The Examination of University Students' Learning Styles by Means of Felder-Silverman Index

Üniversite Öğrencilerinin Öğrenme Stillerinin Felder-Silverman Envanteri Bağlamında İncelenmesi

Emel ÜLTANIR*   Y. Gürcan ÜLTANIR****   Gülhan ÖREKECİ TEMEL******

Mersin Üniversitesi

Abstract

The purpose of the study is, by adapting the Felder-Silverman learning styles instrument into Turkish, to study the reliability and validity of the instrument at Mersin University. Further, it examined the differences among the learning styles according to students' fields of science. The Index of Learning Styles (ILS) that is used in this research is a 44- question instrument designed to assess the four dimensions of the Felder-Silverman model. It was developed in 1988 by Richard Felder and Linda Silverman. Participants consisted of 526 of Mersin University students. The sample included different academic branches as follows: Natural Sciences (*n*=320, 61%), Health Sciences (*n*=149, 28%) and Social Sciences (*n*=57, 11%). Findings show that the preferred learning styles are different which shows that Mersin University students are rather sequential, sensory and active learners. Results have also demonstrated that ILS has a significant difference in sequential/global learning styles according to science, health and social sciences.

Keywords: Leaning Styles, Individual learning Styles, Felder-Silverman Model, Index of Learning Styles.

Öz

Araştırmanın amacı, Felder-Silverman öğrenme stilleri ölçeğinin Türkçeye uyarlanması, geçerlik ve güvenirlik çalışmalarının yapılması ve Mersin Üniversitesi öğrencilerinin tercih edilen öğrenme stilleri profillerinin belirlenmesidir. Bunun ötesinde bilim alanlarına göre öğrenme stilleri arasındaki farklar incelenmiştir. Bu araştırmada kullanılan Öğrenme Stilleri İndeksi (ÖBİ), Felder-Silverman modelinde dört boyutlu tercihlerle değerlendirilen 44 sorulu bir ölçme aracı olarak oluşturulmuştur. Katılımcılar Mersin Üniversitesi öğrencilerinden oluşan 526 kişidir. Örneklem, farklı akademik enstitüler arasından aşağıdaki gibi belirlenmiştir: Doğa Bilimleri: (*n*=320, 61%), Sağlık Bilimleri (*n*=149, 28%) Sosyal Bilimler (*n*=57, 11%). Bulgular, Mersin Üniversitesi öğrencilerinin tercih edilen öğrenme stillerinin Ardışık, Duyumsal ve Aktif öğrenenler olarak farklı olduğunu göstermiştir. Sonuçlar, aynı zamanda, ÖBİ'nin Fen, Sağlık ve Sosyal bilimlerine göre Ardışık/Global öğrenme biçiminde manidar bir farklılık olduğunu göstermektedir.

Anahtar Sözcükler: Öğrenme Stilleri, Bireysel Öğrenme Stilleri, Felder-Silverman Modeli, Öğrenme Stilleri İndeksi.

Introduction

The basic purpose of learning is that the learner takes an active role in the process. Therefore, learners are required to learn and recognize their strengths and weaknesses. In this framework,

* Prof. Dr. Emel ÜLTANIR, Mersin University, Educational Faculty, Department of Educational Sciences, emultanir@yahoo.de

** Prof. Dr. Y. Gürcan ÜLTANIR, Mersin University, Dean of Tarsus Technical Faculty, gultanir@hotmail.com

*** Dr. Gülhan Örekeci TEMEL, Mersin University, Medicine Faculty, gulhanorekeci@mersin.edu.tr

individuals need to know how they perceive and realize the learning process. These features are called '*Individual Learning Styles*' (Özer 1998). The fact that individuals should have knowledge about their learning styles, that they should know their weak and strong sides is very important for them to develop the ability and attitude of a lifelong learning (Coffield, and al, 2004).

Towards the end of sixties, the concept of learning styles became one of the most remarkable and widely studied subjects particularly in the field of education when educators like Dunn and Dunn used it in their studies. (Markova and Powell, 2002). There are at least 100 instruments which detect individuals' learning styles. Some of the most commonly used models include: (Hargrove, Wheatland, Ding ve Brown, 2008). Kolb's model (Kolb and Kolb, 2006), Dunn and Dunn model (Dunn, 2000), Hermann Brain Dominance model (Lumsdaine and Lumsdaine, 1995),VARK model (Fleming,1995), Honey and Mumford (1982) and Felder and Silverman Learning model (Felder and Silverman,1998). There have been criticisms about not having reliability and validity of many learning styles inventories that are still being used in deteceting people's learning styles (Reid, 2005).

In the beginning of the 20th century theoretical and experimental research studies were carried out in the USA and Western Europe which contributed to the development of models set out for determining learning Styles (Coffield and et al., 2004: 2). Researches which have studied and put forward different models have defined learning styles in various ways (İncik, 2009.)

Methods of learning are alternative ways of qualitative preferences for acquiring and processing information (Kolb, 1984) and there are biological and experimental characteristics supporting or hindering academic success of each individual (Dunn, 1984). Similarly, studying the differences in individual approaches in acquiring and processing information (Felder, 1996) is another way. According to Riding and Rayner (1998), styles of learning should be treated as differences in mental or personal psychology, not as a special form of learning activity or a certain personal choice in teaching. Boydak (2008) suggests that methods of learning are inborn characteristics like blood type of individuals that have deep impact on individuals' lives.

Vester (1991) defends that individual differences in the brain and brain networks are established during babyhood which lead to differences in channels of perception. Individual differences in channels of perception lead to differences in learning tendencies. Different world views encountered in different cultures and social classes are also neuron connections and different brain network establishments obtained during babyhood lead to differences in learning tendencies.

Each of the proposed models suggests different definitions and classifications to learning styles. While Felder and Silverman (1988) define learning styles of learners in a more detailed manner with four dimentional preferences, most of the learning style models classify learners in a few groups. In this study, Felder-Silverman style is used in the integration of learning style in technology.

Felder-Silverman Learning Style Model (FSLSM)

Felder-Silverman Model classifies students as having preferences in one category or the other in each of the following four dimensions. Each of them include two poles (Graf, Viola, and Kinshuk, 2007; Felder and Spurlin, 2005;):

• Active (Act) learners learn by trying things out and working with others. Furthermore, they tend to be more interested in communicating with others and prefer to learn by working in groups where they can discuss about the learned material. In contrast reflective (R) learners learn by thinking things through and working alone or may be in a small group together with one good friend.

• Sensing (Sen) learners like to learn concrete material and tend to be practical. They like to solve problems with standard approaches and tend to be more patient with details. Intuitive (I) learners prefer to learn abstract material such as theories and their meanings and they are

more able to discover possibilities and relationships and tend to be more innovative than sensing learners.

• Visual (Vis) learners remember best what they have seen and therefore prefer to learn from what they have seen (e.g. pictures, diagrams and flow-charts) and learners who get more out of textual representations whereas verbal (Ver) learners get more out of words, regardless whether they are spoken or written.

•Sequential (Seq) learners learn in linear steps and prefer to follow linear stepwise paths in finding solutions and are more interested in details. In contrast global (G) learners use a holistic thinking process and learn in large leaps. They tend to absorb learning material almost randomly without seeing connections but after they have learned enough material they suddenly get the whole picture. They tend to find connections between different areas and the whole picture is important for global learners.

The Index of Learning Styles (ILS) is a 44- question instrument designed to assess preferences on the four dimensions of the Felder-Silverman model. It was developed in 1988 by Richard Felder and Linda Silverman with the aim of presenting learning and teaching based insight to Engineering faculty members. An initial version was created in 1991 by Richard Felder and Barbara Solomon of North Carolina State University. In 1994, several hundred sets of responses to Version 1 were collected and subjected to factor analysis, and items replaced by new items to create the current version. A pencil-and-paper version of the instrument was put on the World Wide Web in 1996 and an on-line version was added in 1997 (Felder and Solomon, 2001).

Surveys regarding the development of learning styles show that learners prefer to learn in different ways. It has been showed that learners with a strong preference in a unique learning style might have difficulty when teaching style doesn't fit with the preferred learning style (Felder and Silverman 1998; Felder and Solomon 1997). In this regard, it has been stated that learning activities which fit to individual learning styles have increased the success of learners (Dunn, Beaudry and Klavas, 1990-91). White's (2001) research findings showed that when students know the learning styles they own, they are more successful and they have better problem solving skills. As shown in this study, because of individual differences, each individual has different features, such as ability, interest and learning style. Therefore, some are more effective in some teaching processes.

Successful universities are recognized by distinguishing the ability in their faculties thanks to understanding how their students learn. If this understanding goes along with proper pedagogical techniques, it will be hopeful for student output benefits (Sims and Sims,1995). Student have different strengths and preferences in the ways that they collect knowledge into useful knowledge, process and organize which means they have different learning styles. (Dunn and Dunn,1974; Felder,1996; Felder and Spurlin, 2005; Kolb,1984). Students in different fields also have different learning styles. Differences have been found among the students who are in humanities-based departments and maths based departments (Mathews, 1994), between psychology and special education, social working and criminal justice, (Gadzelle and Masten, 1998) and between psychology and biology (Clump and Skogsberk, 2003). In some surveys, it is recommended when teaching is adapted with students' learning styles, increase in learning can be observed (Albaili, 1997; Baloğlu, Gadzelle, and Stephens, 2002; Dunn, Griggs, Olson, Gormman and Beasely,1995).

There is no doubt that little importance is given to learning styles by educators in higher education and that there is a wrong notion about how students learn. An opinion has been supported by Sims and Sims (1995) as a fatalist point of view to learning which the individual either learns or not. These writers have also accepted that there exists an inability in teaching and learning process behind higher education.

Learning Styles in Colleges and Faculties in Different Fields

Some researchers have found that certain university students who study engineering, business management, sciences and human sciences have different learning styles in different cultures such as USA, England, Brazil and Pakistan (Constant 1997; De Vita, 2001; Lopez, 2002; Zywno, 2003; Alumran, 2008). In an earlier time, some researchers have detected that the most preferred learning style is visual learning style by comparing the learning styles of American Students in some academic colleges with Education, Science, History, Philosophy and Business Management (Litzinger, Ha Lee, Wise and Felder, 2005)

According to Alumran's (2008) findings, it has been found that preferred learning styles in different colleges are different. For example, the students of information technology have been found more active than the student of Law and Science. On the other hand, education students have been found more active than the science students. It is possible that the nature of IT instruction focusing on computer skills and hands on experiences, encourages students to be more active than Law and Science students. The same logic applies to education students whose training in teaching practices requires that they use active LS as a part of their training by applying new teaching methods and using some educational activities with children in classrooms and in field work projects.

While it might have been expected that it students and students would be active learners and law students would be reflective learners, it was surprising to find that science students who are known to be actively involved doing lab experiments, were found to be reflective learners.

In most of the previous research studies carried out before, learning styles of students in western universities have been studied. These students have a different cultural background from Turkish university students. Therefore, they can't be generalized with western findings. Studies mentioned above point out that according to learning styles of learners their preference of learning activities change. In this framework, it is necessary to detect the learning style of students and what kind of learning activities they prefer must be searched.

Purpose

This research has been applied to various student groups that can represent the scientific fields at Mersin University. The purpose of the study is, with the adaptation of Felder-Silverman learning styles instrument to Turkish, to study the reliability and validity of the instrument at Mersin University by determining the learning styles of Mersin University students.

Three questions lead this study:

1. What are the reliability and validity of the instrument proposed by Felder-Silverman as a learning styles instrument?

2. What are the preferred learning styles of the sample of thestudy according to Felder-Silverman learning styles instrument?

3. Is there a meaningful difference between learning styles in Mersin University students according to their branches of study such as science, health and social sciences?

Method

Participants

Participants consisted of 526 Mersin University students. The ages of the sample ranged from 18 to 22, and the age of 23 and above is very few. The students who participated in this study were selected from all the academic institutes by using "quota sampling" method which is used in groups of students that can be reached. The distribution of the sample amongst the different academic institution was as follows:

Natural Sciences (n=320, 61%), Health Sciences (n=149, 28%) the Social Sciences (n=57, 11%).

Instruments

The Index of Learning Styles Index was used in this study. Learning styles instrument has been patterned to evaluate the preferences of students in four dimensions and 44 items. Beginning version of ILS was developed by Richard Felder and Linda Silverman in 1988 as a learning model focused on the structure of learning styles of engineering students. Three years later, Felder Solomon Learning Styles Index was developed (Zywno, 2003). Paper-pencil of the scale was put on WEB in 1996 worldwide and online version was added in 1997 (Felder and Solomon, 2001). The ILS consists of forty-four-item forced-choice instrument with option (a or b). It consisted of four scales' each with eleven items and these are: Active- Reflective, Sensing-Intuitive, Visual-Verbal, and Sequential-Global Learning Styles. Subtracting the lower score from the higher one "a or b" will result in a score indicating the learning style that the individual acquires.

ILS is available at no cost to individuals who wish to assess their own preferences or to instructors or students who wish to use it for classroom instruction or research. Each learning style dimension has associated with it 11 forced-choice items, with each option (a or b) corresponding to one or the other category of the dimension (e.g., active or reflective). Using the active±reflective dimension as an example, 0 or 1 `a' responses would represent a strong preference for reflective learning, 2 or 3 a moderate preference for reflective, 4 or 5 a mild preference for reflective, 6 or 7 a mild preference for active learning, 8 or 9 a moderate preference for active, and 10 or 11 a strong preference for active. This method was used in all of the statistical analyses to be reported. (The method actually used to score the pencil-and-paper and on-line versions of the instrument subtracts the `b' responses from the `a' responses to obtain a score that is an odd number between -11 to +11) (Felder and Spurlin, 2005).

Reliability and Validity Scores of Learning Styles Index

Test-retest reliability

With respect to the psychometric properties of the ILS instrument Felder and Brent (2005) indicated that the instrument had moderate reliabilities from 0.56 for Sequential-Global LS to 0.70 for Sensing-Intuitive LS. Furthermore other studies of test-retest measurements were conducted by Livesay and his colleagues (2002) Seery and his colleagues (2003) and Zywno (2003). The results are reported in Table 1.

Table 1
Test-Retest Correlation Coefficients from Some of the Studies

Δ_t	A-R	S-N	$V_S - V_b$	$S_q - G$	N	Source
2 week	0.800	0.850	0.870	0.810	45	*Alumran (2008)*
3 month	**0,510	*0,890	**0,852	**0,785	51	*present study*
4 week	**0,804	**0,787	**0,780	**0,725	46	*Seery et al.(2003)*
7 month	*0,730	*0,780	*0,680	*0,600	24	*Livesay et al. (2002).*
8 month	**0,683	**0,678	**0,511	*0,505	124	*Zywno (2003)*

*p <.05, **p<.01

The results, in Table 1 show that test-retest reliability measurements have been carried out by Livesay at al. (2002), Seery et al (2003), Zywno (2003), and Alumran (2008). When determining test-retest reliability, the time between test administrations should be wide enough so that subjects

cannot remember their responses from one administration to the next, but not so large that quantity being assessed might change significant extent in the natural course of events (Silverman and Spurlin, 2005). Table 1 shows the eight week interval used by Zywno (2003) applications implemented in 7 and 8 months intervals have been found between 0,5 and almost 0,7. The four interval used by Seery et al. (2003) is ideal for this purpose. The high correlations reported in that study and the statistical significance of other reported correlations and a conclusion that the test-retest reliability of the ILS scores is satisfactory.

In this study, the three week interval was used and the results have been found between 0.5 and almost 0.8. In this study English is not being used as mother tongue and obtained results which have been applied to native speakers of English through tool version, results of analysis are being reflected.

Internal Consistency Reliability

Internal consistency reliability refers to the homogeneity of items intended the measure the same quantity (e.g. the active/reflective preference) that is, the extent to which responses to the items are correlated. Attitudes and learning style preferences in particular are situational dependent and do not necessarily become more pronounced with training or maturation. If students begin with a strong preference in one category or the other of a learning style dimension, this process will move them toward a position of greater balance. If responses to items related to the same learning style dimension exhibited a very high internal consistency (Silverman and Spurlin, 2005). Tuckman (1999) suggests that an alpha of 0.75 or greater is acceptable for instruments that measure achievement and 0.5 or greater is acceptable for attitude assessments. In this instrument all researchers accordingly take alpha=0.5 as the criterion of acceptability for the ILS. Table 2 demonstrates alpha values in four different studies.

Table 2
Cronbach Alpha Coefficients

A-R	S-N	$V_S - V_b$	$S_q - G$	N	Source
0,51	0,46	0,54	0,42	526	present study
0,51	0,65	0,56	0,41	284	Van Zwanenberg et al.(2000)
0,62	0,76	0,69	0,55	584	Spurlin (2005)
0,56	0,72	0,60	0,54	242	Livesay et al.(2002)
0,60	0,70	0,63	0,53	557	Zywno (2003)

Table 2 shows the value of the alpha determined in five different studies. All of the alpha values exceed the criterion value of 0.5 except for the two for the sequential-global dimension determined by Van Zwanenberg (2000) and in present study. In both studies values for all dimensions are consistently lower than those determined in the other studies.

While the maximum values are 0,62 and 0,55 in active-reflective dimensions and sequential-global dimensions, maximum reliability coefficient are between 0,76 and 0,69 in sensory- intuitive learners and visual-verbal dimensions. In this study, the alpha values have been calculated as follows: for active-reflective 0,5064, for sensing-intuitive 0,4616, for sequential-global 0,5426, and for visual-verbal 0,4221.

Adaptation Study of ILS Used in the Study

In 2008, after ILS was translated into Turkish separately by 3 experts in British Sciences, differences in translation has been corrected by coming together with these field experts. ILS translated into Turkish, has been made ready to apply, by being given to 3 instructors who were

experts in educational sciences by paying attention on the items of the scale both to the original one and the suitability of the community to be applied after the academic arrangements have been made. Then, for the *Language Validity*, a field application has been done to 27 university students who knew both the original language (English) and Turkish. The relation between both languages and Pearson correlation coefficient showed the results as follows: active-reflective: 0,637 (p<0,01), sensory-intuitive: 0,514 (p=0,006), visual-verbal: 0,522(p=0,032), and global-sequential: 0,505 (p=0,007). Based on these studies, it can be said that the language validity has been provided with both tests.

For the ILS's *Content Validity*, after the scientific explorations about the learning types have been given to 3 experts in education sciences an answer key has been attempted to be formed by asking which learning type was appropriate to the items of the scale very close results have been taken from each of the three experts. Later, by giving these answer keys and scale questions to another expert, he has been asked to reevaluate in terms of compatibility between the answers and explanations. As a result, it is shown that there was an exact match in 44 items which Felder-Silverman's answer key had the same items.

Results

To answer the second research question regarding the preferred learning styles of university students on each of learning styles dimensions, a serious of *t* tests for independent samples was calculated and results are reported in Table 3.

Table 3
Differences in Learning Styles of Sample Using t-Test

Learning Styles		n	M	SD	df	t	p
Active-Reflective	Active	495	6,28	2,10	988	11,616	<0,001
	Reflective	495	4,72	2,10			
Sensory-Intuitive	Sensory	482	6,74	2,01	962	19,07	<0,001
	Intuitive	482	4,26	2,01			
Visual-Verbal	Visual	476	5,61	1,98	950	1,85	0,065
	Verbal	476	5,38	1,98			
Sequential-Global	Sequential	485	7,65	2,06	968	32,48	<0,001
	Global	485	3,35	2,06			

p<.001

The results in Table 3 show that the t value of the mean differences of each of the four dimensions was significant except visual-verbal learning dimension ($p \leq 001$). Hence for active-reflective ls t (988) = 11,62, $p \leq 001$; for sensing-intuitive ls t (962)= 19.07, $p \leq 001$; for visual-verbal ls t (950) = 1,85, $p \leq .05$ and sequential-global ls t (968) = 32,48, $p \leq 001$ has been found. Examining the means of students' scores in different learning styles in Table 3 shows that the Mersin university students preferred learning styles are as follows: active over reflective, Sensing over Intuitive, there isn't a significant difference between regarding means visual and verbal and sequential over global. Results further show that sequential LS had the highest mean indicating that Sequential LS was the most preferred learning styles by Mersin University students. And the lowest average was Global LS.

In order to answer the third research question, means, standart deviations of student learning styles according to fields of sciences were calculated and reported in Table 4. One-way ANOVA test has been used with aim of comparing Mersin University's Science, Social and Health sciences' students. In addition, the differences between groups have been tested Tukey HSD test.

Table 4

Means and Standard Deviations of Learning Styles for Fields of Sciences with Results of ANOVA for Effect of Fields of Sciences on LS Dimensions (n=526)

Learning Styles	Field of Sciences	n	M	SD	Source of Variance	Sum of Square	df	Mean Square	F	p
Active-Reflective	Natural	301	6,42	2,07	Between groups	16,69	2	8,35	1,89	,152
	Health	54	6,05	2,11	Within Groups	2165,19	491	4,41		
	Social	139	6,05	2,14	Total	2181,89	493			
Sensory-Intuitive	Natural	293	6,73	1,93	Between groups	20,114	2	10,057	2,505	,083
	Health	53	7,25	1,97	Within Groups	1918,751	478	4,014		
	Social	135	6,52	2,16	Total	1938,865	480			
Visual-Verbal	Natural	290	5,68	1,91	Between groups	4,783	2	2,391	,610	,544
	Health	49	5,35	2,58	Within Groups	1850,261	472	3,920		
	Social	136	5,61	1,88	Total	1855,044	474			
Sequential-Global	Natural	297	7,78	2,07	Between groups	44,925	2	22,462	5,412	,05*
	Health	53	8,03	2,02	Within Groups	1996,521	481	4,151		
	Social	134	7,16	1,97	Total	2041,446	483			

* Source of difference (Tukey HSD), * p<0,05

In Table 4, the results showed that highest LS means for Health Sciences (*M*= 8.03) preferred sequential-global ls and lowest ls means for health sciences (*m*= 5.35) preferred visual-verbal LS. The results of ANOVA showed that the Field of Sciences (Natural, Health and Social) only main effect was attributed to sequential/global learning styles *F*= 5.41, p ≤ .05. In order to determine which Field of Science mean differences were significantly different from one another on measures of learning styles Tukey HSD test for post-hoc comparisons (alpha <.01) was performed for the sequential/global Learning Styles (see Table 5).

Table 5

Tukey HSD Test for Post-hoc Comparisons that Mean Differences in Learning Styles

Öğrenme BiçimiLearning Styles	Enstitü(I) Field of Science	Enstitü(J) Field of Science	Ortalama Farklılık Mean Difference	Standard Hata Standard Error	P p
Global-Ardışık GlobalSequential	Fen bilimleriNatural Sciences	Sosyal BilimlerSocial Sciences	0,6203	0,21020	0,010
	Natural Sciences	Health Sciences	-0,2532	0,30380	0,682
	Sosyal BilimlerSocial Sciences	Sağlık BilimleriHealth Sciences	-0,8736	0,33059	0,023

p ≤ .05.

The results showed that the significant mean differences in learning styles were between students in the Natural Sciences and those in the Social Sciences (*M*-diff of 0.62). The results further show that the mean difference in learning styles was significant between students in the

Social Sciences and those in the Health Sciences (*M*-diff of -0.87). The source of difference has been the Social Sciences.

Discussion

The present study completed Felder-Silverman ILS' validity and reliability measurement by translating into Turkish. Second, the study also investigated the preferred learning styles of Mersin University students. It further examined the differences among the learning styles according to Field of Science.

With respect to the first research question, validity *and reliability measurement is done.* The basic studies of validity and reliability of the ILS are completed via *language validity and content validity*. Turkish and English versions of the scale have been carried out to students who spoke both languages, for language validity. *Test-retest reliability* and *internal consistency reliability* studies have been done as reliability studies. In these studies Pearson correlations vary between active-reflective dimension 0,51 and Sensory-Intuitive dimension 0,89. Cronbach alpha values calculated on the same group vary between 0,42 visual-verbal and 0,54 sequential-global sizes. These results can be said to be consistent with opinion that Tucman's (1999) 0,5 or higher alpha value is acceptable in evaluations of attitude and preference.

In the studies of the original scale conducted in Western countries, the test-retest correlation coefficients are 0,5 only in Zywno's (2003) studies of sequential-global and visual-verbal sizes, and they are between 0,7 and 0,9 in Livesay et al. and Seery et al.'s other learning dimensions. All coefficients are significant in the level of $p < .05$ and $p < .01$. In the study of Zywno (2003), which he did with 124 people, in test-retest correlation it varied between 0,51 and 0,68 and as the time interval between two tests got longer, he stated that correlation decreased. Livesay and his colleagues found test-retest correlation between the groups in 4,7,12 and 16 months periods and they detected that correlation fell as linear in these tests. Pearson correlation was higher than the alpha values. Zywno and Livesay et al. concluded that their reliability and validity data justified a claim that the ILS is a suitable instrument for assessing learning styles, although both studies recommended continuing research on the instrument. Livesay et al. have found that alpha value is in a range which varies from 0,54 to 0,72.

Van Zwanenberg et al. (2000) concluded that ILS is the best used to allow individuals to compare the strengths of their relative learning preferences rather than offering comparisons with other individuals' basing this assertion in part on their lack of success in predicting academic performance from ILS scores. In an unpublished study, Spurlin (2002) found that Cronbach alpha coefficient was in the range of 0,55 and 0,76 (Felder &Spurlin, 2005).

In internal consistency analysis of the scale in Turkey, Fer (2003) found the Cronbach's alpha was to be 0,58. According to Zwanenberg, Wilkinson and Anderson (2000) internal consistency of opposite poles are low. Internal consistency of original application of the scale has already varied between 0,41 and 0,65 between four dimensions. Nevertheless, the correlation between the scales of (a) and (b) options has been -1. Despite this, the reason of the use of scale is that this scale has been tested on several sciences long enough and that the scales which measure the learning styles are generally low in validity and reliability (De Bello,1990; Zwanenberg,Wilkinson and Andersen, 2000).

The second research question addressed that according to the preferred learning styles dimensions of Mersin University students' results showed that the most preferred learning style is sequential ls and secondly active ls. Results have also showed that preferred learning styles in four dimensions are: active is more than reflective, sensory is more than intuitive, visual is a bit more than verbal and sequential is more than global. In previous studies, (Alumran, 2008 Constant, 1997; Litzinger et al. 2005; Zywno, 2003) as in some science field studies like engineering students, Visual LS has been found more dominant than other learning styles. Findings of the

study made by Weng (2001) have revealed that most of the university students want activities in lessons which are suitable to their learning styles, and the activities they prefer are the ones based on active life. Besides this, other studies (Antony and Yangerber-Hicks, 2000) have revealed that most of university students don't learn well with learning activities which aim to think independent and abstract. So in a sense, students can be said to fit Institutive and Reflective learning style dimensions.

In this study, educational implication would be that Mersin University students should be encouraged the organization of the material should be sequential (i.e., step by step, logical). Further students should be encouraged to actively process information i.e., physical activity, discussion), the type of information presented should be sensory (i.e., sound, sights); which should be presented through visual modality (i.e., pictures, illustrations).

With respect to second research question regarding the Field of Sciences effect on student learning styles, the result showed that students in different Sciences preferred different learning styles. In Table 4 Natural Science students are seen as sequential/global, sensory/intuitive, active/ reflective and visual/verbal. Also, Natural Science students are seen to be more visual/verbal than Health and Social Sciences. It was not surprising to find that science students was Sensory and this result is consistent with the finding that those who learn in sensory and visual dimension better learn by exhibition which took place in another study finding applied to Chemical Engineering students (Felder,1996). According to Alumran (2008) Natural Science students are expected to be Active LS who are known to be actively involved in doing lab experiments.

Social Sciences students can be seen as firstly sequential than global, sensory than intuitive, active than reflective and visual than verbal (Table 4). Education students in Social Sciences are expected to be Active LS and to have Verbal LS. Because their training by applying new teaching methods and using some educational practices with children in many schools. In social sciences, meaning-focused and in economy science, sample focused learning styles are preferred by Slaats, Lodewijks and Vander Sanden (1999).

Health Sciences students were sequential than global, sensory than intuitive, active than reflective and verbal than visual. It have been expected that Health Sciences students to be Sequential LS (progressing step by step in finding the solution), sensory LS (learning with concrete materials) and active. The results of this study fit to the expected. Only Health Science students have been founded were more verbal than the other sciences. One explanation could be that nature of Medicine students were more communicating to the clients and encourages students to be more verbal learners than Natural and Social Sciences students.

Research findings to which Felder and Silverman model has been applied by Zwanenberg, Wilkinson and Anderson (2000) have revealed that engineering and management disciplinary students are active, sensory, visual and sequential. It has been revealed by Jehng, Johnson and Anderson (1993) that learners, who are in disciplines which are perceived as easy and difficult, have differences in their learning styles. In the findings of this study as well, both students of Natural Science Social Sciences and Health Sciences have been found sequential, sensory and active. Besides in Natural Sciences, Social and Health Sciences learning styles significantly differences has been found only between in sequential/global ls dimension.

Based on this result, it is interesting to note that this study found the most preferred learning style of students was sequential ls who prefer step by step instruction rather than holistic approaches preferred by global learners. Sequential learners learn in linear steps and prefer to follow linear stepwise paths in finding solution and are more interested in details. In contrast global LS use a holistic thinking process and learn in large leaps. Consistent with this result Felder & Silverman (2005) have postulated that the prevailing university teaching styles more closely match sequential and verbal styles.

As an educational implication could be that university instructors may be able knowledge of university students by focusing more on sequential, sensory and active. On the other hand

instruction that suitable predominantly to their learning styles, for instance by following stepwise paths in finding solution, sensory materials by using more audio-visual materials and encourages them to be more Active as working with others. Felder (1996) has mentioned that the objective of university teaching should, help students develop their skills and abilities by using all of the learning styles. The main goal of the proposed learning style model provides a good framework for designing instruction and the learning needs of students in each dimension are met.

Conclusion

The study aimed to investigate the preferred learning styles of Mersin University students and the differences in their learning styles according to Field of Science. One purpose of this study is to adapt Felder and Silverman (1998) model of learning styles by translating from its original language into Turkish through validity and reliability studies. Findings show that preferred learning styles are different which shows that Mersin University students are sequential, sensory and active learners.   Results have also demonstrated that ILS has a significantly difference in sequential/global learning style according to Science, Health and Social Sciences. This study has unique sides which need to be noted. These are as follows: Firstly, Mersin University students have showed preferred learning styles and it has been searched if there is a difference according to science fields. Secondly, forced-choice questionnaire have been used in this study and respondents into one style or another. Therefore, it is hoped that learning styles tools, which itemize the learning styles of students' unique culture, will be progressed in later studies.

Evolutions of learning styles are required to be used with the aim of classifying with purpose to anticipate about students' programmers, career choices or to judge about their abilities of being successful with all efforts. Learning style of the student can provide a clue about fields, like the strong sides of the student, and when an additional concentration is needed, but it can't do more than this. Students, who have the preference of any learning style, have the potential of being successful with all efforts. For example, the fact that the student prefers the knowledge to be presented visually doesn't mean anything about his/her ability of processing verbal information or visual information. It is important to accept certain limitations about this study. The students who answered this application were university students and the sample may not represent all students and therefore generalibility of findings may be limited. Also, benefit of these applications of these scales in classroom may have been limited as (Zywno, 2003) pointed out. Students' possibilities of answering the scales willingly may decrease. Doing these applications before lesson or after exams may decrease the reaction willing of students.

What supports the university students who are the findings of this study, is that they are in Sequential LS and it is the fact that they come from a learning system which passes from concepts to upper concepts and the students have affiliated between concepts and principles since primary school. Because as they are used to learning by teacher instructions, the reason that the students are in sequential LS may depend on this. This learning style is Ausubel's meaningful learning model (1963). Pupils who have graduated from Anatolian high schools and Science high schools take place in university students. They tend to student-oriented learning which is a method of Bruner's (1970) learning through discovery method as they have more laboratory facilities. They outnumber in Health Sciences, Medicine and Natural Sciences. These students learn first by practicing then through patterns and charts and then through verbal symbols. The fact that the sample group in this study is in Active LS may have a relation with this reason. Future results should further investigate the learning preferences of university students in similar Turkish culture to see whether or not the same pattern of learning styles prevails among other Turkish university students.

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