DEVELOPING LEARNING STYLE INVENTORY FOR EFFECTIVE INSTRUCTIONAL DESIGN

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ABSTRACT

In the process of education, instead of classifying students according to their insufficiency, teachers should try to get to know them and determine their cognitive, sensorial, and kinetic characteristics. This study on improving learning style inventory, which aims to help classroom teachers determine students' attributes in individualized educational activities in elementary schools, the first step in obligatory education, originated from the need mentioned. The study involved four stages: determining the questions for the style inventory, preparing the trial inventory, applying the inventory, and determining validity and reliability. In the scope of the study of the reliability and validity, place was determined as fifth class students who studied in the centre of the city of Çanakkale. The study sample were fifth class students who numbered the same as the number of the result when we multiply the question number in the inventory by the step number in the degree scale. All the data obtained at the end of the analysis were analyzed using SPSS. As a result of the analysis, 8 factors were determined. The 27-question inventory was formed from the limitations of which the factor burdens were determined.

Key words: Learning, learning style inventory, elementary education, instruction design

INTRODUCTION

In the process of learning, while transforming facts and events into experience by internalizing them, they can follow different approaches about different learning subjects. With this process, individuals generally prefer using and developing the approaches with which they feel most comfortable (Baldvin&Sabry, 1992). These approaches are called 'learning style' preferences, which determine his/her attitude towards learning and the quality of his/her learning process. Hunt (1979) defines the concept of learning style as 'how the students learn instead of what they learn'. Learning styles can be used as the meaning of the differences of individual approaches in the process of getting and processing knowledge. In the process of obtaining and processing knowledge, preference of method differs from student to student (Felder, 1996). Birkey and Romdan (1995) also support the idea that individuals have different learning and information processing systems, which means they have different learning styles.

The research results stated in books and articles show that when the teaching environment is designed by taking the learning style of the students into consideration, their success increases (Ayersman, 1996). Dvyer (1996) implies that whichever learning environment the students study in, the process must be planned by taking student learning styles into consideration. Carbo (1980) points out that determining the learning style features of the students and making the necessary arrangements increases their success. He also emphasizes that it is necessary to prepare teaching strategy and teaching materials appropriate for all learning styles.

Since 1940, many learning styles have been suggested. From these, the most well-known are the Gregorc, Dunn, and Kolb learning style models. Each of these models emphasizes different dimensions; cognitive, sensorial, and psychological (Başıbüyük, 2004). Heredity, educational background, conditional realities, age, and other factors also affect the style of learners. Apart from these factors, when an individual prefers a specific learning style, his/her aptitude about how she learns in a specific situation also affects the formation of learning style (DeCapua&Wintegerst, 2004).

Apart from the subject of determining learning style features, there have been also researchers who have investigated the influence of these styles on success in working life and education (Gregorc, 1979; Dunn&Dunn, 1979; Schmeck, 1982; Dunn, 1981). In these studies, they sought a way of determining the learning styles of individuals and examining the behaviour related to these styles. Many inventories have been developed for determining the learning styles of the students. The most popular is Dunn's learning style inventory, which

includes 223 questions. In this inventory, the preferences of the students in the course of learning are examined within four fields: environmental conditions, social preferences, sensory attributes, and physical attributes. There are also sub-factors in the inventory (Özer, 1998).

The learning style inventory developed by Kolb in 1976 and revised by him in 1985 as a result of criticism consists of 12 questions with 4 choices. The points on the scale show the different preferences of the individual from concrete to abstract, from active to reflector. Kolb's learning style inventory was adapted into Turkish by Aşkar and Akkoyunlu (1993). The total score of the individual obtained from the scale determines which learning style the individual has (a style which alters, assimilates, decomposes, and places).

Another learning style scale was developed by Renzulli and Smith (1978). In this scale, there are 65 questions related to methods of discussion, individual study, projects, exercise-repetition, simple expressions, games, and peer tutoring education. The psychometric features of the scale, which were revised in 1998, support the validity and reliability of the test.

In the 1980s, a style of learning inventory was developed by the NASSP (National Association of Secondary School Principals) in the USA. This work consists of four categories, namely;

1. Cognitive/Data Processing: Spatial, Analytical, Sequential processing, Memory, Immediate Processing, Distinguishing Small Differences and Oral-Spatial.
2. Preferences of Study: Movement, Voice, Posture, Study time in the afternoon, Lighting.
3. Perceptible Reactions: Visual, Auditory and Emotional
4. Educational Preferences: Studying early in the morning, Oral risk, Skilful managing, Forming a group, and Friendliness (Açıkgöz, 1996).

The style of learning scale developed by Grasha (1995) divides the features of learning into the passive, dependent, cooperative, participant, competitor, and independent dimensions. In each dimension there are 10 sentences. In total, it consists of 60 sentences with 5 Likert type choices. This scale was adapted into Turkish by Uzuntiryaki et al (2002).

Another scale tool was developed by Willing (1998) to be applied to English students. It consists of 28 questions in 4 independent subscales, which are the scale-analytical, authority-centred, communicator, and concrete learning styles. In Forster's (1999) learning style scale, which he developed for a mathematics course, there are 20 questions in all. Instead of an inventory, Gregorc's inventory can be accepted an observation form. He developed a scale tool including 40 questions that reflects the features of 4 learning style dimensions which he suggested in his model (concrete sequential, abstract sequential, concrete random, abstract random) (Sağ, 2005).

Although style of learning is an important element in learning, it is seen that there is insufficient research in this subject in Turkey (Ekici, 2002; Kılıç, 2004; Babadogan, 1994, Aşkar, Akkoyunlu, 1993).

When we take the learning features of elementary students into consideration, it is especially important to determine the learning styles of the students at this level and share the results with teachers who work in this field. Although teachers believe that they expend much effort to increase the success of the students in their class, they always complain that they can't get the success they want. Although adequate preparation is made and different equipment is used in the class, if the learning style features aren't determined in the proper way, the expected success cannot be achieved (Güven, 2003).

By determining the learning features of the students which appears evidently, it might be helpful to the students for learning, with activities that will be developed by taking these features into consideration. It might be also given education about using methods and techniques which help them to learn. For teachers' doing these activities mentioned, they must be informed about learning styles in in-service training related to teaching (Babadoğan, 1991).

Recently, successful schools depend on student achievement and equal opportunity in education if they can determine the individual characteristics that the students have and represent appropriate teaching activities for them. When we look at this situation from the perspective of the Turkish Education System, it contributes to the expression 'individuals must be educated according to their interest, aptitude, and ability', which is stated in the Turkish Education Law to be functional. This study of improving learning style inventory aimed at helping classroom teachers determine student's attributes in activities that aim the education to be individualized in the elementary schools, the first step in compulsory education, originated from this need mentioned.

RESEARCH AIM
The aim of research in the direction of the explanations is to improve learning style inventory which can be used to determine the learning features of students who study in the fifth class of elementary school.

PLACE SAMPLING
In the work of reliability and validity, place was determined as fifth class students who studied at the centre of Çanakkale. The study sample included 211 students who studied in the fifth class of Atatürk, Barbaros and Onsekizmart elementary schools, which were chosen at random.

METHOD
This work has a descriptive quality and was carried out in four stages: determining the questions of the scale, preparing a trial scale, applying the scale, and determining reliability and validity. In the process of determining substance, books and article were reviewed related to the work of improving learning style inventory and researches about this subject were examined. In addition to this, related to the preferences of the students who aimed at learning, it was required from the sampling group of 100 who represented the fifth class elementary students, the target audience, to write a composition which explained their feelings, ideas, and behaviour. In these compositions, the sentences related to learning preferences were analyzed systematically and clues which will form a basis for writing inventory expressions were obtained. With these clues, the substance of the learning style inventory was written with its 44 tests.

In the process of preparing the trial scale, it was given the form of scale to the inventory questions. For this reason, 44 inventory sentences were arranged in row one under the other and it was put a scale which showed the expressions 'appropriate, inappropriate, completely appropriate, completely inappropriate'.

Furthermore, at the beginning of the inventory, instructions which gave information about the aim of the inventory, the number of questions in the inventory, and the way of answering, were written. In the inventory, instead of using negative expressions, positive expressions were preferred because it was thought that the age of student groups was not suitable for opposite thinking. By seeking the opinion of an expert, it was checked whether there was any confusion which could cause misunderstanding or deficiency in these 44 questions and at the end of this checking, the number of questions was decreased. As a result of the evaluation, 3 questions were edited out. Therefore, a learning style inventory which included 41 questions for trial was prepared.

In the process of applying the inventory, the tool prepared as a draft was applied to 211 fifth class elementary students in December 2005. Because of faulty and deficient marking, the answers of 4 students were not included.

In the process of determining reliability and validity, by using data obtained from the inventory, which 207 fifth class elementary students completed, the reliability and validity of the trial tool was determined (Tezbaşaran, 1996). For this aim, Cranbach alpha coefficient, which was the most appropriate one for Likert type scales, was calculated. Testing was made to determine validity, scope validity, and structure validity. At this point, no new testing was made for scope validity. Experts' opinions which were taken at the time of determining inventory questions, which were accepted as efficient and appropriate to determine scope validity. For structure validity, factor analysis was used. After this analysis, the inventory was reduced from 41 questions to 27 questions. The analysis related to structure validity is explained in detail in the section on comments and results.

Cronbach alpha reliability coefficient was found to be 0,78, which aimed to determine the reliability of the instrument, that included 27 questions prepared to determine fifth class elementary students' style of learning. This might be accepted as a very good value. Therefore, it might be said that the questions which form the scale are consistent with each other. Furthermore, when each question in the inventory was excluded from it one by one after the factor analysis, there were no increase in the alpha reliability coefficient, which was calculated as 0,78. Therefore, no question was excluded from the scale as a result of the study of reliability (Özdamar, 1997).

When determining the validity of the trial tool for scope validity test, the work with which 7 expert and 4 classroom teachers who work in the Faculty of Education of five different universities (Gazi, Abant Izzet Baysal, Anadolu, Dokuz Eylul, Cukurova, Marmara) were accepted as the basis in the process of determining inventory questions. In this study, it can be said that inventory which was changed and corrected following the opinion of teachers and experts, is appropriate for its aim and represents the field aimed to be scaled.

RESULTS AND COMMENTS
With the factor analysis which aims to test the structure validity of the trial tool, the number of the dimensions of the scale and what these dimensions were was also determined at the same time. At first, at the end of the principle component analysis and with varimax rotation, 15 factors whose value was higher than 1.00 appeared. However, the number of factors was more than expected. Therefore, whether this number could be decreased or not was considered. By looking at the differences between factors, they were eliminated. If the factors had smaller difference than 0.1, they were eliminated. Secondly, the Scree Test of Cattel was used (Kline, 1994) and the chart below was obtained.

Figure 1. Scree Plot
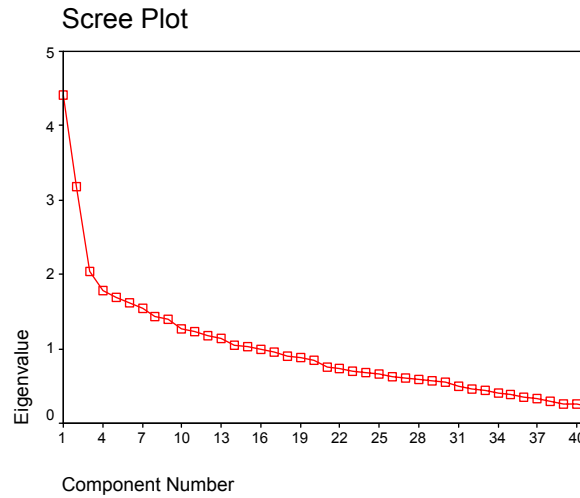
In the 'Scree test graph, the point where curve chart shows a fast decline in value is the point of the eighth factor. After the eighth factor, it is seen that curve goes forward in the same direction. It is concluded that the number of factors in the scale must be 8. Variances related to the 8 factors, percentage of variance and total percentage of variance are shown in chart 1.

Chart 1. Results Obtained Related to Factors at End of Factor Analysis

Factor	Variance	Percentage of Variance (%)	Total Percentage of Variance
1	4,890	11,927	11,927
2	3,237	7,895	19,822
3	2,066	5,040	24,861
4	1,848	4,508	29,369
5	1,739	4,242	33,612
6	1,503	3,665	37,277
7	1,477	3,604	40,880
8	1,323	3,227	44,108

As seen in Chart 1, the variance values of the 8 factors in the scale are 4,89, 3,237, 2,066, 1,848, 1,739, 1,503, 1,477 and 1,323. All of the 8 factors explain 44,1 of the total variance. This rate variance which is above the acceptable rate, that is 41%, enables that this inventory will be evaluated as an inventory which is formed of 8 factors. Varimax rotation is made again for the questions to be distributed to 8 factors. According to the values which were obtained at the end of the analysis, it was decided that a question can be situated with at least 4 factor burdens only in one factor. Also, the questions' burden in one of the factors must have greater value than at least the value of 1.

Chart 2. Results Obtained Related to Questions at End of Factor Analysis

Mad. No	F1	F2	F3	F4	F5	F6	F7	F8
2	.518							
3	.641							
7	.731							
9	.606							
21	.415							
27	.542							
19		.568						
24		.756						
25		.549						
26		.593						
11			.697					
12			.535					
15			.799					
23			.514					
13				.707				
17				.612				
22				.723				
6					.580			
18					.661			
4						.713		
5						.598		
14						.499		
10							.747	
16							.476	
20							.590	
1								.725
8								.773

As seen in Chart 2, the factor burdens related to the 27 questions on the trial scale range from 40 to 83. From this point, it can be said that these 27 questions are qualified enough to be put in the inventory. The distribution of the 27 questions to the factors which are decided to remain on the scale at the end of the factor analysis and factor burdens are shown in the chart.

When the chart is examined, it is seen that the 2,.3.,7.,9.,21. and 27th questions on the scale are in one factor; 19., 24., 25., and 26th questions are in the second factor; 11., 12., 15., 23th questions are in the third factor; 13., 17., 22nd questions are in the fourth factor; the 6., and 18th questions are in the fifth factor; 4., 5., and 14th questions are in the sixth factor; 10., 16., 20th questions are in the seventh factor; and lastly, 1., and 8th questions on the scale are in the eighth factor.

DISCUSSION AND CONCLUSION
The results of the study of improving learning style inventory which aims to help classroom teachers about planning activities that enables learning to be individualized an determining the learning features of the students in the elementary schools are explained sequentially below.

1. At the end of the analysis, six of the questions are gathered in the first factor, four of them in the second factor, three of them are in the fourth factor, two of them are in the fifth factor, three of them are in the seventh factor, and two of them are gathered in the eighth factor.

2. By looking at the meaning of the six questions in the first factor, it can be said that this factor reflects the features of 'being motionless in the course of learning, being a listener, and studying by taking small notes'. The four questions in the fourth factor can be said to reflect 'features related to the students' preferences when they listen and study'. The other four questions in the third factor can be said to represent 'features related to visual and auditory preferences'. When the questions in the fourth factor

are examined, it can be said that this factor explains 'attention strategies which are used in learning'. It can be said that the questions in the fifth factor points out 'repetition strategies in learning'. When we look at the other factors sequentially, the sixth factor is called 'visuality and capable of motion in learning', the seventh factor is called 'writing preferences in learning', and the eighth factor is called 'auditory preferences in learning.

Determining the learning features that students have, and studying with appropriate strategies after this determination process, will affect the process of learning in a positive way. It is therefore very important and necessary to determine the learning features the students have at the beginning of the learning process. It is thought that teachers can use the learning style inventory easily which was developed for fifth class elementary students. For elementary classroom teachers to achieve the success they aim in their classes, such inventories may help. For example, this inventory may help teachers in lowering the number of students who usually are considered as unsuccessful but in reality may have learning difficulties. These students may be considered as unsuccessful just because they do not study in accordance with their learning styles (In fact, these students are classified as unsuccessful because they do not study according to the features they have.)

This kind of study for elementary students should be applied to the learning steps. The researcher's and teacher's attention should be called to the subject of learning strategies, individual differences, and learning features.

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INVENTORY OF LEARNING STYLE

Dear student,

This inventory was prepared to determine your learning style. There are sentences below which aim to determine your learning style. After reading each sentences carefully, determine by marking (X) in the most appropriate choice for you to the right of the sentences. For each sentence, you must mark just one choice. The choice that you mark will not be evaluated as right and wrong. Therefore, please do not leave unmarked sentences. Thank you for your contribution.

*Yrd.Doç.Dr.Bülent Güven
**Özge Özbek

HOW CAN I LEARN?	Completely Appropriate	Appropriate	Inappropriate	Completely Inappropriate
1. I like telling anecdotes.				
2. When I listen the course, I draw about the subject that I try to learn.				
3. I like listening to fairy-tale and book cassettes.				
4. I always examine and handle new tools and equipment.				
5. I always feel pleased if there are pictures related with the subject in the book I read.				
6. I like singing when I learn.				
7. I don't like making practical jokes on my friends.				
8. I have difficulty in imagining events on my mind.				
9. When I listen to the lesson or study, I move my legs involuntarily.				
10. I like telling rather than writing when I learn.				
11. I learn the subject easier with pictures and maps.				
12. I like reading aloud when I learn.				
13. I listen to radio and television loudly.				
14. I like cleaning the blackboard, and opening and closing the window.				
15. I prefer a silent environment when I learn.				
16. It is difficult for me to draw graphs, pictures and maps.				
17. When I listen to the lesson, the noise my friends make causes me to have difficulty in learning.				
18. I think that the best way to remember what I learn is to imagine them on my mind.				
19. I don't like eating something or chewing when I study.				
20. I learn better by taking notes repeatedly after each lesson.				
21. I don't like telling fairy-tales.				
22. When I learn, I like playing with coins or keys in my pocket.				
23. I like learning by discussing the lessons with my friends in the class.				
24. When I study, I frequently take a break and do other things.				
25. I want my teacher to correct me by explaining when I give wrong answers in the lesson.				
26. I remember easier when I learn the subject by applying it.				
27. I learn better by taking notes and writing when I repeat the lesson.				