

Designing and validating the questionnaire used to measure the attitude of students towards e-Learning

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Abstract. Over the past two decades, numerous studies have been conducted to analyze the achievements of e-Learning; among other things, user's of information and communication technology (ICT) skills, Internet access and attitude of students towards e-Learning. The majority of studies examine the attitude by establishing the purpose and frequency of computer use, while some measure students' attitudes using a questionnaire without determining the measuring properties of the questionnaire. For this reason, the goal of this paper is to create a questionnaire used to measure the attitudes of students towards e-Learning and to determine its psychometric properties.

Keywords: e-Learning, students, attitude, questionnaire, ICT.

1. Introduction

The implementation of ICT achievements in teaching processes leads to changes at all levels of education, especially at higher education institutions, and requires new standards in teaching [1]. New information is created every day, the amount of ICT knowledge and skills is growing, and this requires "faster" education that is accessible and open, which in turn requires higher student literacy [2]. The basis of computer literacy in e-Education implies the use of software support, for example, for writing and text processing, for creating presentations and/or for creating graphic representations and tabular data processing. Furthermore, at the level of undergraduate academic studies (UAS), the description of competences for the majority of occupations strictly defines the necessary ICT skills, and this emphasizes the necessity of constant improvement and improvement of basic professional skills that require ICT [3-6]. Due to changes in the ICT, the teaching process is increasingly relying on multimedia and the Internet, and e-Education is mentioned more and more in the context of teaching.

It has been shown that the understanding of the academic community regarding the efficiency of e-Learning and the factors that affect the acceptance or non-acceptance of e-Learning is insufficient [7, 8]. It has been established that the efficiency of knowledge acquired based on the use of ICT is comparable to the knowledge acquired in traditional teaching [2].

It is a well-known fact that the acceptance of teaching based on e-Learning is influenced by motivation, advance ICT skills and the attitudes towards e-Learning [7, 9, 10-14].

2. Literature review

Further review of relevant scientific literature yielded the researches and questionnaires used to test the experiences of work with computers and/or to measure the attitude of students and professors towards learning on the Internet. Table 1. shows certain tools used to measure the attitude towards the use of ICT in the learning process of student population [15-18].

Table 1. Certain tools used to measure the attitude of students population towards the use of ICT in teaching process.

Year Country	Authors	Sample	Instrument (Questionnaire)	Number of items	Cronbach Alpha
2006 Austria	Link and Marz [15]	N=1160	Stance and experience of e-learning, online questionnaire	32	a=0.97
2007 India	Mirsha and Panda [16]	N=150	Development and factor analysis of an instrument to measure faculty stance towards e-learning	12	a=0.85
2007 Taiwan	Liaw et al. [17]	N=50 Instructor's	Computer and Internet experience and learner stances towards e-learning questionnaire	25	a=0.95
		N=168 Students		19	a=0.92
2010 United Kingdom	Wilkinson et al. [18]	N=60	Questionnaire for measuring student ICT skills, experience and stances to e-learning	47	a=0.87

Even though the above-mentioned researches have shown high reliability ($\alpha \geq 0.912$), careful examination of the statements has shown that their sense and/or content does not correspond to the situation in our system of higher education, i.e. to the way of work and the habits of our test subjects. All the questionnaires we examined were drafted in English language. The translation of these questionnaires would partially lose the original meaning of the statements, and thus it would be questionable whether any such (translated) questionnaire would indeed measure the attitude of students towards *e-Learning*. The translated questionnaire does not have the same psychometric properties as the original questionnaire. The reliability and validity of the questionnaire translated into Serbian language are not the same as the reliability and validity specified in the original research [3, 19].

3. Methodology

3.1. Research objective

The objective of this research is to design a questionnaire and determine psychometric properties of the questionnaire, such as reliability and validity, and to determine the attitude of students towards *e-Learning*.

The determination of the attitude of students towards *e-Learning* would contribute to a more efficient implementation of *e-Learning*, as well as to the teaching process development strategy in the institutions of higher education [20-22].

3.2. Questionnaire development

After reviewing the relevant scientific literature on *e-Learning* and the questionnaires used to measure the attitude towards *e-Learning*, as well as based on our research done so far [2, 7, 9], a group of over 50 items has been prepared. During the preparation of statements, the rules and recommendations for questionnaire designing have been taken into consideration [9, 14, 18]. A total of eleven items have been taken from the Questionnaire stance and experience of *e-Learning*, online questionnaire [15] and adapted to our research, from the Questionnaire development and factor analysis of an instrument to measure faculty stance towards *e-Learning* [16] a total of nine items have been taken, while five items have been taken from the Questionnaire for measuring student ICT skills, experience and stances to *e-Learning* [18]. For the first version of the questionnaire used to measure the attitude towards *e-Learning*, 20 items were selected, 10 positive and 10 negative. The positive items describe the awareness, feelings and

positive behaviours towards e-Learning. The negative items describe dislike, negative behaviours or awareness towards e-Learning. Both positive and negative items in the questionnaire were given in random order to maintain the attention of the test subjects during the completion of the questionnaire and to reduce untruthful responses to the minimum. The responses to the items were shown on the Likert scale from one to five for positive statements (ranging from “strongly agree” to “strongly disagree”) and opposite, from five to one for negative items (ranging from “strongly disagree” to “strongly agree”). The introductory part of the questionnaire includes demographic data about the test subjects: gender, faculty, year of study, place of study, questions concerning the frequency of computer use, questions concerning the purpose of computer use, while the last two questions relate to the familiarity with the concept of e-Learning and to attending e-Lectures.

3.3. Psychometric properties of the questionnaire

In order to determine the validity of the questionnaire, the exploited factor analysis has been used, specifically Principal Component Analysis, while the Internal-consistency method has been used to determine the reliability, which involved the determination of the Cronbach’s Alpha reliability coefficient.

The validity has been determined indirectly by determining the number of factors, while the number of factors has been determined based on the results of the Cattell scree test, through the use of Guttman-Kaiser criterion and by calculating the value of inter-correlation between opposite factors and by calculating the value of inter-correlation between factors and individual statements. An Oblimin rotation of items has been done due to the fact that orthogonal rotation did not result in the sequence of items that would be meaningful. The appearance of the Scree curve and the number of items with the own value of >1 (Guttman-Kaiser criterion for factor reduction was used) have determined the number of factors. An additional reduction of the factors was made when there was a significant correlation between individual factors (for the inter-correlation coefficient >0.6). The critical value of Cronbach’s Alpha coefficient of reliability is the value of > 0.70 .

According to Guttman-Kaiser's criterion, we only require factors >1 . We have five such elements. These five factors explain a total of 70.185% variance. According to the Cattell criterion, we look for a fracture point on the transient diagram. This is point 3, and we keep only the factors above (before point 3), the first two. These two factors explain much more of the variance than the remaining elements.

3.4. Sample of subjects

The analysis covered a total of 121 subjects, of which 51 or 42.1% were male and 70 or 57.9% were female. From the total of 121 subjects, 20 subjects or 16.5% were the students of the first year, 21 or 17.4% were the students of the second year, 32 or 26.4% were the students of the third year and 48 or 39.7% were the students of the fourth year. As many as 93 subjects, i.e. 76.9%, were studying in capital city - Belgrade while 28 subjects or 23.1% came from other cities. The response percentage was 100%.

3.5. Procedure

Prior to the survey, the test subjects were familiarized with the goal of this research, as well as with the questionnaire completion procedure. At the very beginning of the lecture, the students have filled in the questionnaire in very similar conditions. All the subjects have filled in the questionnaire voluntarily and independently, while the time needed for the completion of the questionnaire was around fifteen minutes. The questionnaires were fully filled in by 121 test subjects. The response percentage was 100%.

The research procedure that was carried out during June-July 2019.

4. Interpretation of results

4.1. Validity and Reliability of the Questionnaire

Twenty items on the use of ICT in teaching were subjected to factor analysis (main component analysis).

Firstly, we assessed the suitability of data for factor analysis. By reviewing the correlation matrix, we noticed that there were many coefficients above 0.3. The value of Kaiser-Meyer-Olkin indicator is $0.867 > 0.6$. The Bartlett's Test of Sphericity (Table 2.) has reached statistical significance (< 0.05).

Table 2. KMO and Bartlett's test.

Kaiser-Meyer-Olkin Adequacy	Measure of Sampling	0.867
Bartlett's Test of Sphericity	Approx. Chi-Square	1468.441
	df	190
	Sig.	0.000

A two-factor solution explains 52.415% of the variance, where the contribution of the first factor is 36.271%, and of the second factor 16.144%. The rotated solution (Oblimin) has shown that both factors have a lot of large factor loadings and that all the variables yield significant loadings to only one of the factors. There is a moderate positive correlation between these two factors.

A principal component factor analysis has been done, which incorporated a scree curve analysis, a Guttman-Kaiser criterion for the reduction of principal factors, as well as the analysis of inter-correlations between the factors and individual items and analysis of intra-correlation between factors. We have determined two factors: a positive attitude towards *e*-Learning and a negative attitude towards *e*-Learning.

Cronbach's Alpha reliability coefficient for the questionnaire has shown the value of 0.900, which means that the questionnaire is highly reliable (Table 3.). Therefore, a good correlation has been established for all 20 items between individual items and the factors (majority of inter-correlation coefficients amounted to > 0.3), as well as some minor overlapping between two factors. The intra-correlation between these two factors amounted to $r=0.305$, which describes a good correlation and allows for the measuring of the overall attitude of the students (Table 4.).

Table 3. Reliability Statistics.

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0,900	0,896	20

Table 4. Component Correlation Matrix.

Component	1	2
1	1.000	0.305
2	0.305	1.000

4.2. Attitude Towards *e*-Learning

The overall attitude of students towards *e*-Learning is highly positive and amounts to 78.65 ± 14.35 .

The only significant difference was found in the frequency of Internet use. By applying the independent *t*-test, we found that there was a significant difference ($p = 0.026$) in students' stance towards *e*-Learning comparing students using the Internet weekly (66.00 ± 18.751) in the ratio to students using the Internet daily (79.31 ± 13.876). Students who use the Internet daily have a more positive stance.

5. Conclusion

The application of this questionnaire to the student population in the Republic of Serbia and the statistic processing of data would allow for a better understanding of attitudes of students towards *e*-Learning. At this moment, there are no rules of profession in relation to the designing of *e*-Courses, there are no recommendations on how much of the lectures should be optimally organized in the traditional way and how much in the form of *e*-Lectures. In education, it is surely important to raise the awareness of the teachers and educational institutions about the use of new forms of teaching, such as *e*-Learning. Now when we know the attitude, we can predict the intention and the behaviour of the students in relation to *e*-Teaching. The results obtained should help with the defining of the changes in the teaching process at universities, and potentially with the designing of guidelines for *e*-Education.

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