories of respondents were identified: students living in the same city, students living in the same county, and students from outside the county. The immediate assumption was that these groups of students had different perceptions regarding the relevance of the geographical location. Unfortunately, the survey did not contain a question about the respondents' place of residence, thus the only option was to post process the data provided by the respective question. The following assumption was formulated: most of the students from one category (same city, same county, and different county) selected the same answer to the question regarding the relevance of the 'geographical location of the university'. Five categories are needed to define the relevance of the 'geographical location of the university' factor, while three categories are more appropriate for experimental design. However, since data were collected using five categories, we could only presume the distribution obtained when using only three categories. The simplest assumption provided the proportion of population who selected the 'geographical distance'. This assumption was the binomial distribution of the sample. The binomial distribution assumption with three categories provided a binomial sample of 2. If f_1 denoted the observed frequency of students answering 0 (as insignificant), and f_2 denoted the observed frequency of students answering (1 as average), then $388\text{-}f_1\text{-}f_2$ students answered 2 (most important). By using the well known probability distribution function ($PDF_{Binomial}(k,2)=C^2_k p^k(1-p)^{2-k}$) of binomial distribution and approximating the true proportion ($\mu=2\cdot p$, eq.2) with the observed one, the Chi Square statistic was expressed according to the two frequencies (eq.3):

$$n_1 = 388; \quad p(f_1, f_2) \cong \frac{f_1 \cdot 1 + (388 - f_1 - f_2) \cdot 2}{2 \cdot 388} \tag{2}$$

$$X^2(f_1, f_2) = \frac{\left(388(1 - p(f_1, f_2)) - f_1\right)^2}{388(1 - p(f_1, f_2))} + \frac{\left(776p(f_1, f_2)(1 - p(f_1, f_2)) - f_2\right)^2}{776p(f_1, f_2)(1 - p(f_1, f_2))} + \frac{\left(388p^2(f_1, f_2) - 388 + f_1 + f_2\right)^2}{388p^2(f_1, f_2)} \tag{3}$$

Minimizing X^2, the f_1 and f_2 frequencies were obtained using a math program: $f_1 = 173$; $f_2 = 172$; $X^2(173,172) = 6 \cdot 10^{-3}$. The following table (Table 8) contains the expected results under the assumption that there were three categories. The changes in the observed data matched this expectation.

Table 8. Changes in the observable according to the Binomial (size=2) hypothesis

Relevance of geographical location	None	Small	Medium	High	Highest
Observed	126	104	99	34	25
Changed	126	47+57	99	16+18	25
Expected	173		172		43
Relevance of geographical location	0 (Insignificant)		1 (Average)		2 (Most important)

The *Binomial(2)* hypothesis on the expected answer was accepted with a high degree of confidence (93.8% probability of observing a worse agreement). Because the expected relevance was in agreement with the binomial model, the true proportion of the population (students enrolled at the Technical University of Cluj-Napoca) who regarded the 'geographical location of the university' as an important factor in choosing a university was obtained (using eq.2): $p(173,172) \approx 0.334$. Thus, about 33% of the students chose the Technical University due to the geographical location of the university.

CONCLUSIONS

We conducted a survey with over 96% feedback rate on a sample of 403 students enrolled at the Technical University of Cluj-Napoca in order to analyze the factors that contributed to the students' decision to attend this university.

Four factors (quality of the academic staff, university infrastructure, university image, and specializations offered) showed a generalized extreme value distribution of the Weibull type. Mode ordered the factors according to relevance as follows: university infrastructure: 2.56 (extreme value: 4.30), specializations offered: 2.65 (extreme value: 4.71), quality of the academic staff: 2.88 (extreme value: 4.35) and university image: 3.20 (extreme value: 4.29).

One factor (geographical location of the university) presented an expected size 2 binomial distribution thus showing that 33% of students regarded it as the main factor in choosing the Technical University of Cluj-Napoca.

The 'admission requirements' was rejected as a factor influencing the students' decision (over 9% of random assignments were better than the observed influence, Table 2). Both the normal and the generalized extreme value distribution were also rejected.

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