Tendency to be Open to Learning Scale: Validity and Reliability Studies

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Abstract
This study aims to develop a valid and reliable measurement tool that will serve to determine the level of higher eduction students' tendency to be open to learning. The sample of the research consists of 523 higher education students. As a result of the literature review and analysis, the dimensions predicted as sub-dimensions in the scale are "being curious/ investigative, reflecting, being open-minded, being planned, being patient. Within the scope of the validity studies of the Tendency to Be Open to Learning Scale (TOLS), exploratory factor analysis was performed and construct validity was determined. As a result of the exploratory factor analysis, a 5-point Likert-typetool with 22 items collected in four dimensions was reached. The resulting TOLS consists of "F1. being patient, F2. being open-minded, F3. being curious, F4. being planned" sub-dimensions. As a result of the exploratory factor analysis performed to determine the scale's validity, it is seen that the four dimensions included in the scale explain 49.31% of the total variance.
Keywords: Lifelong Learning, Openness to Learning, Higher Education

Introduction

Experiencing the pandemic process in the world led to the emergence of modern technologies, the increase in participation in the international labor market and organizations, the emergence of new professions, changes in the way existing professions work, to the change of social structures, differentiation in the lifestyles of individuals. Education is the institution most affected by the global factors specified and the problems and opportunities caused by these factors. During this period, the characteristics of the qualified individual expected to be trained by educational institutions have changed. "Able to promote democratic processes, manage controversial issues, work in a multicultural environment, adapt to changes brought by new technologies and new organizational forms in social life, think globally and act locally" (Ivanova, 2009) individuals are needed. Based on these requirements, different characteristics of twenty-first century learning have been defined by many researchers in the literature.

As a result of the research conducted by the National Research Council (2011) on teaching and evaluating 21st century skills, they classified the types of knowledge and skills that students need to be ready for university and profession:(1) cognitive skills, including critical thinking, non-routine problem solving and systematic thinking; (2) interpersonal skills, including complex communication and social skills, teamwork, cultural sensitivity and

coping with diversity; (3) intrinsic skills, including self-management, time management, self-improvement, self-regulation, adaptation and executive function (NRC, 2011). Lai and Viering (2012) analyzed the main frameworks mentioned in the literature on twenty-first century skills. They determined that critical thinking, collaboration, creativity, metacognition and motivation are the most commonly used terms. As it can be seen, from an individual point of view, it is crucial to be an individual who is open to learning new ideas regardless of age and understanding that education should not end when someone graduates in order to secure a job in the twenty-first century (El-Mawas and Muntean, 2018). On the other hand, from a social point of view, it is essential to have a learning society in order for the society to survive. Lifelong learning, which is defined as an umbrella concept that covers all aspects of education, embraces everything in it, and the totality of which is more than the sum of its parts, is the cornerstone of the learning society(Love, 2011).

Lifelong learning is defined as "all learning activities carried out throughout life in order to improve personal, civic, social or employment-related knowledge, skills and competence" (Lewis and Whitlock, 2002; EC, 2002). The most important of these components is the tendency to be "open to learning", which explains the individual's desire to learn (Crick et al., 2004; Goeller, 2008) and motivation for learning, an innate trait of the individual such as breathing. In their study, which aimed to identify the components of lifelong learning, Crick et al. (2004) being a good lifelong learner is to be open and willing to learn. All theoretical or practical studies conducted in the relevant literature point out that to survive in the twenty-first century, individuals should have a tendency to "be open to learning". However, as Zepke and Leach (2002) pointed out, today's students have docile, passive characteristics that seek advice from their teachers for the information they need, stick to the curriculum and books, work for high grades, diplomas or certificates, leave learning control to others, exhibit learned helplessness. Therefore, to develop 21st-century competencies and skills in students, there is a need to include the tendency to be open to learning in the programs and teaching and evaluating this tendency (Saavedra and Opfer, 2012). Based on this requirement, this study aims to develop a valid and reliable measurement tool that will determine the level of higher eduction students' tendency to be open to learning. When the relevant literature is examined, measurement tools have been developed for individuals at primary, higher and in-service education levels that serve to measure their; lifelong learning tendencies and competencies (Diker-Coşkun and Demirel, 2010; Şahin et al., 2010; Boztepe and Demirtaş, 2016; Gür-Erdoğan and Arsal, 2016; Engin et al, 2017), responsibilities towards learning (Yakar and Saracaloğlu, 2017) and attitudes towards learning (Kara, 2010). Although the measurement tools developed in the literature provide indirect data about the tendency to be open to learning, the absence of a measurement tool that directly focuses on the tendency to be open to learning makes this research valuable. In addition, the research is considered necessary to provide a measurement tool to the Turkish literature on the relevant psychological structure, thereby leading empirical research on this subject.

Method

Research Model

This research is a scale development study that can be used to determine the tendency of higher education students to be open to learning.

Study Group

The study group, which was created to carry out the validity and reliability studies of the research, was determined using the appropriate sampling method. The sample of the research consists of 523 students studying at Kütahya Dumlupınar University in the fall semester of the 2017-2018 academic year in the faculties of education, arts and sciences, engineering, fine arts, economics and administrative sciences, and the school of health and the school of physical education and sports. The majority of the 523 students in the study group are female students; in terms of the class they are studying, they are in the fourth grade; in terms of the secondary education institution they graduated from, they graduate from general high school; reads a book per month or longer in terms of reading status; in terms of average daily study, they study for one hour a day.

Development of Data Collection Tool

A conceptual framework regarding the concept of being open to learning could not be reached in the literature. For this reason, the definition and scope of the concept of being open to learning have been determined and observable markers (behavior indicators) have been written. In this process, first of all, the literature and scales related to the concept was examined (Diker-Coşkun and Demirel, 2010; Şahin, Akbaşlı and Yanpar Yelken, 2010; Boztepe and Demirtaş, 2016; Gür-Erdoğan and Arsal, 2016; Engin et al., 2017; Kara, 2010; Sarıçam et al., 2016; Yakar and Saracaloğlu, 2017). Finally, an open-ended questionnaire was applied to 80 students studying at different faculties and colleges at Dumlupınar University in Kütahya. In the open-ended questionnaire, students were asked questions: "What are the behaviors that a university student who is open to learning should display?" As a result of analyzing the data obtained from the students, the following themes were reached.

Table 1 Themes Obtained as a Result of the Analysis of the Data Obtained From the Open-Ended Questionnaire

Being curious	Be planned
Being investigative	Using time effectively
Being open to innovations	Being respectful of differences
Keeping up to date	Being open-minded
Following resources related to the field	Being inquisitive
Participating in cultural-artistic activities	Be patient
Continuous self-assessment	

As a result of the analysis, it was determined that some of the themes obtained within the scope of the tendency to be open to learning cover each other. Some of them have similar behavioral indicators and are insufficient in number. As a result of the literature review, the data obtained from university students and expert opinions, considering the criteria of "writ ability of behavioral indicators" and "limitation of the scope", the dimensions envisaged as sub-dimensions in the scale are "being curious/ being investigative, reflecting, being open-minded, being planned and being patient". Regarding the five predicted sub-dimensions, an item pool of 40 items was created by taking into account the literature and the answers given by the students to the question "The behaviors that a university student who is open to learning should display" in the open-ended questionnaire. In order to examine the scope validity of the created 40-item scale form, the scale form was submitted to the opinion of five field experts and an assessment expert. In accordance with the feedback and corrections received from experts, the articles were rearranged and the number of articles was reduced to 35. The 35-item draft scale was applied to 20 fourth-grade students studying in the departments of Kütahya Dumlupınar University to evaluate the scale in terms of language and intelligibility and the participants found the items to be understandable. Thus, the final 35-point draft scale form was made ready for application to conduct validity-reliability studies.

Data Analysis

Cronbach Alpha analysis, correlation analysis, halving test reliability analysis and exploratory factor analysis were performed on the data analysis. Before starting the validity and reliability studies of the scale form, the extreme values that are likely to distort the results of statistical tests were examined in the data set. As a result, after univariate and multivariate outliers were removed from the study, analyzes were conducted with 480 university students. KMO value (.90) and Bartlett test ($x2=5461.941$, $sd = 595$, $p < .00$) results were examined to determine the suitability of the data set for factor analysis before proceeding to the construct validity of the scale form. This result showed that the data were suitable for factor analysis (Büyüköztürk, 2006).

Results

Validity Studies

Construct Validity

In the study, the exploratory factor analysis approach and principal component analysis technique were used to determine the factor structure of the TOLS. As a result of this technique being performed without rotation, when the variance rates explained by the factors with eigenvalues greater than 1 were examined by the Kaiser-Guttman

principle, the 10-factor structure of the TOLS was revealed. These 10 factors accounted for 60.77% of the total variance. In this study, deciding the number of factors according to the Kaiser-Guttman principle specified in the literature can lead to the production of more factors than actually exists. In order to decide on the number of factors, it was also important to make theoretical sense of the factors (Akbulut 2010) and it was observed that the items collected under factors other than the first 4 components were either very small in number (one or two items) or had a factor load of more than 30 under other components. While deciding on the number of factors, the contribution of each factor to the total variance was also taken into account. It was predicted that the first 4 of the 10 factors with an eigenvalue greater than 1 performed most of the explanation of the variance. As a result of the exploratory factor analysis carried out for the four-factor structure of the instrument, it was seen that the scale items were gathered under the factor structures in question in a statistically and theoretically significant way. Therotation technique was used in the analysis of the four-factor structure of the TOLS with the basic components technique. Varimax was used as the rotation technique since it was predicted that the TOLS has a multifactorial structure. As a result of varimax vertical rotation, some criteria were selected to determine which items each factor of the four-factor structure consisted of from the rotated components matrix. These criteria are that the load value in the factor in which an item is included should be at least .30 or higher, and the difference between the factor loading value of an item with a load value of .30 or higher in a factor and the load values in other factors should be at least .10. The path followed while performing the exploratory factor analysis for the four-factor structure is given in Table 2.

Table 2 The Path Followed When Performing the Exploratory Factor Analysis for the Four-Factor Structure

	Deleted item	Close factor load values	CITC	Alpha, after the deletion	Variance (%), after the deletion
	Initial state of the scale			**.90**	**41.15**
1	Item 20	.37 - .39	.43	.90	41.55
2	Item 27	.35 - .36	.55	.90	41.69
3	Item 23	.36 - .38	.23	.90	42.61
4	Item 7	.27 - .32	.41	.89	43.34
5	Item 22	.33 - .39	.45	89	43.95
6	Item 1	.26 - .35	.36	.89	44.86
7	Item 4	.28 - .34	.43	89	45.61
8	Item 19	.39 - .49	.52	89	45.91
9	Item 25	.29 - .42	.47	87	46.59
10	Item 26	.40 - .45	.38	.87	47.26
11	Item 11	.30 - .42	.48	.87	48.00
12	Item 18	.25 - .48	.50	.86	48.73
13	Item 28	.28 - .56	.49	.85	49.31

As shown in Table 2, 11 items in the study were excluded from the analysis because they did not meet the criteria established to determine which items each factor of the four-factor structure consists of as a result of varimax vertical rotation; since two items were not loaded on the expected factors, they were removed from the analysis and the analysis was repeated. In the first version of the analysis, 41.15% variance was explained under four factors with all items; in the final version, 49.31% variance is explained after deleting 13 items. In the literature, it is considered sufficient for the total variance to be between 40% and 60% in multi-factor scale structures (Scherer et al., 1988, as cited in Tavşancıl, 2005). Based on this criterion, the obtained four-factor scale structure is sufficient to measure the level of openness to learning of university students. After the substances were eliminated, the results of the principal component analysis, which was rotated vertically by the varimax method, are given in Table 3.

Table 3 Results of Vertically Rotated Principal Components Analysis by Varimax Method After Elimination of Items

Item No According to Factor Structure of TOLS	Post-Rotation Factor Load Values of TOLS				CFV
	F1	F2	F3	F4	
Item 32	.77	.00	.12	.19	.64
Item 33	.76	.00	.00	.17	.61
Item 34	.70	.20	.00	.00	.54
Item 30	.66	.15	.00	.23	.52
Item 31	.66	.17	.20	.14	.53
Item 35	.64	.00	.00	.11	.42
Item 5	.55	.00	.17	.22	.38
Item 13	.00	.78	.00	.00	.60
Item 10	.11	.68	.12	.00	.49
Item 12	.12	.67	.21	.00	.51
Item 14	.22	.63	.00	.00	.45
Item 9	.00	.56	.19	.21	.39
Item 6	.00	.55	.25	.00	.37
Item 16	.00	.21	.83	.00	.73
Item 17	.23	.20	.71	.00	.60
Item 15	.00	.28	.70	.00	.57
Item 2	.26	.11	.44	.00	.27
Item 29	.26	.00	.00	.71	.57
Item 24	.19	.00	.00	.70	.52
Item 3	.14	.00	.00	.57	.34
Item 8	.00	.21	.00	.53	.33
Item 21	.17	.00	.26	.52	.36
% Variance % 17.54 % 12.19% 9.24% 9.02					
Eigenvalue4.21 2.922.222.16					
For the whole scale; % Total variancec= % 49.31 KMO=0.86 Bartlett's test of sphericity[=3115.560, sd =231, p< .01] F1. Being Patient, F2. Being Open-minded, F3.Being Curious, F4. Being Planned CFV: Common Factor Variance					

As shown in Table 3, for the "F1", which consists of seven items, factor load values range from .55 to .77, common factor variances range from .38 to .64, explaining 17.54% of the total variance. Fort he "F2", which consists of six items, factor load values range from .58 to .78, common factor variances range from .37 to .60, explaining 12.19% of the total variance. Fort the"F3", which consists of four items, factor load values range from .44 to .83, common factor variances range from .27 to .73, explaining 9.24% of the total variance. For the "F4", which consists of five items, factor load values range from .52 to .71, common factor variances range from .36 to .57, explaining 9.02% of the total variance. There is no reverse item on the scale. As the scores obtained from the scale increase, the level of openness to learning will increase. The correlation matrix for the total score and subscales of the openness to learning scale values are given in Table 4.

All of the sub-dimensions in the scale of the tendency to be open to learning show significant relationships with each other and with the total score. The being patient dimension showed a significant positive correlation with values of .32, .35, and .47 with other dimensions, respectively and .81 with total

points. The open-mindedness sub-dimension showed a positive correlation of .48 with the sub-dimension of being curious, .19 with the sub-dimension of being planned, and .69 with the total points. Being curious sub-dimension showed a positive correlation of .19 with the sub-dimension of being planned, and .65 with the total points while being planned sub-dimension has a positive correlation value of .67 with the total points.

Table 4 Correlation Matrix for Total Score and Subscales of Openness to Learning Scale, Standard Deviation Values

	F1	F2	F3	F4
F1. Being patient	-			
F2. Being open-minded	.32	-		
F3. Being curious	.35	.48	-	
F4. Being planned	.47	.19	.19	-
TOLS total points	.81	.69	.65	.67

Reliability Studies

Cronbach Alfa Reliability Coefficient

The reliability coefficient obtained from the responses of 480 participants to 22 items of the scale was determined as .85. Reliability coefficients of the four dimensions of the scale are; .84 for "being patient", .76 for "being open-minded", .71 for "being curious", and .64 for "being planned". The calculated reliability coefficients indicate that the scale's reliability is high.

Item Analysis

Table 5 shows the independent t-test results examining the significance of the difference between the item scores of the top and bottom 27% groups which are determined according to the total point and the item-total correlations, which is calculated to reveal the distinctiveness of the items in the scale to measure openness to learning.

Table 5 Item Analysis Results for Each Dimension of the Scale

F1	CITC	t-test*	F2	CITC	t-test*	F3	CITC	t-test*	F4	CITC	t-test*
M32	.58	17.18	M13	.39	9.83	M16	.41	10.61	M29	.45	11.52
M33	.52	14.81	M10	.42	9.64	M17	.44	11.72	M24	.29	8.21
M34	.50	12.58	M12	.43	11.40	M15	.41	10.46	M3	.26	7.67
M30	.56	15.23	M14	.41	9.64	M2	.35	9.38	M 8	.34	8.99
M31	.57	17.85	M9	.42	9.61				M21	.36	10.24
M35	.44	10.47	M6	.31	7.37						
M5	.45	11.89									

* The p values for all items are .000. Comparisons for all items are significant at the .001 level.
F: Factors and item no, t-test:Top %27- Bottom %27 the significance test of the difference (Independent t-Test), CITC: Corrected item-total correlations

When Table 5 is examined, the item-total correlations of the items in F1 are between .44 and .58; F2 are between .31 and .43; F3 are between .36 and .44; F4 are between .26 and .45. Another method used within the scope of item analysis is to test the differences between the item average scores of the bottom 27% and top 27% groups (outlier groups), which are formed based on the total scores of the test, using the unrelated t-test.As a result of the comparison of the bottom and top groups consisting of 260 individuals, it was determined that the t values of all items in the scale were significant at the $p < .01$ level. This can be considered as an indicator of the internal consistency of each dimension of the TOLS. The analysis results show that the items contained in each factor distinguish university students in terms of being open to learning.

Studies Aimed at Determining the Reliability with the Halving Test Method

The reliability of the TOLS was also determined by the halving test reliability method. The alpha value and test correlations of two halves for each dimension of the TOLS are given in Table 6.

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able 6 Analysis Results Regarding the Halving Test Reliability Method

TOLS	Test Correlations of Two Halves First Half	Test Correlations of Two Halves Second Half	Spearman-Brown	Spearman-Brown	Guttman Split-Half
Being patient	.81	.60	.82	.82	.79
Being open-minded	.60	.70	.70	.70	.70
Being curious	.36	.70	.70	.70	.70
Being planned	.41	.60	.60	.60	.60

These values indicate that the reliability for both parts of each dimension is close to each other (Kalaycı, 2005) and that the test items are arranged sequentially. In addition, the correlations between the two halves of the dimensions, Spearman-Brown and Guttman split-half reliability indicate that the reliability of all scale dimensions is at a reasonable level.

Discussion, Conclusion and Suggestions

This study, aimed to develop a valid and reliable measurement tool for university students regarding the tendency to be open to learning. As a result of the studies, a 5-point Likert-type (1 = it doesnot reflect me at all, 2 = it doesnot reflect me, 3 = it reflects me partially, 4 = it reflects me, 5 = it reflects me a lot) tool consisting of 22 items collected in four dimensions (being patient, being open-minded, being curious, being planned) was obtained. There areno reverse-scored items on the scale. Scores obtainable from the scale range from 22 to 110. As the scores obtained from the scale increase, the tendency to be open to learning will increase.

These four dimensions of the scale are in remarkable agreement with the studies in the literature on the learning tendencies and skills of university students. For example, in her study where Namlu (2004) developed the metacognitive learning strategies scale, she determined the sub-dimensions of metacognitive learning strategies as “planning, organization, supervision, evaluation”. Kökdemir (2003) determined the sub-dimensions of the critical thinking tendency scale, which he adapted into Turkish, as “truth scanning, open-mindedness, systematicity, self-confidence, analyticity, inquisitiveness, maturity”. As a result of validity and reliability studies, Coşkun (2009) defined the sub-dimensions of lifelong learning as “motivation, persistence, lack of regulation of learning, lack of curiosity” in her doctoral thesis in which she developed the scale of lifelong learning tendencies. When the studies in the literature are examined, it can be said that the scale of the tendency to be open to learning developed in the study has a high scope validity in terms of the tendencies expected to be possessed by university students who are open to learning.

The statistical validity and reliability analyses for TOLS provide strong evidence that the scale is suitable for use. As a result of the exploratory factor analysis performed to determine the scale’s validity, it is seen that the four dimensions in the scale explain 49.31% of the total variance. Considering that the total variance rates ranging from 40% to 60% are considered sufficient in the multi-factor scale structures developed in the social sciences in the literature (Tavşancıl, 2005), the variance rate explained by the TOLS can be seen as an indicator that it measures the tendency of university students to be open to learning at an acceptable level. First of all, the internal consistency coefficients were examined in order to determine that the TOLS is a reliable tool. The internal consistency coefficients of the dimensions constituting the scale are pretty high, except for the TOLS and the being plannedsub-dimension. In the literature, it is stated that the reliability coefficient value of .70 or higher for a psychological test is generally sufficient for the reliability of the test scores (Büyüköztürk, 2006). Considering the criteria stated by Özdamar (1999) in evaluating of the alpha coefficient, it can be said that the sub-dimension of being planned with an internal consistency coefficient of .64 is also quite reliable.

Secondly, item-total correlations were examined in order to determine that the TOLS is a reliable tool. The item-total correlations in the first, second and

third sub-dimensions of the TOLS are above .30. In the literature, when statistical significance is taken as a criterion for interpreting the item-total correlation, it is stated that items with an item-total correlation of .30 and higher distinguish individuals well (Büyüköztürk, 2006). The item-total correlations (.29 and .26) of the two items in the fourth factor are below .30. In the literature, it is stated that the items with item-total correlation values between .20 and .30 can be taken to the test if they are deemed necessary (Büyüköztürk, 2006). Since the factor load values (.70-.57) and common factor variances (.57-.34) of the two items mentioned in this study were high, it was decided not to be removed from the scale by taking expert opinion.

Thirdly, item analysis was performed to determine that the TOLS is a reliable tool. As a result of the study conducted for item analysis, it was seen that the t values of all items were significant at the .001 level. This result shows that the scale items distinguish university students in terms of their tendency to be open to learning. The results of the halving test method also indicate that the reliability is close to each other and high for both halves in each dimension.

Finally, the correlation of the scale's total score with the sub-dimensions was examined to determine that the TOLS is a reliable tool. The literature states that the sub-dimensions showing a low correlation with the total score should be removed from the scale (Tavşancıl, 2005). As a result of the examination, taking into account the limits specified by Büyüköztürk (2006) in interpreting the correlation, it is concluded that the total score of the scale is high with the sub-dimension of "being patient"; and moderately related with the sub-dimensions of "being open-minded, being curious, being planned". These correlation values show that the four sub-dimensions are the components of the tendency to be open to the learning scale.

The results of all analyses made for the scale's reliability show that the TOLS is a reliable measurement tool. As a result of the validity and reliability analyses, it is seen that the TOLS is an acceptably valid and reliable measurement tool that measures the tendency of university students to be open to learning.

By all these explanations, the following suggestions can be made for future research:

The scale of the tendency to be open to learning, which was developed in the research, can be used by other researchers as a data collection tool.By determining the tendency levels of university students to be open to learning, researchers can identify problems related to being open to learning and conduct studies in which they can provide solutions to these problems. It is noted in the literature that the tendency to be open to learning is theoretically related to many concepts. By using the TOLS, this relationships can also be proven statistically.

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