Yayın Geliş Tarihi: 04.08.2017
Yayına Kabul Tarihi: 09.11.2018
Online Yayın Tarihi: 26.12.2018
http://dx.doi.org/10.16953/deusosbil.332763

Dokuz Eylül Üniversitesi
Sosyal Bilimler Enstitüsü Dergisi
Cilt: 20, Sayı: 4, Yıl: 2018, Sayfa: 711-736
ISSN: 1302-3284 E-ISSN: 1308-0911

Research Article

ADAPTATION OF THE FELDER-SOLOMAN INDEX OF LEARNING STYLES (ILS) INTO TURKISH AND AN ASSESSMENT OF ITS MEASUREMENT QUALITY[1]

Çağla ŞENELER[*]
Helen PETRIE[**]

Abstract

The Index of Learning Styles (ILS) is a questionnaire (in English) used to measure preferences of learners on the four dimensions of the Felder-Silverman Learning Style Model (LSM): Active-Reflective, Sensory-Intuitive, Visual-Verbal, and Sequential-Global. To make it suitable for Turkish learners and researchers, we provided a definitive translation of the ILS into Turkish, which we refer to as the Turkish Index of Learning Styles, (T)ILS. To verify the translation, multiple forward and back translation techniques were used and four translators employed. The reliability and validity of the (T)ILS were also checked by conducting two different test administrations to 63 undergraduate students in Turkey. The (T)ILS has the highest Cronbach's alpha and test-retest reliability values among other studies that have tested its validity and reliability. Besides, no significant differences were found between mean scores of the two test administrations. Furthermore, the factor structure gave evidence of construct validity. Recommendations on further work of (T)ILS are also discussed.

Keywords: *Learning Styles, Index of Learning Styles, Multiple Forward Translation Technique, Back Translation Technique, Reliability, Validity.*

Bu makale için önerilen kaynak gösterimi (APA 6. Sürüm):

Şeneler, Ç. & Petrie, H. (2018). Adaptation of The Felder-Solomon Index of Learning Styles (ILS) Into Turkish and an Assessment of Its Measurement Quality. *Dokuz Eylül Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, 20* (4), 711-736.

[1] This paper is derived from Çağla ŞENELER's PhD dissertation titled "The Impact of Learning Styles and Cultural Background on Users' Experience of Websites" (University of York, Graduate School of/Faculty of Sciences, 2014).

[*] Assistant Professor, Yeditepe University, Faculty of Commerce, Department of Management Information Systems, ORCID: 0000-0003-1817-9806, cagla.seneler@yeditepe.edu.tr

[**] Professor, University of York, Faculty of Sciences, Department of Computer Science, ORCID: 0000-0003-1817-9806, helen.petrie@york.ac.uk

FELDER-SOLOMAN ÖĞRENME STİLLERİ ENVANTERİ (ÖSE)'NİN TÜRKÇE'YE UYARLANMASI VE ÖLÇÜM KALİTESİNİN DEĞERLENDİRİLMESİ[2]

Öz

Öğrenme Stilleri Envanteri (ÖSE) İngilizce dilinde bir test olup Felder-Silverman Öğrenme Stilleri Modeli (ÖSM)'nin dört boyutunda (yaparak-düşünerek, hissederek-sezgisel, görsel-işitsel, sıralı-bütünsel) öğrenenlerin tercihlerini ölçmek için kullanılmaktadır. Türkçe araştırmalarda ya da yazında kullanılmak üzere ÖSE'nin Türkçe diline tam çevirisi yapılmıştır. Çeviriyi doğrulamak için çoklu ileri ve ters çeviri teknikleri kullanılmış ve dört farklı çevirmen ile çalışılmıştır. Türkçe diline çevrilen ÖSE'nin ayrıca geçerlilik ve güvenirlik testleri Türkiye'de 63 lisans öğrencisine uygulanan iki farklı test ile kontrol edilmiştir. Türkçe diline çevrilen ÖSE için elde edilen Cronbach alfa katsayıları ve test-tekrar yöntemi değerleri, bu envanterin geçerliliğini ve güvenirliliğini test eden çalışmalar arasında en yüksek değerlere sahiptir. Ayrıca bu öğrencilere belli bir aralıkta, iki farklı zamanda uygulanan testlerin sonuçlarının arasında hiçbir farklılık bulunmamıştır. Ek olarak, güvenirlik analizi sonuçları tatmin edicidir. Çalışmanın sonunda sonraki çalışmalar için de önerilerde bulunulmuştur.

Anahtar Kelimeler: *Öğrenme Stilleri, Öğrenme Stilleri Envanteri, Çoklu İleri Çeviri Tekniği, Ters Çeviri Tekniği, Geçerlilik, Güvenirlik.*

INTRODUCTION

Learning styles have been studied in different disciplines including psychology, education and computer science and can be defined as "…how people acquire and understand new knowledge and skills" (ETaLD, 2005, p.5). A considerable number of studies have been carried out in the area of learning styles and many learning style models (LSMs) have been proposed in the literature. Coffield Moseley, Hall and Ecclestone (2004) identified 71 LSMs and the instruments, inventories or questionnaires[3] that are used to measure learning styles. They categorized 13 models as major ones, according to their theoretical importance in the field, widespread use, and their influence on other models.

Many educational institutions now use the concept of learning style in developing educational materials, including web materials (ETaLD, 2005) and teachers recognize the importance of using different instructional methods and materials matched to their students' learning styles (Leite, Svinicki & Shi, 2010). For that reason alone, investigating learning styles has become an important research topic in recent years. As Graf (2007) pointed out, many educational researchers believe learning styles are an important factor in the learning process

[2] Bu çalışma Çağla ŞENELER'in "The Impact of Learning Styles and Cultural Background on Users' Experience of Websites" başlıklı doktora tezinden (York Üniversitesi, Fen Bilimleri Enstitüsü, 2014) türetilmiştir.

[3] Numerous terms are used. Henceforth, the term questionnaire will be used.

and have suggested that implementing them in education has potential to enhance learners during their learning processes. In addition, Felder and Silverman (1988) emphasized that learners with a strong preference for a specific learning style may experience difficulties if the teaching style does not match with their learning style. As Graf (2007) discussed, making learners aware of their learning styles lets them see their strengths and weaknesses and by focusing on their weaknesses they may be able to develop their learning processes. Learning styles are also a supportive factor in designing learning systems. Finally, from the perspective of educators, by providing various learning materials to learners they hope to enhance learners' learning process.

Coffield et al. (2004) discussed the Felder-Silverman LSM as one of the widely used models. The Felder-Silverman LSM was originally formulated to identify the most important learning style differences among engineering students and provide a teaching approach for engineering instructors (Felder & Silverman, 1988). It originally proposed five dimensions of learning style: Active-Reflective, Sensing-Intuitive, Visual-Auditory, Sequential-Global and Inductive-Deductive. Felder subsequently changed the name of the Auditory endpoint of the Visual-Auditory dimension to Verbal since verbal activity covers both spoken and written words. In addition, the Inductive-Deductive dimension was omitted since Felder realized that students need to be taught both inductive and deductive methods for pedagogic reasons, in spite of preferring one over the other. Felder (2002, p.1-2) explained this as: "I don't want instructors to be able to determine somehow that their students prefer deductive presentation and use that result to justify continuing to use the traditional but less effective lecture paradigm in their courses and curricula. I have therefore omitted this dimension from the model."

There is some confusion over the title of this LSM and the associated questionnaire used to measure its dimensions: the model is based on the work of Felder and Silverman, but the questionnaire is the work of Felder, Silverman and Soloman (Felder, Silverman & Soloman, 1996), so the questionnaire is often referred to as the Felder-Soloman Index of Learning Styles (ILS)4.

In the revised version of the model, the Felder-Silverman LSM now has four learning style dimensions: Active-Reflective, Sensing-Intuitive, Visual-Verbal, Sequential-Global.

The Active-Reflective dimension is the learner preference for processing information. If learners prefer to discuss new information, they are more towards the Active end of the dimension. Alternatively, if learners prefer to think about new information, then they are more towards the Reflective end of the dimension. The Sensing-Intuitive dimension depends on the type of information learners preferentially perceive. In other words, if learners connect information in the real world with signs, sounds, physical sensations, they are more towards the Sensing

[4] Henceforth, ILS abbreviation will be used to refer this questionnaire.

end of the dimension. On the other hand, if they are more comfortable with abstractions and rely on their own hunch, they are more towards the Intuitive end of the dimension. The Visual-Verbal dimension is the sensory channel that learners prefer while they are acquiring information. If learners prefer acquiring information through pictures, diagrams, graphs, they are more towards the Visual end of the dimension. In contrast, Verbal learners prefer acquiring information from words, written and spoken explanations. Lastly, the Sequential-Global dimension is related to learners' progress towards understanding. If learners are more likely to learn in linear steps, not in large jumps, then they are more towards the Sequential end of the dimension. Conversely, if learners prefer to see the big picture first, they are more towards the Global end of the dimension.

The ILS has both pencil-and-paper and online versions5 and it is free to take. It consists of 44 items (11 items for each of the four dimensions), each of which has a binary choice (option a or b) for the learner. At the end of the questionnaire learners get a score on the four dimensions with values between +11 and -11 in steps of +/-2. The ILS scores provide a detailed description of learning styles, a main benefit of this questionnaire in comparison to other LSM questionnaires. Furthermore, free versions of the questionnaires are available online. This enables learners to access the questionnaire quickly and without difficulty. In addition, educational institutions do not have to pay any fees to use the ILS. According to Litzinger, Lee, Wise and Felder (2005), educators use the ILS to identify learning styles for more than 100,000 learners annually.

Research has shown that learning systems using the Felder-Silverman LSM produce contradictory findings in relation to the usefulness of learning style adaptations. Some of the studies present evidence on improving learners' learning experience (Carver, Howard & Lane, 1999; Popescu, 2010) whereas some of them showed no significant differences in relation to learning styles (Brown, Brailsford, Fisher, Moore & Ashman, 2006; Brown, Fisher & Brailsford, 2007).

Felder and Spurlin (2005) investigated ILS and showed that it can be considered reliable, valid and suitable for identifying learning styles. There have been a number of studies conducted on the reliability and validity of the ILS (Felder & Spurlin, 2005; Litzinger et al., 2005, 2007; Livesay, Dee, Felder, Hites, Nauman & O'Neal, 2002; van Zwanenberg, Wilkinson & Anderson, 2000; Zywno, 2003). These studies have resulted in some contradictory findings. Livesay et al. (2002), Zywno (2003), Litzinger et al. (2007), and Felder and Spurlin (2005) all found that the ILS is questionnaire with acceptable reliability and validity, whereas van Zwanenberg et al. (2000) concluded that the questionnaire needs further studies on its reliability and validity. Felder and Spurlin (2005) summarize most of the reliability and validity studies to give readers an overview of what has been done to test and validate the ILS. Litzinger et al. (2007) not only tested the

[5] www.engr.ncsu.edu/learningstyles/ilsweb.html, Accessed 5th Aug 2018

reliability, factor structure, and construct validity of the ILS, but also whether changing the dichotomous response scale of the ILS to a five-option response scale would improve reliability and validity. They found that a five-option scale improved the reliability of the ILS, but it did not change the validity strength of the questionnaire. Brown (2007) mentioned that in terms of reliability and validity, the Felder-Silverman LSM is one of the few questionnaires that scores moderately well and has acceptable standards.

The original ILS was developed in English and has been widely used in that language. Since its development, it has been translated into numerous languages, including Chinese (Ku & Shen, 2009; Lawa & Meyer, 2010), Swedish (Nilsson, Ostergen, Fors, Rickenlund, Jorfeldt, Caidahi & Bolinder, 2012), Spanish, Portuguese, Italian, and German. To make it suitable for learners and researchers from Turkey, this study provides a definitive translation of the ILS into the Turkish language. In spite of a literature review that failed to find a Turkish version of the ILS (a fact confirmed by Professor Felder), in the course of conducting the development of the Turkish ILS, it was discovered that the ILS had already been translated into Turkish and studies on reliability and validity of the translated questionnaire had been performed (Samanci & Keskin, 2007). In Samanci and Keskin's study, the ILS was translated into Turkish with the help of academics. Some problems with the translations have been found and these problems were discussed in detail in Discussion section of this paper. In the current study, professional translation techniques were applied to develop the (T)ILS. In addition, this study also established the reliability and validity of the (T)ILS by means of conducting two different test administrations with a four-week inter-test interval. These methods will be discussed in detail in the following section.

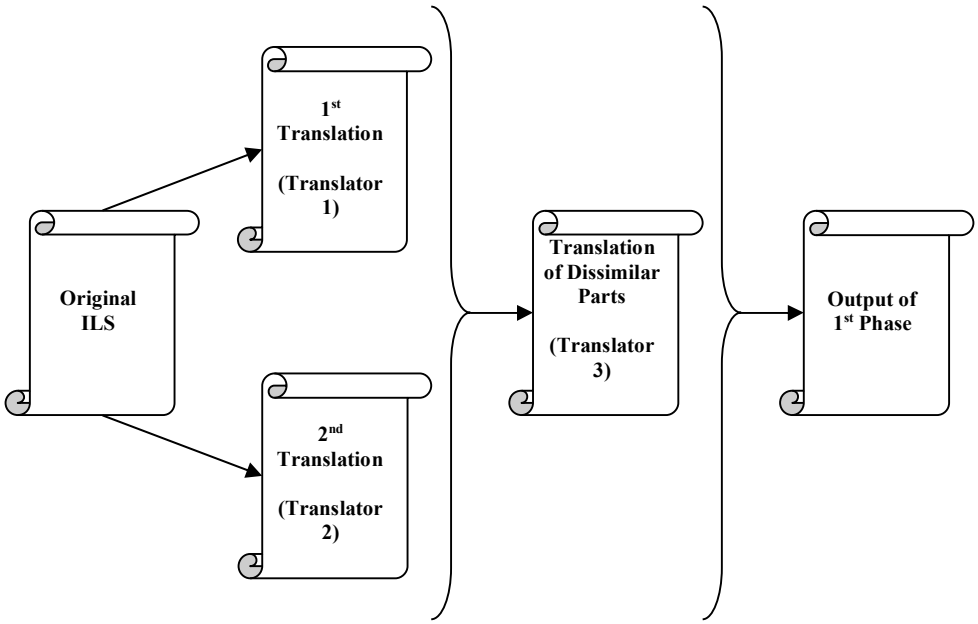
METHOD

Translation of the ILS into Turkish

With permission from its main author, Professor R. M. Felder, the ILS was translated into Turkish. To verify translations and to reduce the risks that can be encountered while translating from one language to another, two different translation techniques were used. Although most studies that have translated questionnaires into other languages have applied one of these translation techniques during the translation process (Isemonger & Sheppard, 2007), the use of both multiple forward and back translation techniques in this study prevented poor translations and enabled translations to be crosschecked. In order to translate the ILS into Turkish, four translators who are native speakers of Turkish and advanced speakers of English were employed. These four translators will be referred to as Translator1, Translator2, Translator3 and Translator4 in this text. In addition, we did several additional translations where necessary.

Figure 1, below, illustrates the first phase of the ILS translation process.

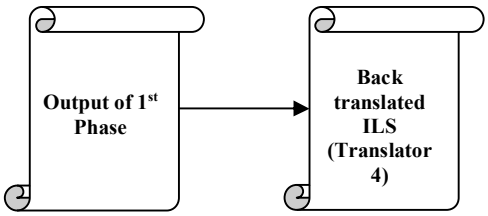
Figure 1. *First Phase Of The Translation Process*



In the first phase, a multiple forward translation technique was used. A multiple forward translation technique is the translation of a document from the source language into the target language independently by a number of translators (Maxwell, 1996). Translator1 and Translator2 undertook two independent translations. Then, first author of the paper as a native speaker of Turkish and fluent English speaker, compared these translations on an item-to-item basis in order to identify any differences in meaning. Then, Translator3 was asked to translate only the dissimilar parts of the first two translations. Next, the efforts of all three translators were evaluated and these efforts produced an overall first translation.

Figure 2, below, illustrates the second phase of the translation process.

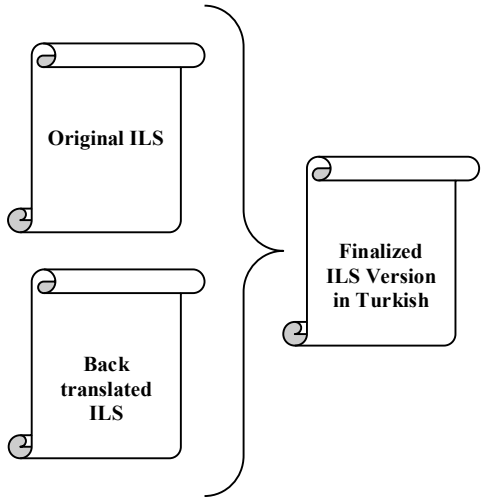
Figure 2. *Second Phase Of The Translation Process*



In the second phase, a back-translation technique was used, that is a translation of a document that has been already translated into a target language back into the source language (Maxwell, 1996). Translator4 was asked to translate the output of first phase (the overall first translation of the ILS) back into English.

Figure 3, below, shows the third phase of ILS translation process.

Figure 3. *Third Phase Of The Translation Process*



In the third and last phase of translation process, the original ILS and the back translated ILS were compared. Appropriate modifications were made and the Turkish version of ILS was finalized. The original ILS and finalized Turkish ILS version, now known as the (T)ILS can be found in Appendix 1 and 2, respectively.

Participants

The (T)ILS was administered to a class of 63 undergraduate students in the Information Systems and Technology Department of Yeditepe University, Istanbul, Turkey. Students participated voluntarily in the study and received no compensation for their time. The questionnaire was administered twice, four weeks apart. After removing data from participants whom had missed either of the administrations of the (T)ILS, 60 valid sets of data from participants were available for analysis. There were 21 female and 39 male participants. They were all native Turkish speakers and their ages ranged between 20 and 23 years.

Procedure

Students worked with a pencil-and-paper version of the (T)ILS in a class environment. In addition to the responses on the (T)ILS, only basic demographic data were collected. Those students who did not wish to take part in the study left the class while participants completed the questionnaire. The sessions took approximately 15 minutes on the first occasion and approximately 10 minutes on the second occasion.

RESULTS

To investigate the reliability of the (T)ILS, Cronbach's alpha coefficients were conducted for each of the four dimensions. As noted by Felder and Spurlin (2005), Cronbach's alpha values of 0.5 or higher are acceptable for assessment. Table 1 presents the Cronbach's alpha values for the (T)ILS and a range of previous studies of the ILS. The comparison with previous studies in Table 1 shows that the (T)ILS generally has the highest Cronbach's alpha values among recent studies (except for Sen-Int dimension).

Table 1: Cronbach's Alpha Coefficients for Current and Previous Studies for The Four ILS Dimensions

Study	n	Act-Ref	Sen-Int	Vis-Ver	Seq-Glo
Current study *	60	0.66	0.64	0.76	0.65
Samanci & Keskin (2007) *	381	0.43	0.54	0.59	0.32
Litzinger et al. (2005)	572	0.60	0.77	0.74	0.56
Litzinger et al. (2007)	448	0.61	0.77	0.76	0.55
Zywno (2003)	557	0.60	0.70	0.63	0.53
Livesay et al. (2002)	242	0.56	0.72	0.60	0.54
Spurlin (2002)	584	0.62	0.76	0.69	0.55
Van Zwanenberg et al. (2000)	284	0.51	0.65	0.56	0.41

Note. *Turkish version of ILS is used in these studies

To test the temporal stability of the (T)ILS, the test-retest coefficient was calculated, that is the correlation between scores gathered at two different times from the same set of respondents. The (T)ILS was administered to the same sample of participants on two occasions, approximately four weeks apart. As noted by Zywno (2003), the period between questionnaires is important since it has an effect on participant responses. Livesay et al. (2002) analyzed test-retest coefficient correlations for the ILS with a small sample size (n=24) at intervals of four, 7, 12 and 16 months. These different intervals gave linearly decreasing correlations. As indicated by Felder and Spurlin (2005), the interval between test administrations should not be too large since learning style preferences might change over time. On the other hand, this interval should be large enough because respondents might remember their preferences, and that responses at first administration might influence responses on second administration. As applied by Seery, Gaughran and Waldmann (2003) and approved by Felder and Spurlin (2005), a four-week interval is suitable in order to prevent any such effects on responses. Table 2 lists a number of studies that measured test-retest correlation coefficients for the ILS, along with sample size and time lapse between the two administrations. The table also compares the results of the current questionnaire with previous studies and demonstrates that highest test-retest reliability coefficients were obtained for the current questionnaire.

Table 2: Test-Retest Correlation Coefficients For A Range Of Studies With The ILS

Study	n	Interval	Act-Ref	Sen-Int	Vis-Ver	Seq-Glo
Current study	60	4 weeks	0.964**	0.917**	0.951**	0.858**
Seery et al. (2003)	46	4 weeks	0.803**	0.787**	0.870**	0.725**
Livesay et al. (2002)	24	7 months	0.73*	0.78*	0.68*	0.60*
Zywno (2003)	124	8 months	0.683**	0.678**	0.511**	0.507**
Note: * $p < 0.05$, ** $p < 0.01$						

Table 3 shows the test-retest mean scores in four dimensions of the (T)ILS on the two test occasions. A series of repeated measures t-tests showed that there were no significant differences between the mean scores of the two occasions. This finding demonstrates that learners' learning styles did not change during the four-week interval and also offers an evidence for the stability of the questionnaire.

Table 3: Participants' Test Mean Scores On Two Different Tests

Dimension	Mean Test 1	Mean Test 2	t value	Significance
Act-Ref	5.80	5.85	-0.554	n.s.
Sen-Int	7.30	7.30	0.000	n.s.
Vis-Ver	8.03	8.13	-0.925	n.s.
Seq-Glo	6.12	6.22	-0.603	n.s.
Note. df in all cases = 59				

To validate the dimension structure of the (T)ILS, a principal component analysis (PCA) was performed. According to Hair, Tatham, Anderson and Black (1998), to conduct a factor analysis including a PCA, the sample should not be fewer than 50 observations, if possible, it should be larger than 100. Thus, the sample size of 60, although towards the lower end of the recommended size, is adequate for a PCA. Several studies have performed factor analysis on the ILS (Litzinger et al., 2005; Zynwno, 2003). Zynwno (2003) obtained a five-factor solution, while Litzinger et al. (2005) produced eight factors.

In this study, first the KMO and Bartlett tests were used to test the appropriateness of the data set for factor analysis. The KMO is a statistic that indicates the proportion of variance in the variables that might be caused by underlying factors (KMO value should be greater than 0.5) and Bartlett test was used to check whether the correlation matrix is an identity matrix (KMO value 0.54 > 0.50, $p < 0.001$; Bartlett's Test of Sphericity = 2530.16, df = 946, $p < 0.01$). Results of these tests showed that the data are suitable for factor analysis. Kaiser's criterion method was used to extract the factors. Since the ILS has four dimensions, a PCA with four factors was performed with varimax rotation method. Table 4 lists the factors obtained along with the number of items from each ILS dimension, which loaded onto these factors. In the model, each factor loaded most of the items that were related to the respective learning style dimension except for Act-Ref dimension. The variance explained by the model is 34%. This model explained the variance better compared to the results of a recent study of both the ILS and the Kolb Learning Style Inventory (Platsidou & Metallidou, 2009) that explained only 24% of the variance in the ILS.

Table 4: Relationship Between Items On ILS Dimensions And The New PCA

Dimension	1	2	3	4
Act-Ref	5	1	5	0
Sen-Int	1	3	0	7
Vis-Ver	10	0	1	0
Seq-Glo	1	7	1	2

As illustrated in Table 4, the Act-Ref dimension loads onto two factors, factor-1 with 5 items and factor-3 with 5 items from that dimension. As illustrated in Table 5, there is a correlation between the Act-Ref and Vis-Ver dimensions ($r = 0.467$, $p < 0.01$). Some previous studies (Van Zwanenberg et al., 2000; Zywno, 2003) that performed factor analyses also found a correlation between these two dimensions. The Sen-Int dimension predominantly loads into factor-4 with 7 items from that dimension. Moreover, factor-1 is predominantly related to the Vis-Ver dimension as 10 items from that dimension load into this factor and only one item loads any other factor. Lastly, the Seq-Glo dimension predominantly loads into factor-2 with 7 items from that dimension. This analysis support that the questionnaire has construct validity. The Structure of the T(ILS) was not changed

in line with the results of the new principal components analysis in order to keep the T(ILS) directly comparable with other versions of the ILS.

Table 5 indicates the correlations between the four dimensions. If the results of the factor analyses are valid, these correlation values should be minimal. Of the six correlations, three are not significant while the other three are significant: between the Act-Ref and Vis-Ver dimensions ($r = 0.467$, $p < 0.01$), Act-Ref and Seq-Glo dimensions ($r = -0.215$, $p < 0.05$) and Sen-Int and Seq-Glo dimensions ($r = 0.213$, $p < 0.05$). However, two of these are relatively weak correlations, each accounting for less than 5% of the variance (the Act-Ref and Seq-Glo and the Sen-Int and Seq-Glo correlations). Only the correlation between the Act-Ref and Vis-Ver dimensions accounts for a substantial amount of variance (21.8%). Some previous studies that performed factor analyses also found some overlaps between these dimensions, particularly between the Act-Ref and Vis-Ver dimensions (Van Zwanenberg et al., 2000; Zywno, 2003). In general, the weak or non-significant inter-dimension correlations support the factor analysis findings.

Table 5: Correlations Between The Four (T)ILS Dimensions

Dimension Pair	Pearson Coefficient	Significance
Act-Ref vs. Sen-Int	- 0.074	n.s.
Act-Ref vs. Vis-Ver	0.467	$p < 0.01$
Act-Ref vs. Seq-Glo	- 0.215	$p < 0.05$
Sen-Int vs. Vis-Ver	- 0.125	n.s.
Sen-Int vs. Seq-Glo	0.213	$p < 0.05$
Vis-Ver vs. Seq-Glo	- 0.159	n.s.

DISCUSSION

The ILS is a widely used questionnaire to assess individuals' learning style preferences. In order to prevent any problems that may arise with the administration of the ILS in Turkey, especially for learners who are non-native speakers of English, the ILS was translated into Turkish. Four translators participated and two translation techniques, multiple forward and back translation were used in the translation process. This study also investigated the reliability and validity of the (T)ILS by conducting two administrations at a four-week interval. The (T)ILS has the highest Cronbach's alpha values, a measure of internal consistency, among recent studies. In addition, the highest test-retest reliability coefficients were obtained for the (T)ILS. Moreover, no significant differences were found between the mean scores of the four dimensions of the (T)ILS on the two administrations. These results show that the (T)ILS has strong reliability. Lastly, the proposed factor structure gave evidence of the construct validity for the (T)ILS. Generally, weak or no inter-dimension correlations support the factor analysis findings.

The ILS had already been translated into Turkish and studies on reliability and validity of the questionnaire had been performed (Samanci & Keskin, 2007).

In Samanci and Keskin's study, although the ILS was translated into Turkish with the help of academics, some problems were found in the translations.

When the (T)ILS was compared with Samanci and Keskin's (2007) translation of the ILS, nine items were found to differ in meaning (see Table 6 for a full list of the items). In item #3, getting a picture was translated as getting a film. However, they translated the word picture in item #7 as it was translated in this work in both item #3 and #7. In item #9, the translation of the sit back phrase should give the meaning of being inactive while something is happening. But, their translation gives the meaning of staying in the background. Respondents might not select this option since many people may interpret this phrase translation as a negative behavior. In item #14, the translation of the word nonfiction differs in the two translations. Samanci and Keskin translated reading nonfiction as reading nonliterary material. However, nonliterary material is not the same as nonfiction and again has a negative connotation. In item #18, in the translation of certainty, two different Turkish words are used in the two translations. However, both of them give the meaning of certainness. Item #24 is part of the Seq-Glo dimension of the ILS. In this item, the phrase a fairly regular pace relates to sequential learners' preference for learning in linear, sequential steps. However, Samanci and Keskin's translation of this phrase does not imply this meaning. Although the phrase has nothing to do with learners' learning speed, they translated it as learning in regular equal speed. Fits and starts phrase in the next choice refers to irregular intervals. Although the phrase has nothing to do with learners' time taken during their study, Samanci and Keskin translated this phrase as studying intensively in a short period of time. Similarly, in the first choice of item #32, "working on the beginning of the paper and progress forward" gives the idea of working sequentially. However, Samanci and Keskin translated this as first thinking on the subject as a whole and then writing on it, the opposite effect. Moreover, in the second choice of item #32, they translated work on different parts of the paper as dividing subject into parts, think and write on them, a very different meaning. In Item #30, the first choice refers to learners who prefer to learn the best way of doing a task while they perform it. But Samanci and Keskin's translation of this choice refers to learners who prefer to use a particular way and being an expert on this way. They consider the word master as an adjective for learner. However, it is a verb that describes the way of doing a task. Additionally, in the second choice, the word come up with means invent or create. But, in their translation the meaning for this word is missing. In Items #34 and #37, the words imaginative and outgoing have translation problems, respectively. Samanci and Keskin translated imaginative as creative. Being imaginative is having a creative imagination whereas creative means only having the ability to create. Samanci and Keskin translated outgoing as sympathetic. Although these words can be used in literature interchangeably, the word outgoing reflects more having strong external relations and being comfortable in different environments. Since Item #37 is related to the Act-Ref

dimension of the Felder-Silverman LSM, a word that gives the meaning of the word extrovert will be more appropriate for translation of the word outgoing.

Further studies could offer further validation by using the (T)ILS with larger sample sizes. In addition, further studies could establish the discriminant validity of the dimensions, if (T)ILS can be applied to the students majoring a different education department such as business students. Moreover, participants' perception of their learning styles could be gathered to assess whether their questionnaire of learning style matches their perception of their styles. Nonetheless we believe this is a definitive translation of the ILS into Turkish.

Table 6: Comparison Of Different Translations Of ILS

Item No	Dimensions	Current translation	The Original ILS	Samancı and Keskin's translation
3	Vis-Ver	Dün ne yaptığım hakkında düşündüğüm zaman, daha çok a) bir resim b) kelimeler elde ediyorum.	When I think about what I did yesterday, I am most likely to get a) a picture. b) words	Dün ne yaptığımı düşünmeye başladığımda, genellikle bunu a) bir film olarak canlandırırım b) kelimelerle ifade ederim.
9	Act-Ref	Çalışma grubunda, zor bir konu üzerine çalışırken, daha çok a) tartışmaya dâhil olur, görüşlerimle katkıda bulunurum. b) arkama yaslanır ve dinlerim.	In a study group working on difficult material, I am more likely to a) jump in and contribute ideas. b) sit back and listen.	Zor bir konu hakkında çalışan bir grupta, genellikle a) konuya hemen dahil olurum ve fikirlerimi söyleyerek katkıda bulunurum. b) arka planda kalır ve dinlerim.
14	Sen-Int	Kurgusal olmayan düzyazıda a) bana yeni olgular öğreteni veya birşeyi nasıl yapacağımı anlatanı b) bana düşünmem için yeni fikirler vereni tercih ederim.	In reading nonfiction, I prefer a) something that teaches me new facts or tells me how to do something. b) something that gives me new ideas to think about.	Edebi olmayan kitapları okurken a) bana bazı gerçekleri (olguları) veya bazı şeylerin nasıl yapılacağını anlatan kitapları okumayı tercih ederim. b) bana üzerinde düşünmem için yeni fikirler veren kitapları okumayı tercih ederim.
18	Sen-Int	a) Belirlilik b) Teori fikrini tercih ederim.	I prefer the idea of a) certainty. b) theory.	a) Kesin olan düşünceyi tercih ederim. b) Kuramsal düşünceyi tercih ederim.
24	Seq-Glo	a) Oldukça düzenli adımlarla öğrenirim. Eğer çok çalışırsam, onu elde ederim. b) Rastgele çalışarak öğrenirim. Tamamen kafam karışır, daha sonra bir anda hepsi yerine oturur.	I learn a) at a fairly regular pace. If I study hard, I will "get it." b) in fits and starts. I will be totally confused and then suddenly it all "clicks."	Genellikle a) düzenli eşit bir hızla öğrenirim. Eğer çok çalışırsam başarılı olurum. b) kısa sürede yoğun çalışırım. Kafam bazen tamamıyla karışır sonra bir anda her şeyi anlarım.
30	Sen-Int	Bir görev yerine getirmem gerektiğinde, genelde tercihim a) o işi yapmanın en iyi yolunu tam öğrenmektir. b) o işi yapmanın yeni yollarını bulmaktır.	When I have to perform a task, I prefer to a) master one way of doing it. b) come up with new ways of doing it.	Bir işi yapmam gerektiğinde a) genellikle bu işi yapmak için bir yolu kullanıp o konuda uzman olmayı tercih ederim b) bu işi farklı yollarla yapmayı tercih ederim.
32	Seq-Glo	Yazı yazarken, daha çok a) yazının başlangıcı üzerine çalışırım (düşünürüm veya yazarım) ve ileriye doğru geliştiririm. b) yazının farklı parçaları üzerine çalışırım (düşünürüm veya yazarım) ve sonra onları sıraya koyarım.	When writing a paper, I am more likely to a) work on (think about or write) the beginning of the paper and progress forward. b) work on (think about or write) different parts of the paper and then order them.	Bir yazı yazarken genellikle a) Konuyu başta bütünüyle düşünür ve daha sonra yazmaya başlarım. b) Konuyu parçalara bölerek, bunların üzerinde düşünür ve yazarım. Sonunda yazdıklarımı sıraya koyarım.
34	Sen-Int	Daha çok a) dışa dönük b) çekingen biri olarak nitelendirilirim.	I am more likely to be considered as a) outgoing. b) reserved.	Genelde a) sempatik olarak nitelendirilebilirim. b) çekingen olarak nitelendirilebilirim.

REFERENCES

Brown, E. (2007). *The use of learning styles in adaptive hypermedia.* (Doctoral dissertation). University of Nottingham, Nottingham.

Brown, E., Brailsford, T., Fisher, T., Moore, A., & Ashman, H. (2006, May). *Reappraising cognitive styles in adaptive web applications.* In Proceedings of the 15th international conference on World Wide Web (pp. 327-335). ACM.

Brown, E., Fisher, T., & Brailsford, T. (2007, September). *Real users, real results: examining the limitations of learning styles within AEH.* In Proceedings of the eighteenth conference on Hypertext and hypermedia (pp. 57-66). ACM.

Carver, C., Howard, R., & Lane, W. D. (1999). *Enhancing student learning through hypermedia courseware and incorporation of student learning styles.* Education, IEEE Transactions on, 42(1), 33-38.

Coffield, F., Moseley, D., Hall, E., & Ecclestone, K. (2004). *Should we be using learning styles? What research has to say to practice.* London, Learning and Skills Centre.

ETaLD (2005). *Reaching them all: Using student learning styles to teach more effectively,* Effective Teaching and Learning Department, Baker College.

Felder, R. M. & Silverman, L. K. (1988). *Learning and teaching styles in engineering education.* Engineering Education, 78(7), 674-681. Preceded by a preface in 2002.

Felder, R. M., Silverman, L. K. & Soloman, B.A (1996). *Index of Learning styles (ILS).* North Carolina State University.

Felder, R. M. & Spurlin, J. (2005). *Applications, reliability and validity of index of learning styles.* International Journal of Engineering Education, 21(1), 103-112.

Graf, S. (2007). *Adaptivity in learning management systems focusing on learning styles.* (Doctoral dissertation). Vienna University of Technology, Vienna.

Hair, J. F., Tatham, R., L., Anderson, R. E. & Black, W. (1998). *Multivariate data analysis (6th ed.).* Upper Saddle River, NJ: Prentice Hall, pp. 98-99.

Isemonger, I. & Sheppard, C. (2007). *A construct-related validity study on a Korean version of the perceptual learning styles preference questionnaire.* Educational and Psychological Measurement, 67(2), 357-368.

Ku, D. T. & Shen, C.Y. (2009). *Reliability, validity, and investigation of the index of learning styles in a Chinese language version for late adolescents of Taiwanese.* Adolescence, 44(176), 827-850.

Lawa, D.C.S & Meyer, J.H.F. (2010). *Adaptation and validation of the Inventory of Learning Styles for quality assurance in a Hong Kong post-secondary education context.* Quality in Higher Education, 16(3), 269-283.

Leite, W. L., Svinicki, M. & Shi, Y. (2010). *Attempted validation of the scores of the VARK: Learning styles inventory with multitrait-multimethod confirmatory factor analysis models.* Educational and Psychological Measurement, 70(2), 323-339.

Litzinger, T. A., Lee, S. H., & Wise, J. C. (2005). *A study of the reliability and validity of the Felder-Soloman Index of Learning Styles.* Education, 113, 77.

Litzinger, T. A., Lee, S. H., Wise, J.C. & Felder, R. M. (2007). *A psychometric study of the index of learning styles.* Journal of Engineering Education, 96 (4), 309-319.

Livesay, G., Dee, K., Felder, R., Hites, L., Nauman, E., & O'Neal, E. (2002). *Statistical evaluation of the index of learning styles.* Session, 2430, 16-19.

Maxwell, B. (1996). *Translation and cultural adaptation of the survey instruments.* Third international mathematics and science study (TIMSS) technical report, 1, 159-169.

Nilsson, M., Ostergren, J., Fors, U., Rickenlund, A., Jorfeldt, L., Caidahl, K. & Bolinder, G. (2012). *Do individual learning styles influence the choice to use a web-based ECG learning programme in a blended learning setting?* BMC Medical Education, 12(5).

Platsidou, M. & Metallidou, P. (2009). *Validity and reliability issues of two learning style inventories in a Greek sample: Kolb's Learning Style Inventory and Felder & Soloman's Index of Learning Style.* International Journal of Teaching and Learning in Higher Education, 20 (3), 324-335.

Popescu, E. (2010). *Adaptation provisioning with respect to learning styles in a Web-based educational system: an experimental study.* Journal of Computer Assisted Learning, 26(4), 243-257.

Samanci, N. K. & Keskin, M. O. (2007). *The Felder and Soloman Index of Learning Styles: Translation to Turkish and the study of validity-reliability.* Ahi Evran Universitesi Kirsehir Egitim Fakultesi Dergisi (KEFAL), 8 (2), 37-54.

Seery, N., Gaughran, W. F. & Waldmann, T. (2003). *Multi-modal learning in engineering education,* In Proceedings of the American Society for Engineering Education Annual Conference and Exposition, June 22-25, Nashville, Tennessee.

Van Zwanenberg, N., Wilkinson, L. J. & Anderson, A. (2000). *Index of learning styles and Honey and Mumford's learning styles questionnaire: How do they compare and how do they predict?* Educational Psychology, 20(3), 365-381.

APPENDIX 1: Felder-Soloman Index of Learning Styles (ILS)

Directions.

Enter your answers to every question on the ILS scoring sheet. Please choose only one answer for each question. If both "a" and "b" seem to apply to you, choose the one that applies more frequently.

1. I understand something better after I
a) try it out.
b) think it through.

2. I would rather be considered as
a) realistic.
b) innovative.

3. When I think about what I did yesterday, I am most likely to get
a) a picture.
b) words.

4. I tend to
a) understand details of a subject but may be fuzzy about its overall structure.
b) understand the overall structure but may be fuzzy about details.

5. When I am learning something new, it helps me to
a) talk about it.
b) think about it.

6. If I were a teacher, I would rather teach a course
a) that deals with facts and real-life situations.
b) that deals with ideas and theories.

7. I prefer to get new information in
a) pictures, diagrams, graphs, or maps.
b) written directions or verbal information.

8. Once I understand
a) all the parts, I understand the whole thing.
b) the whole thing, I see how the parts fit.

9. In a study group working on difficult material, I am more likely to
a) jump in and contribute ideas.
b) sit back and listen.

10. I find it easier
a) to learn facts.
b) to learn concepts.

11. In a book with lots of pictures and charts, I am likely to
a) look over the pictures and charts carefully.
b) focus on the written text.

12. When I solve math problems
a) I usually work my way to the solutions one step at a time.
b) I often just see the solutions but then have to struggle to figure out the steps to get to them.

13. In classes I have taken
a) I have usually gotten to know many of the students.
b) I have rarely gotten to know many of the students.

14. In reading nonfiction, I prefer
a) something that teaches me new facts or tells me how to do something.
b) something that gives me new ideas to think about.

15. I like teachers
a) who put a lot of diagrams on the board.
b) who spend a lot of time explaining.

16. When I am analyzing a story or a novel
a) I think of the incidents and try to put them together to figure out the themes.
b) I just know what the themes are when I finish reading and then I have to go back and find the incidents that demonstrate them.

17. When I start a homework problem, I am more likely to
a) start working on the solution immediately.
b) try to fully understand the problem first.

18. I prefer the idea of
a) certainty.
b) theory.

19. I remember best
a) what I see.
b) what I hear.

20. It is more important to me that an instructor
a) lays out the material in clear sequential steps.
b) gives me an overall picture and relates the material to other subjects.

21. I prefer to study
a) in a study group.
b) alone.

22. I am more likely to be considered as
a) careful about the details of my work.
b) creative about how to do my work.

23. When I get directions to a new place, I prefer
a) a map.
b) written instructions.

24. I learn
a) at a fairly regular pace. If I study hard, I will "get it".
b) in fits and starts. I will be totally confused and then suddenly it all "clicks".

25. I would rather first
a) try things out.
b) think about how I am going to do it.

26. When I am reading for enjoyment, I like writers to
a) clearly say what they mean.
b) say things in creative, interesting ways.

27. When I see a diagram or sketch in class, I am most likely to remember
a) the picture.
b) what the instructor said about it.

28. When considering a body of information, I am more likely to
a) focus on details and miss the big picture.
b) try to understand the big picture before getting into the details.

29. I more easily remember
a) something I have done.
b) something I have thought a lot about.

30. When I have to perform a task, I prefer to
a) master one-way of doing it.
b) come up with new ways of doing it.

31. When someone is showing me data, I prefer
a) charts or graphs.
b) text summarizing the results.

32. When writing a paper, I am more likely to
a) work on (think about or write) the beginning of the paper and progress forward.
b) work on (think about or write) different parts of the paper and then order them.

33. When I have to work on a group project, I first want to
a) have "group brainstorming" where everyone contributes ideas.
b) brainstorm individually and then come together as a group to compare ideas.

34. I consider it higher praise to call someone as
a) sensible.
b) imaginative.

35. When I meet people at a party, I am more likely to remember
a) what they looked like.
b) what they said about themselves.

36. When I am learning a new subject, I prefer to
a) stay focused on that subject, learning as much about it as I can.
b) try to make connections between that subject and related subjects.

37. I am more likely to be considered as
a) outgoing.
b) reserved.

38. I prefer courses that emphasize
a) concrete material (facts, data).
b) abstract material (concepts, theories).

39. For entertainment, I would rather
a) watch television.
b) read a book.

40. Some teachers start their lectures with an outline of what they will cover. Such outlines are
a) somewhat helpful to me.
b) very helpful to me.

41. The idea of doing homework in groups, with one grade for the entire group,
a) appeals to me.
b) does not appeal to me.

42. When I am doing long calculations
a) I tend to repeat all my steps and check my work carefully.
b) I find checking my work tiresome and have to force myself to do it.

43. I tend to picture places I have been
a) easily and fairly accurately.
b) with difficulty and without much detail.

44. When solving problems in a group, I would be more likely to
a) think of the steps in the solution process.
b) think of possible consequences or applications of the solution in a wide range of areas.

APPENDIX 2: Öğrenme Stilleri Envanteri (ÖSE)/ Felder-Soloman Index of Learning Styles (ILS)

Yönlendirmeler.

Lütfen her soru için tek bir cevap veriniz. Eğer hem "a" hem "b" size uygun görünüyorsa, en sık uyguladığınızı işaretleyiniz.

1. Bir şeyi
a) denedikten
b) üzerinde düşündükten
sonra daha iyi anlarım.

2. Daha çok
a) gerçekçi
b) yenilikçi
biri olarak nitelendirilmeyi tercih ederim.

3. Dün ne yaptığım hakkında düşündüğüm zaman, daha çok
a) bir resim
b) kelimeler
elde ediyorum.

4. a) Konunun detaylarını iyi anlarım ancak genel yapı hakkında pek net olamamaya eğilimim vardır.
b) Konunun genelini çok iyi anlarım ama detaylara tam hakim olamamaya eğilimim vardır.

5. Yeni bir şey öğrenirken
a) o konu hakkında konuşmak
b) o konu hakkında düşünmek
bana yardımcı olur.

6. Eğer bir öğretmen olsaydım
a) olgular ve gerçek hayat durumlarını ele alan
b) fikirler ve teorileri ele alan
bir dersi öğretmeyi tercih ederdim.

7. Yeni bilgileri
a) resimler, şemalar, grafikler veya haritalar
b) yazılı yönlendirmeler veya sözlü bilgiler
olarak almayı tercih ederim.

8. a) Tüm parçaları anladığımda, bütünü anlarım.
b) Bütünü anladığımda, parçaların nasıl uyduğunu görürüm.

9. Çalışma grubunda, zor bir konu üzerine çalışırken, daha çok
a) hemen tartışmaya dâhil olur, görüşlerimle katkıda bulunurum.
b) arkama yaslanır ve dinlerim.

10. a) Olguları
b) Kavramları
öğrenmeyi daha kolay bulurum.

11. Birçok resim ve çizim ile dolu bir kitapta,
a) resimlere ve çizimlere dikkatlice göz gezdiririm
b) yazılı metine odaklanırım.

12. Matematik problemleri çözerken
a) genelde çözümlere adım adım giderim.
b) genellikle çözümleri hemen bulurum ama çözümlere ulaşmak için gerekli adımları anlamaya çalışmam gerekir.

13. Daha önce aldığım derslerde
a) genelde birçok öğrenciyi
b) nadiren sınıftaki öğrencileri
tanırım.

14. Kurgusal olmayan düzyazıda
a) bana yeni olgular öğreteni veya bir şeyi nasıl yapacağımı anlatanı
b) bana düşünmem için yeni fikirler vereni
tercih ederim.

15. a) Tahtaya birçok şema çizen
b) Zamanın çoğunu açıklama yaparak geçiren
öğretmenleri severim.

16. Bir hikâye veya roman analizi yaparken
a) olayları düşünür ve bir araya getirerek konuyu anlamaya çalışırım.
b) okumayı bitirdiğimde konunun ne olduğunu anlarım ve sonra geri dönüp bu konuyu oluşturan olayları bulurum.

17. Bir ev ödevi problemine başladığım zaman, daha çok
a) hemen sonuç üzerinde çalışmaya başlarım.
b) ilk önce problemin tamamını anlamaya çalışırım.

18. a) Kesin
b) Teorik
düşünceyi tercih ederim.

19. En iyi
a) gördüğümü
b) duyduğumu
hatırlarım.

20. Benim için eğitmenin
a) materyali açık ve sıralı adımlarla sunması
b) bütün resmi vermesi ve materyali diğer konularla ilişkilendirmesi
daha önemlidir.

21. a) Bir çalışma grubu içinde
b) Yalnız
çalışmayı tercih ederim.

22. Daha çok
a) çalışmamın detayları hakkında dikkatli
b) çalışmamı nasıl yaptığım hakkında yaratıcı
biri olarak nitelendirilirim.

23. Yeni bir yer için tarif aldığımda
a) bir harita
b) yazılı yönergeleri
tercih ederim.

24. a) Oldukça düzenli adımlarla öğrenirim. Eğer çok çalışırsam, onu elde ederim.
b) Rastgele çalışarak öğrenirim. Tamamen kafam karışır, daha sonra bir anda hepsi yerine oturur.

25. Ben önce bir şeyi
a) denemeyi
b) nasıl yapacağım konusunda düşünmeyi
tercih ederim.

26. Eğlenmek için okuduğumda ne demek istediğini
a) açıkça söyleyen
b) yaratıcı, ilginç yollarla ifade eden
yazarları severim.

27. Derste şema ya da çizim gördüğümde, en çok
a) bir resim
b) eğitmenin onun hakkında söylediklerini
hatırlarım.

28. Bir grup bilgiyi değerlendirirken, daha çok
a) detaylara odaklanır ve büyük resmi kaçırırım.
b) detaylara girmeden önce büyük resmi anlamaya çalışırım.

29. a) Yaptığım bir şeyi
b) Üzerinde çok düşündüğüm bir şeyi
daha kolay hatırlarım.

30. Bir görev yerine getirmem gerektiğinde, genelde tercihim
a) o işi yapmanın en iyi yolunu tam öğrenmektir.
b) o işi yapmanın yeni yollarını bulmaktır.

31. Biri veri gösterdiği zaman
a) şema veya grafikleri
b) sonuçları özetleyen metni
tercih ederim.

32. Yazı yazarken, daha çok
a) yazının başı üzerinde çalışırım (düşünürüm veya yazarım) ve ileriye doğru geliştiririm.
b) yazının farklı parçaları üzerine çalışırım (düşünürüm veya yazarım) ve sonra onları sıraya koyarım.

33. Bir grup projesinde çalışmam gerektiğinde, ilk olarak
a) herkesin fikirleriyle katkıda bulunduğu bir beyin fırtınası isterim.
b) bireysel beyin fırtınasından sonra grup ile fikirleri karşılaştırmak için bir araya gelmeyi isterim.

34. Birine
a) mantıklı
b) hayal gücü kuvvetli
diye hitap etmenin daha yüksek bir övgü olduğunu düşünürüm.

35. Bir partide insanlarla tanıştığımda, onların daha çok
a) nasıl göründüklerini
b) kendileri hakkında ne söylediklerini
hatırlarım.

36. Yeni bir konu öğrenirken
a) konu üzerinde odaklanıp, konu hakkında öğrenebildiğim kadar çok şey öğrenmeyi tercih ederim.
b) o konu ve ilgili konular arasında bağlantı kurmaya çalışmayı tercih ederim.

37. Daha çok
a) dışa dönük
b) çekingen
biri olarak nitelendirilirim.

38. a) Somut materyal (olaylar, veri)
b) Soyut materyal (kavramlar, teoriler)
üzerinde duran dersleri tercih ederim.

39. Eğlence için
a) televizyon seyretmeyi
b) kitap okumayı
tercih ederim.

40. Bazı öğretmenler derslerine işleyecekleri konuların ana hatları ile başlarlar. Bu ana hatlar bana
a) biraz
b) çok
yardımcı olur.

41. Bütün gruba bir notun verileceği bir grupta ödev yapma fikri benim için
a) uygundur (çekicidir).
b) uygun değildir (çekici değildir).

42. Uzun hesaplamalar yaptığım zaman,
a) bütün adımlarımı tekrarlama ve işimi dikkatlice kontrol etme eğilimindeyimdir.
b) işimi kontrol etmeyi yorucu (sıkıcı) bulurum ve kontrol yapmak için kendimi zorlarım.

43. Daha önce bulunduğum yerleri
a) kolay ve oldukça doğru
b) zor ve az detayla
resmetmek eğilimindeyimdir.

44. Grup içinde problem çözerken, ben daha çok
a) çözüm sürecindeki adımları düşünürüm.
b) çözümlerin geniş çaptaki alanlarda olası sonuçlarını ve uygulamalarını düşünürüm.