DEVELOPING A LATERAL THINKING DISPOSITION (LATD) SCALE: A VALIDITY AND RELIABILITY STUDY

(YANAL DÜŞÜNME EĞİLİMİ (YADE) ÖLÇEĞİNİN GELİŞTİRİLMESİ: GEÇERLİK VE GÜVENİRLİK ÇALIŞMASI)

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ABSTRACT

This research aims to develop a lateral thinking disposition (LATD) scale. The survey method was used throughout the study. In practice, it was studied with 908 students. According to the factor analyses results, KMO value of LATD scale has been found to be 0.794 and the value of Barlett test has been found to be 1585.363 (Sd= 36, p=0.000). LATD scale is a unidimensional scale which explains 46.637% of the total variance. The analysis results of LATD scale is seen to change between 0.41-0.70 of factor loading and between 0.474-0.668 of item-total correlations. It was found out that test-retest correlation was 0.771 and correlation coefficient between two half- points was 0.685. Cronbach Alpha Coefficient of LATD scale has been found to be 0.754. The scale consists of 9 items. According to these results, the scale can be claimed to be valid and reliable. Having proved to be valid and reliable, the LATD scale has gone through confirmatory factor analysis with the help of AMOS program (Chi-square = 6,744, Sd = 16, GFI = 0.998, CFI = 1.000, RMSEA = 0.000). According to these results, the scale is found to be appropriate to be applied to university students.

Key words: Lateral thinking, lateral thinking disposition, validity, reliability, scale development.

ÖZET

Araştırmanın amacı, yanal düşünme eğilimi (YADE) ölçeğinin geliştirilmesidir. Araştırmanın yöntemi tarama modeli şeklindedir. Uygulamada 908 öğrenci ile çalışılmıştır. Faktör analizi sonuçlarına göre, YADE ölçeğinin KMO değeri 0.794, Bartlett testi değeri 1585.363'dir (Sd= 36, p=0.000). YADE ölçeği tek boyutludur. Ölçek, varyansın % 46.637'sini karşılamaktadır. YADE ölçeği için yapılan analiz sonuçlarında, faktör yüklerinin 0.41-0.70 arasında ve madde toplam korelasyonlarının 0.474-0.668 arasında değiştiği görülmektedir. Ölçeğin test tekrar test korelasyonu 0.771 ve iki yarı puanları arasındaki korelasyon katsayısı 0.685 bulunmuştur. YADE ölçeğinin Cronbach Alpha katsayısı 0.754'dir. Ölçek, 9 maddeden oluşmuştur. Bu sonuçlara bakarak, ölçeğin geçerli ve güvenilir olduğu söylenebilir. Geçerliği ve güvenirliği sağlanmış YADE ölçeğinin AMOS programı ile doğrulayıcı faktör analizi yapılmıştır (Kay kare=6.744, Sd=16, GFI=0.998, CFI=1.000, RMSEA=0.000). Bu sonuçlara göre, ölçek üniversite öğrencilerine uygulanabilir.

Anahtar Kelimeler: Yanal düşünme, yanal düşünme eğilimi, geçerlik, güvenirlik, ölçek geliştirme.

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INTRODUCTION

Lateral thinking is a kind of creative thinking (Fisher, 2005, 26). Lateral thinking is a dimension of creative thinking. A person who thinks laterally, at the same time, thinks creatively. Thus, it is essential to focus on creative thinking first. Creativity is a term difficult to be defined (Halpern, 2009, 397), as there are several views on this concept. Creativity is to make the new ideas evoked and to examine the hypothesis to discover new things (Boone & Hollingsworth, 1990, 1-3). Creativity includes harmonizing with the continuous change, coping with the ambiguity (Karpova, Marcketti & Barker, 2011, 53) and focusing on the successful harmony of daily life (Cropley, 1990, 167-170; Reiter-Palmon, Mumford & Threlfall, 1998, 187-190). Creativity experts emphasize that creative potential of the human being is a limitless source which doesn't depend on race, economy, social status or gender (Florida, 2002, 12-16; Michalko, 2006, 20-25). For this reason, everyone can be creative.

A creative person is someone who solves the problems or produces something, or whose study is evaluated as both original and acceptable by the experts (Gardner, 2004, XXI) and who generalizes his/her opinions (Üstündağ, 2002, 79). These people's creativity is multi-level and complicated; this can be measured and observed with several ways (Daniels, 1987, 163). It is complicated to measure creativity and it is difficult to compare. There are tests and versatile solutions. Creativity has been tried to be measured with versatile inventories such as interest, attitude, personality, biographic or creativity activities or individual reports for success and so on (Gough, 1979, 1398-1400; Torrance & Goff, 1989, 137-140; Fleenor & Taylor, 1994, 464-466; Amabile, 2001, 334-335; Clapham, 2004, 828-833; Kelly, 2004, 12-15 Cramond, Matthews-Morgan, Bandalos, & Zuo, 2005, 284-286). On the other hand, the creative thinking aspect of teacher candidates should be evaluated by the teacher education institutions, including their creativity at work. Moreover, as a result of these evaluations, the teacher candidates should be supported in avoiding behaviors that prevent their creativity.

Some behaviors that prevent creativity are excessive criticism, disbelief, dogmaticalness, inadequacy in the field (Champers, 1973; cited in Sungur, 1997, 349) and not being flexible in terms of thinking (Rıza, 2000,5-6). Scott, Leritz and Mumford (2004, 361-365) proved in their meta-analysis studies that the most effective cognitive training programs have taken place in the cognitive framework. In this context, for a successful creativity training, generating and assessing ideas are important (Milgram, 1990, 215-220; Clapham, 1997, 33-35; Csikszentmihalyi & Epstein, 1990, 58- 60; Lonergan et al., 2004, 231-233).

Divergent thinking and lateral thinking are two significant notions in creative thinking. Divergent thinking appeared in a project research by Guilford in 1950's (Moir,1986,44; Guilford,1950 cited in Ergeneli & Özyurda, 139) and became popular in 1960's and 1970's (White, 1990, 209-210). Lateral thinking is a concept which was discovered and brought in the domain of science by Bono in 1967 (De Bono, 1999, 137). It is very difficult to sort these two concepts. Divergent thinking is important in terms of dealing with more than one formula for a problem (Ergeneli

& Özyurda, 139) and pointing out the creative potential of a person (Acar & Oğurlu, 2009, 3-5; Hu, 2002, 400-4001). Divergent thinking is an important determinent of creativity (Runco & Okuda, 1991). Moreover, it can be said to be the core of the creativity (Guilford, 1977, 184). Even though it is stated that divergent thinking is used synonymously with creative thinking (Halpern, 1997, 244), it is not the same thing with creative thinking, it is just an important component of it (Runco, 1991, 10-18; Runco. 1986, 375-380). The number of tests and techniques which encourage creativity are related with the measuring of divergent thinking (Nystron, 1979, 40).

Lateral thinking is also thought as a crucial component of creative thinking (De Bono, 1999, 9). One of the reasons of lateral thinking being proposed De Bono's study about creative thinking, in which he took creativity as a comprehensive term but saw that there is an indefiniteness in that comprehension. So, there is a need for a claer and definite term for it, and this term is lateral thinking. Lateral thinking is an alternative thinking which is developed against natural, logical and mathematical thinking. Lateral thinking is defined as "skipping from one model to another in the system of forming an asymmetric model" (De Bono, 1999, 137-138). This is a way of thinking about a problem (De Bono, 1968, 6) and originally it is based on the idea to "handle a problem with new perspectives" (Onargan et al, 2004, 2). This thinking, a method of problem solving, appears by imagining. It is a method of problem solving by using imagination, rather than using conventional thinking or logic, to help us in thinking solutions which are not obvious at first sight. Using lateral thinking is a good idea if a new idea is being proposed (Collins Cobuild, 1994, 814).

In the literature, lateral and convergent thinking are used interchangeably, although there exists a nuance between them (Moir, 1986, 49-51). De Bono thinks that lateral thinking is different than convergent thinking even though they yield the same results (De Bono, 2011).

Lateral thinking produces new patterns and ideas for the purpose of shaping vertical or convergent thinking. As Gilford does in divergent thinking, De Bono claims that lateral thinking must be required consciously since the brain possesses natural prudent information processing system (Moir, 1986, 51). The properties of lateral thinking can be listed as follows (De Bono, 1990, 1-62; De Bono, 1977, 180-200):

1. Lateral thinking is generative and moves in order to generate a direction.
2. Lateral thinking is provotive and can make jumps. It can be deliberately perverse.
3. Lateral thinking explores the least likely and it is a probabilistic one.
4. Lateral thinking is the same as inductive logic.
5. Lateral thinking is not a deliberate way of thinking but a creative gift which some people have and others do not.
6. Lateral thinking is concerned with changing patterns.
7. Lateral thinking is both an attitude and a method of using information.

      8. Lateral thinking is directly related to the information handling behaviour of mind.

In lateral thinking, the individual uses information provocatively to reveal restructuring. Internal motivation is critically important in creativity (Amabile, 1988, 123-125; Torrance, 1968; 1995). Arousing the sense of cruosity is important for preserving creativity (Vural, 2008, 30). New concepts, knowledge, theorems, and verbal and quantitative formulas can be produced via lateral thinking. Lateral thinking is a more unambiguous concept than creat ve thinking. The purpose of this study is to develop a new measure to evaluate the students' lateral thinking disposition.

METHOD

The descriptive method is used in this research. With this method, events and objects are described (Kaptan, 1998, 59; Sönmez & Alacapınar, 2011, 46; Karasar, 1995, 77; Büyüköztürk at al., 2009, 16-17). The measure of "lateral thinking disposition" is developed in this study.

Studing Group

The scale to be developed was administered to 908 students. The application was performed in Fırat University, Yüzüncu Yıl University, Cumhuriyet University and Atatürk University. The distribution of students with respect to universities are seen in Table 1.

Table 1. The distribution of working grup with respect to universities

Universities	f (Under graduates)	f (Master Without Thesis)
Fırat University	188	53
Yüzüncü Yıl University	137	46
Cumhuriyet University	173	48
Atatürk University	202	61
TOTAL	700	208

This is the distribution of the universities' application performed with respect to department of education faculties: at Firat University, the scale was applied to the students of Computer and Instructional Technology Education (34 students), Classroom Teaching (55 students), Turkish Language Teaching (40 Students), Science Education (59 Students), Department of Turkish Language and Literature (Without-thesis) (20 Students), Maths Department (15 Students), Physics Department (8 students) and Biology Department (10 Students). In addition, at Yüzüncü Yıl University, it was applied to the students of Social Sciences Teaching (36 Students), Computer and Instructional Technology Education (41 Students), Classroom Teaching (60 Students), Maths Department (Without-thesis) (22 Students) and Department of Turkish Language and Literature (24 Students). Moreover, at Cumhuriyet University, the scale was appied to the students of Classroom Teaching (58 Students), Social Sciences Teaching (40 Students), Turkish Language Teaching (31 Students), Science Education (43 Students), Maths Department (Without-thesis) (21 Students), Physics Department (13 Students) and

Biology Department (14 Students). Furthermore, at Atatürk University, the scale was applied to the students of Preschool Education (38 Students), Psychological Counselling and Guidance (52 Students), Classroom Teaching (64 Students), Turkish Language Teaching (48 Students), Department of Turkish Language and Literature (Without-thesis) (30 Students) and Maths Department (34 Students). The steps of developing Lateral Thinking Disposition Scale are given below:

Developing the Scale of Lateral Thinking Disposition (LATD)
The lateral thinking disposition was developed through the following steps:
1. Literature and the pool of components
2. Expert views and application
3. Factor analysis and total component correlations
4. Test-retest correlation, the correlation between two equivalent semi-score, cronbach alpha
5. Confirmatory factor analysis with AMOS

1. In the draft scale, 29 items were chosen through literature review and the analysis of similar measures and these items were placed into the item pool. The grading scale is as follows: (5) I completely agree, (4) I usually agree, (3) I partly agree, (2) I usually do not agree, (1) I never agree.

2. Five academicians (2 Associate Professors and 3 Assistant Professors) studying in the field of education sciences in the Firat University were consulted for their expert views on the LATD scale. Additionally, 10 students were asked whether they understood the items or not. In line with the views of experts and students, a consensus was reached over 23 out of 29 items. Expressions in some of the items were corrected and as a result, it has been concluded that the scale can be used to measure students' lateral thinking dispositions. The draft scale consisted of 17 positive and 6 negative items. The items, which were determined in line with the expert views, were administered to 908 students and the resulting data were processed. First of all, the 1-5 scaling of the 6 negative items was rescaled as 5-1.

3. Factor analysis, which is a multivariate statistics which aims to explore and find a few new independent and conceptually meaningful dimensions by combining p item variable related to each other (Büyüköztürk, 2002, 117), was conducted on the data. First of all, Kaiser-Meyer-Olkin (KMO) value, which introduces the coherence of the factor analysis, was calculated. Furthermore, in order to test the hypothesis based on the idea of "correlation matrix is equal to unit matrix", Bartlett Test was conducted (UYTES, 1995, 4). In this sense, the population may be seen in the normal distrubition

The items, the factor loadings of which were thought to be below 0.40 were excluded in the students' lateral thinking scale. Factor loadings of the scale are shown in Table 1. The scale can be used as one- dimensional. Factor loadings occurred between 0.41- 0.70. While the scale was being developed, three different assignments were done in factor analysis. In each assignment, KMO and Bartlett values and reliability coefficiency increased. In the third assignment, the scale was

processed as a single factor scale. As a result of the factor analysis, variance has been seen to correspond with 46.637%. According to the results of the factor analysis, in students' lateral thinking disposition scale KMO value has been found to be 0.794 and Bartlett test value has been found to be 1586.363 (Df=36, p=0.000).

Table 1. Factor loadings of the scale and item- total correlations

	Scale Item Number	Items	Factor Loadings	Item-total r
Lateral thinking disposition				
11	1	I'm clever at innovation.	0.68	0.64**
12	2	I tell different things to change one's mind.	0.70	0.65**
13	3	I have aims in my aim.	0.70	0.67**
1	4	I create alternative solutions against a problem.	0.62	0.60**
2	5	I don't follow only one way when thinking about a subject, I create new aspects.	0.58	0.60**
4	6	I look at very different aspects of the events.	0.54	0.56**
17	7	I can brainstorm about all aspects of a subject.	0.52	0.54**
22	8	I don't have fixed categorizations, classificatios and etiquettes while thinking.	0.46	0.52**
23	9	I can be interested in improbable approaches while thinking.	0.41	0.47**
		Eliminated Items		
3	-	I can think many-sided.	-	-
5	-	I enjoy relating the events.	-	-
6	-	I think a subject not deeply in one side but broadly in all sides.	-	-
7	-	I create new ideas.	-	-
8	-	It's my work to produce alternative solutions.	-	-
9	-	I think many-sided when solving a problem.	-	-
10	-	I can change people's ideas with the results of my research.	-	-
14	-	I think analytically but I'm also an instigator for new ideas.	-	-
15	-	I'm high in persuasion.	-	-
16	-	I read in my free times.	-	-
18	-	There is no problem that I cannot solve.	-	-
19	-	I become close-friends with people who favour change.	-	-
20	-	I can state different points by skipping from an idea.	-	-
21	-	I can appropriate any new idea.	-	-

**p<.01

Then, item-total correlations of the scale which identifies the relation between the points of the scale items and the total points of the scale was found. And item-total correlations being 0.30 and above is taken to be sufficient (Büyüköztürk, 2002,32) for the present study. The results of analysis of students' lateral thinking disposition scale show that Item-total correlations varies between 0.474- 0.668 (Table 1).

4. On the other hand, for this questionnaire, test-retest correlation was performed. Which includes applying the same scale to the same group at different times. A 15-day application period can be said to be sufficient in this process. The same scale was applied to 3rd grade students at Classroom Teacher Department at Firat University after 15 days. Test retest was carried on 48 students. In fact, the scale was applied to 55 students. However, there were absent students 15 days later.

For this reason 48 paired data could be done; 30 paired data being the lowest limit (Büyüköztürk, 2002, 20). Consequently, 48 paired data was seen sufficient. In the end, test -retest correlation was found 0.771.

This result was significant in 0.01 levels. In the scale, equivalent two half score correlation was used. The scale was applied once to 908 students and was divided into two (halves) via "odd and even numbers" approach. The correlation between the points which the students got from the two halves was 0.685.

Furthermore, the internal consistency coefficient of the scale was calculated. In this context, Cronbach Alpha coefficient was calculated over 908 students' answers. The general result was found to be 0.754. In the end, the scale consisted of 9 items all of which were positive (Appendix-1).

5. At last, Valid confirmatory factor analysis of valid and reliable LATD scale was done via AMOS program (Figure 1), which is an analysis used to confirm a fictitious or formerly fixed structure or to analyze validity in developing a scale (Bolln, 2007, 40-51; Sümer, 2000, 49-52). Together with this analysis, the factor analytic structure of the variables of the study is tested or confirmed on how it is adjusted according to the model tested (Bayram, 2010, 42). In the studies where structured equality models (SEM) are used, the reliability and validity of the parameter predictions for the population and the coherence of the model evaluation criteria is significantly related to the volume size of the sample (Tezcan, 2008, 30). In this context, gathering data form 908 people in the study is seemed to be sufficient.
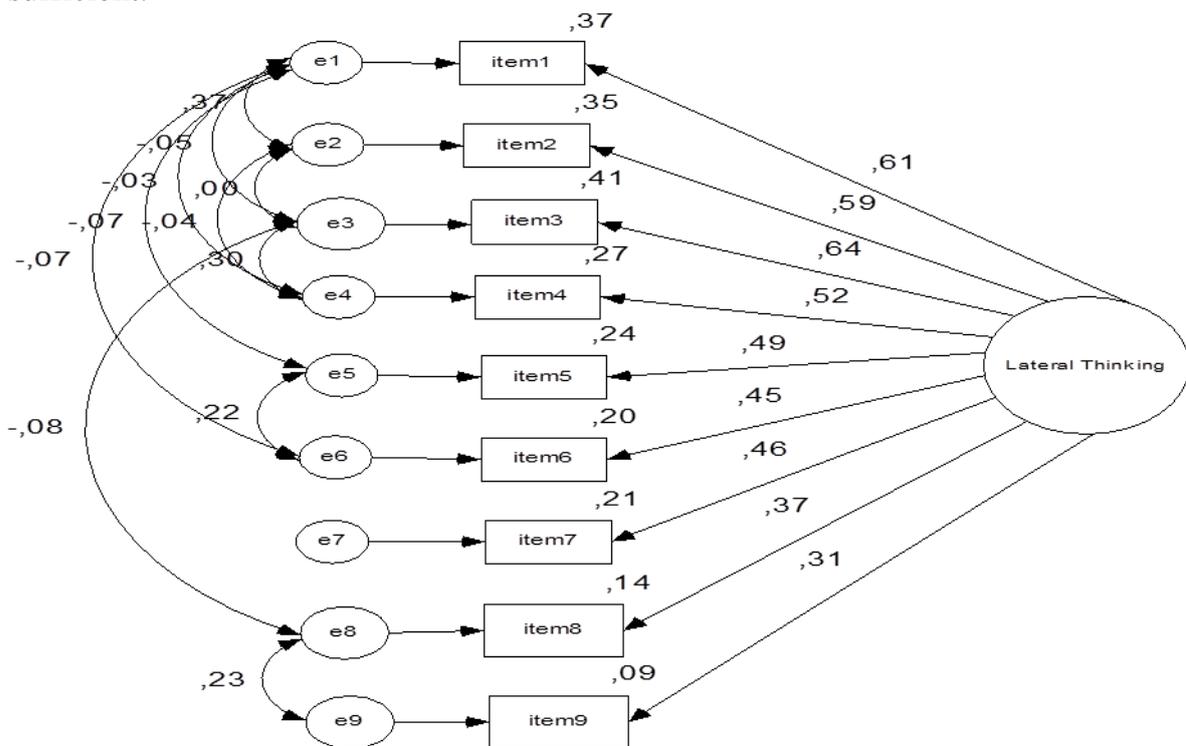
Chi squared=6,744 df=16 p=\pStandardized estimates
GFI=,998 CFI=1,000 RMSEA=,000

Figure 1. The results of confirmatory factor analysis of LATD scale

The results given by the AMOS program are shown in Figure 1. The chi-square value of the output of the program was found to be 6,744. The Chi-square (χ2) / degrees of freedom obtained as 6.744 / 16 < 2 reveals a very strong fit of the model. In addition, what supports this fitting is that the Goodness-of-fit index explained by the model (GFI = 0.998) is close to 1 and Root Mean Square Error of Approximation (RMSEA = 0.000) is zero (0).

The results of confirmatory factor analysis of LATD scale are as follows:

Observed variables are between Item-1 and Item-9; lateral thinking is represented as latent variable. Each variable between e1 and e9 is the measurement error of observed variable. According to the results obtained from the study, there found to be more significant correlation between item-8 and item-9 variables (e8-e9) than the model predicted in modification measurement errors, and the errors were found to be highly correlated. Therefore, covariance was added to the model and the model was estimated again. Similarly, the same procedure was repeated between e3-e8, e1-e6, e5-e6, e3-e4, e4-e2, e1-e4, e2-e3, e1-e3, and e1-e2. Single headed arrows in the figure represent regression coefficients from latent variable to observed variables. In the study, regression coefficients range from 0.64 to 0.31.

Table 3. Confirmatory Factor Analysis Results of the Scale

Model Fit Indexes	The LATD Scale	Goodness of Fit Standart Measures
χ2/sd	0.421	0≤ χ2 /sd ≤2
RMSEA	0.000	0≤ RMSEA≤0.05
SRMR	0.0097	0≤SRMR≤0.05
GFI	0.998	0.95≤GFI≤1.00
AGFI	0.995	0.90≤GFI≤1.00
CFI	1.000	0.97≤CFI≤1.00
NFI	0.996	0.95≤NFI≤1.00

χ2/sd (Cmin / DF) value of the estimated model was found to be 0,421. This result is suitable for a good fit standard size (0 ≤ χ2 / df ≤ 2) . Root Mean Square Error of Approximation was obtained as 0.000. RMSEA values which are 0.05 or less indicate better fit, the RMSEA value of 0.000 reflects perfect model fit. However, there are no differences between the population and sample covariances (Table 3).

According to the GFI and AGFI fit indexes based on the matrix of Standardized Root Mean Square Residual (SRMR), evaluation can be made as follows: If the value of standardized root mean square residual is close to zero, which means that there is a perfect goodness-of-fit (Bayram, 2010, 75). This perfect goodness-of-fit has been indicated in this research (SRMR = 0.0097). Covariance is calculated between observed variables and Goodness of Fit Index (GFI). The GFI result of the research was obtained to be 0.998 and took part among good fit standard sizes. On the other hand, Adjusted Goodness of Fit Index (AGFI) was calculated by taking degrees of freedom into account. AGFI was found to be 0.995 that was suitable for the purpose.

Normed Fit Index (NFI) and Comparative Fit Index (CFI) were calculated. Normed Fit Index is a relatively baseline model between saturated model and independence model (Schermelleh-Engel at al., 2003 cited in Bayram, 2010, 75). As a result of the research, NFI was found to be 0,996. Therefore, according to the standard sizes ($0.95 \leq$ NFI ≤ 1.00), there was a goodness-of-fit. Comparative Fit Index that was found 1.000 at the end of the study has also indicated that there was a goodness-of-fit in the model.

CONCLUSION AND DISCUSSION

In the research, Scale of Lateral Thinking Disposition (LATD) was developed. The scale was applied to 908 students, which is almost 39 times more than the number of outline item. Thus, it can be concluded that the number of students who were applied the LATD scale is sufficient.

While developing LATD scale, 29 items of the scale were brought down to 23 items in respect to the experts' views. As the experts found many items evaluating the same behaviour, they elimated 6 items in the scale. The other 23 items were used in item-factor analysis. Tavşancıl (2002, 31) proposes that in order to increase reliability of the scale, the number of the items should be increased. However, while thinking this idea, one should be careful; because, if many items evaluating the same behaviours are added to the scale to increase reliability, it can be harmful for reliability. Moreover, there is also possibility of unreadability of many items. For this reason, the number of the items (9) in LATD final scale is sufficient.

Moreover, the measurement strength of the scales can be discussed. Scales are indirect measurements. Thus, they cannot replace direct measurements. For this reason, while interpreting the measurements from LATD scale, one should be careful. For instance, a measurement obtained from the first item should be interpreted like this: For the item" I am clever at innovation", a student can give 5 out of 5 poits for himself., Even though this student is not so clever enough on a certain subject, he may reflect himself as if he were more clever. Consequently, the situation should not be ignored and when a description is made, it should be confirmed from different views.

There are 9 positive items in LATD scale. Turgut and Baykul (1992, 162) emphasized that the number of neagative and positive items in the scale should be equal. However, this situation is only possible in theoretical terms, although discussive results may ocur in practice.

Focusing on the supportive points of the scale; from the results of LATD scale, it is seen that factor loads are between 0.474- 0,777 and correlation coefficient between two semi-score is 0.685. Cronbach Alpha Coefficient of the scale is 0.754. Moreover, as a result of confirmatory factor analysis evaluated by AMOS program, these fit index values ($\chi 2$/Sd =0.421, RMSEA=0.000, SRMR=0.0097, GFI=0.998, AGFI=0.995, CFI=1.000, NFI=0.996) show that the scale is valid. In these values, division of $\chi 2$ to free level is smaller than 3. This

value shows that factor structure is well-adjusted (Kline, 1998; Segars & Grover, 1993).

As a resulty, LATD scale can be used in order to measure university students' lateral thinking. Moreover, original ideas may emerge in the groups (Yanpar Yelken, 2009, 93). So, lateral thinking in group activities can be measured. Furthermore, lateral thinking scales can also be developed for teachers, administrators and parents.

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Appendix-1. Yanal Düşünme Eğilimi (LADE) Ölçeği [Lateral Thinking Disposition (LADT) Scale]

1- Hiç katılmıyorum **2-** Çoğunlukla katılmıyorum **3-** Kısmen katılıyorum **4-** Çoğunlukla katılıyorum
5- Tamamen katılıyorum

	Rakam Değeri
1. İnovasyon (yenilikçilik) konusunda zekiyimdir.	[ ]
2. Bir kişinin fikirlerini değiştirmek için farklı durumlar anlatırım.	[ ]
3. Amaç içinde amaçlarım vardır.	[ ]
4. Bir problemle karşılaştığımda alternatif çözümler üretirim.	[ ]
5. Bir konu etrafında düşünürken bir yön takip etmem yeni yönler üretirim.	[ ]
6. Olaylara çok farklı açılardan bakarım.	[ ]
7. Bir konunun tüm yönleriyle ilgili beyin fırtınası yapabilirim.	[ ]
8. Düşünürken kategori, sınıflama ve etiketlerim sabit değildir, değişkenlik gösterir.	[ ]
9. Düşünürken ihtimal dışı yaklaşımlarla ilgilenebilirim.	[ ]