INTERNAL CONSISTENCY DETERMINATION FOR QUESTIONNAIRES DESIGNED TO EVALUATE STAKEHOLDERS SATISFACTION IN TECHNICAL HIGHER EDUCATION

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ABSRACT
The accelerate rhythm in which the society develops along with the new generations that leave their mark on it, bring on major changes in all fields. Do to the fact that education is the main supplier of „raw material" for a high ranking society, a particular higher interest should be upon how change is managed in higher education units.
The objective of this scientific paper is to determine if the questionnaires prepared to evaluate the stakeholders' satisfaction in technical Higher Education are reliable and have good internal consistency. By validating these attributes, the results regarding the degree of satisfaction obtained based on the responses received, are used to establish the factors that require change in Technical Higher Education.

Keywords: quality, satisfaction, education

1. INTRODUCTION

For the higher education units to survive in this more and more unsecure, changing and challenging environment that it's dealing with nowadays, universities should not only identify an achievable number of good ideas for change. They should also make them possible to achieve and sustain in case they remain viable. This will be the opportunity to bring together what must be changed and how it must be changed, fact that will decide each university's future. [1]
In order to be able to find what changes need to be done in Technical Higher Education, 3 sets of questionnaires have been made in order to evaluate the stakeholders' satisfaction towards the way things are going at the moment.

The questions found in the research tools refer to the satisfaction regarding the work environment, classrooms and laboratories equipment, financial resources, professional development opportunities, external environment and so on.
After establishing the eloquent questions the research tools need to have, they were sent to the teachers, students and employers from different places of the country.
When the answers have been gathered, an internal consistency test was requested in order to find out if the items of research tools were relevant.
For this type of research tools the most reliable and used way to determine the internal consistency is by calculating the value of the Cronbach-Alfa coefficient.

2. THE STRUCTURE OF THE QUESTIONNAIRES

In this study, a series of 3 questionnaires were developed and distributed directly to the stakeholders in the Technical Higher Education, represented by teachers, students and employers.
The questionnaires for teachers and students have been distributed to five Technical Universities from Romania, as it fallows: Politehnica University of Bucharest, Politehnica University of Timi□oara, Technical University of Cluj-Napoca, Transilvania University of Bra□ov and "Gheorghe Asachi" Technical University of Ia□i.
The structure of the questionnaires is presented in the table below:

Table 1. Questionnaires structure

Questionnaire structure	Teachers	Students	Employers
Total number of questions	33	46	17
Number of questions with „Yes"/„ No"/„ I don't know /I don't answer" answers	23	35	9
Number of questions with different answers	3	5	1
Number of questions regarding the respondent's identification	7	6	6

Table 2. Questionnaires comparison

3 answer option questionnaires				6 answer option questionnaires			
	Teachers	Students	Employers		Teachers	Students	Employers
Number of sent questionnaires	489	675	179	Number of sent questionnaires	489	675	179
Number of answers received	147	183	56	Number of answers received	66	59	13
Number of validated answers	136	166	48	Number of validated answers	66	59	13
Number of invalidated answers*	11	17	8	Number of invalidated answers*	0	0	0

*the invalidation was due to the absence of answer to at least one question

Although the questionnaires were sent to a big number of recipients, only a certain percentage among them took their time to answer.

Table 3. Received answers percentage reported to the number of sent questionnaires

3 answer option questionnaires			6 answer option questionnaires		
Teachers	Students	Employers	Teachers	Students	Employers
27,81%	24,59%	26,81%	13,49%	8,74%	7,26%

3. CRONBACH-ALFA INTERNAL CONSISTENCY ANALYSIS

One of the required conditions of a research tool is to be consistent and reliable. Otherwise said, the items from which it's composed (questions or statements as in the present paper) must correlate, each one, with the additional result of all the items (the scale, the global score).
The questions and items of a research tool are designed to measure a certain attribute (attitude, factor, behaviour, knowledge). The internal consistency is defined as the property of the items to correlate with the „global score" of the research tool or scale they belong to. Since all the items must reflect a certain attribute, they have to develop a common way, correlate with each other and, at the same time individually correlate with the score that reflects that attribute. The correlation between an item and the total score, from which that item is omitted, gives us information regarding the relevance of that item to the global result of the test. When each item is relevant, we can allege that the research tool has „internal consistency".
The Cronbach-Alfa internal consistency can take values between 0 and 1, where 0 indicates that the research tool only measures random errors, having nothing to do with the real score, and 1 indicates that the research tool measures only the real score, random errors being completely eliminated.
To be considered consistent, a scale must overcome the 0, 60 value which is accepted as lowest limit by most researchers.
One of Cronbachs' Alfa coefficient formula is:

$$\alpha = \frac{n*r}{1+r(n-1)} \qquad ...(1)$$

Where: n – number of items and r – average correlation coefficient between items. [2]
In the present paper, the Cronbach-Alfa internal consistency was determined using the SPSS (Statistical Package for the Social Sciences) software.
In order to use the software, numerical values have been assigned to the answer options as it fallows:
„Totally disagree" - 1
„Partially disagree" - 2
„Totally agree" - 3
„Partially agree" - 4
„I don't know" - 5
„I don't answer" – 6
The variables must contain values that express the importance of the answer reported to the global scale and not to the actual response of the subject. For example, if the answer options are coded with 1 and 2, there can be questions for which „1" brings one point to the scale and „2" brings zero points to the scale. Conventional codes of the answer options will be transformed into values, depending on their contribution for building the global score.

After assigning a value to each answer, the obtained input was introduced into the SPSS software. After the necessary settings were made in order to determine the value of the internal consistency, the software offers us the fallowing output:

Case Processing Summary

		N	%
Cases	Valid	66	100,0
	Excluded[a]	0	,0
	Total	66	100,0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
,766	,750	26

Figure 1. Cronbach-Alfa value for the teachers' questionnaire

In figure 4 we see that the value of Cronbach-Alfa is 0,766, which puts it within the accepted limits and indicates that the designed research tool has internal consistency and its items are correlated.

Further, the software generates the fallowing two figures:

Item Statistics

	Mean	Std. Deviation	N
I1	3,5152	,76946	66
I2	2,9697	1,12277	66
I3	2,9242	1,40669	66
I4	2,5000	1,25576	66
I5	3,1818	,85771	66
I6	2,7879	1,19634	66
I7	2,8030	1,34987	66
I8	3,0909	,83624	66
I9	2,5606	1,19136	66
I10	3,2273	,73997	66
I11	2,6212	1,41166	66
I12	3,1061	,50012	66
I13	3,2273	1,13403	66
I14	1,8636	1,17521	66
I15	2,8333	1,55498	66
I16	1,0758	,50568	66
I17	3,4091	,78402	66
I18	2,1212	1,11652	66
I19	2,8788	1,17034	66
I20	2,1970	1,38364	66
I21	3,6364	1,21068	66
I22	2,4091	1,52897	66
I23	3,1970	1,13977	66
I24	2,8939	1,13854	66
I25	2,8333	1,28402	66
I26	2,8485	1,32714	66

Figure 2. Value analysis for the teachers' questionnaire

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
I1	69,1970	125,791	,273	,406	,760
I2	69,7424	122,533	,294	,496	,758
I3	69,7879	119,862	,301	,361	,758
I4	70,2121	132,477	-,102	,256	,782
I5	69,5303	124,868	,287	,324	,759
I6	69,9242	117,456	,471	,633	,747
I7	69,9091	116,084	,454	,551	,748
I8	69,6212	127,408	,159	,379	,764
I9	70,1515	117,546	,470	,512	,748
I10	69,4848	129,084	,087	,398	,767
I11	70,0909	118,976	,329	,422	,756
I12	69,6061	130,119	,064	,309	,767
I13	69,4848	121,115	,349	,468	,755
I14	70,8485	122,254	,287	,470	,759
I15	69,8788	112,047	,505	,554	,742
I16	71,6364	128,604	,195	,351	,763
I17	69,3030	126,830	,207	,382	,763
I18	70,5909	121,415	,343	,631	,756
I19	69,8333	127,556	,082	,511	,770
I20	70,5152	113,977	,515	,490	,743
I21	69,0758	118,410	,426	,447	,750
I22	70,3030	118,645	,304	,349	,758
I23	69,5152	129,269	,021	,402	,773
I24	69,8182	127,813	,077	,514	,770
I25	69,8788	113,431	,586	,594	,739
I26	69,8636	117,443	,414	,556	,750

Figure 3. Cronbach's value if items eliminated for the teachers' questionnaire

In table 5 are presented the descriptive indicators, the average value and the standard items deviation. The value analysis highlights the central tendency as well as the answers spread area for each item.
Table 9 presents a set of descriptive statistic indicators, wide scale, that give information about the correlation between the item and the global score and Cronbach's value if one item is deleted. Analyzing the table, we see that only one item (I4) has negative correlation with the global score. This shows that it doesn't bring useful information regarding the measured attribute but rather goes in a different direction. First of all it's necessary to check if the items values have been properly encoded. If so, the only possible solution is to eliminate the item. From this output we can also see that item 23 has very low correlation with the global score (0,021), indicating that this item neither hurts or helps.
The same procedure has been applied to the questionnaires distributed to students and employers for which the software provided the fallowing Cronbach values:

Case Processing Summary

		N	%
Cases	Valid	59	100,0
	Excluded[a]	0	,0
	Total	59	100,0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
,776	,777	39

Figure 4. Cronbach-Alfa value for the students' questionnaire

Case Processing Summary

		N	%
Cases	Valid	13	100,0
	Excluded[a]	0	,0
	Total	13	100,0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
,654	,606	10

Figure 5. Cronbach-Alfa value for the employers' questionnaire

As shown in figures 4 and 5, Cronbach's value overcomes the accepted lowest limit of 0,60.

Because all of Cronbach's values overcome the lowest limit of acceptability, we can claim that all the questionnaires are well set and have good internal consistency, which makes them realiable for the research.

5. CONCLUSIONS

Using the questionnaire as a research tool, a relevant confirmation was required to be done regarding their construction, if they are constant and valid and if they can be use as base support. As a result of the internal consistency analysis, Cronbach's value has been situated above the 0,6 limit of acceptability, for all the research tools designed to evaluate the stakeholders satisfaction in the Technical Higher Education, as it fallows:

- Cronbach's value for teacher's questionnaire - 0,766
- Cronbach's value for students' questionnaire - 0,776
- Cronbach's value for employers' questionnaire - 0,654.

By all determinations, the degree of confidence regarding the questionnaires has been verified and that makes them safe to use in further research.

6. REFERENCES

[1] S. Geoff , „Change Matters: Making a difference in Higher Education", European Universities Association Workshop ,University of Technology, Sydney;

[2] Cristian Opariuc Dan, "Statistică aplicată in stiintele socio-umane.Analiza asocierilor si a diferentelor statistice", Constanta, 2011;

[3] Howitt D., Cramer D., "Introducere in SPSS pentru psihologie", editura polirom, 2010;

[4] E. Jaba, A. Grama, „Analiza statistica cu SPSS sub Windows", Editura Polirom, 2004;

[5] Vasile M. ,"Introducere in SPSS pentru cercetarea sociala si de piata", editura Polirom, 2014

[6] Willem E. Saris, Irmtraud N. Gallhofer, „Design, Evaluation, and Analysis of Questionnaires for Survey Research", Published online, 2007;

[7] Popa, M. (2011) "Infidelităţile" coeficientului de fidelitate Cronbach alfa. Psihologia resurselor umane, Vol. 9, Nr.1, pp. 85-99

7. ACKNOWLEDGEMENT

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