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DEVELOPING DECISION SUPPORT SYSTEM TO DETERMINE LEARNING STYLES

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ABSTRACT

An effective and fruitful education includes guiding the students on how to learn, how to motivate themselves, how to recall things and how to control and direct their own learning effectively. The recent studies have focused on learning strategies. Each student has original ways while preparing for learning, during the process of learning and while recalling. Learning styles are inherent characteristic features. They effect behaviour in every step and dimension of life. Students are in need of certain behavioural and intellectual processes. The purpose of this study is to develop decision support system to prove that students can learn better by using learning strategies. Independent variables of the application were defined in the normalized matrix result created. Later on, the dominant learning style of the student was defined by means of a mathematical model.

Keyword: *Learning Styles, Decision Making, Decision Support System*

ÖĞRENME STİLLERİNİ BELİRLEMEK İÇİN BİR KARAR DESTEK SİSTEMİ GELİŞTİRİLMESİ

ÖZ

Etkili ve verimli bir öğretim, öğrenciye nasıl öğreneceğine, nasıl hatırlayacağına, kendi kendini nasıl güdüleyeceğine ve kendi öğrenmesini etkili olarak nasıl kontrol edip yönlendireceğine rehberlik etmeyi kapsamalıdır. Son yıllardaki çalışmalar, öğrenme stratejileri üzerinde yoğunlaşmıştır. Her bir öğrenci yeni ve zor bir bilgiyi öğrenmeye hazırlanırken, öğrenirken ve hatırlarken farklı ve kendine özgü yollar kullanır. Öğrenme stilleri doğuştan var olan karakteristik özelliklerdir. Yaşamın her anında ve her boyutunda davranışları etkiler. Öğrenciler, öğrenmeyi gerçekleştirmek amacıyla belirli davranışsal ve düşünsel süreçleri gerekserler. Bu çalışmanın amacı; öğrencilerin öğrenme stillerini kullanarak daha iyi öğrenebileceklerini tespit etmek için karar destek sistemi geliştirilmesidir. Oluşturulan normalize matris sonucunda uygulamanın bağımsız değişkenleri belirlenmiştir. Daha sonra öğrencinin en baskın öğrenme stili matematiksel bir model yolu ile belirlenmiştir

Anahtar Kelimeler: *Öğrenme Stilleri, Karar Verme, Karar Destek Sistemi*

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INTRODUCTION

Cognitive learning theories, underline the fact that it is necessary to give the learners the responsibility of learning and to make them participate in learning actively. Hence, the studies in the field have recently focused on learning strategies. Dunn&Dunn learning style model was put forth by Dr. Rita Dunn and Dr. Kenneth Dunn in 1967. The basic reason for the model is: every individual reaches the target through different ways while learning a subject. During this period realizing the best ways of oneself to get the easiest and fastest knowledge enable us to get the knowledge in a healthy way. Learning strategy is "the expected behaviours and thoughts of the learners that will affect their coding process while learning." (Claire and Mayer, 1986). Learning strategies indicate cognitive strategies such as storage allocation, recalling and executive cognition processes that direct cognitive strategies, the behaviour and thought processes assumed by the learner that affect the learning. (Arends, 2001).

Students are in need of certain behavioural and intellectual processes to execute learning such as finding the main idea of a reading passage, summarizing it or note-taking. Their success in fulfilling these tasks successfully depends on the use of several most suitable strategies for learning. Learning strategies "are the processes used by the students for self-learning." (Gagne and Driscoll, 1988) Students who can maintain their own learning are defined as "strategic learners", "independent learners", self- regulated learners".

Richard (1997) states that people have different learning and different data processing systems, consequently different learning styles. Teachers must consider the fact that students have different learning styles, and should also know by means of which style the students learn better and should present their lessons accordingly.

We can sum up learning strategies in three main topics such as; Visual, Audio, and Kinaesthetic/ Tactile. (Boydak, 2006).

Visual: They are usually tidy in their private lives. They don't like mess and untidiness. They can't work at an untidy desk, they have to tidy it up first in their own way so that they can study.

They specify certain places for tools such as pencil, eraser and pencil sharpener on the desk and always keep them in those places. Their bags and wardrobes are always tidy. Even though, they don't like writing, they use their notebooks neatly and carefully.

Audio: They talk to themselves at early ages. They are sensitive to sound and music. They like to char and work with someone. They often speak harmonically and nicely. They are good at foreign language learning. They remember the things they want to remember by hearing as if someone is telling them those things.

Kinaesthetic/Tactile: They are quite active. They can't stand still in their places in the class. They always want to be the ones who to do the tasks in the class such as cleaning the board, opening the window, closing the window, bringing chalk. They might fail to understand what is going on in the lesson if they are forced to sit for a long time. They usually cause problems in the class if this activeness is not directed for the right tasks. They are usually affected negatively by our schooling system. They make the least use of chalk and board education so they might be declared as naughty, lazy and unintelligent.

Defining the learning styles of students help to prepare the environment they prefer, and make it easier for them to construct the knowledge. That's why; the most suitable activities that will be presented to students should be defined carefully beforehand. (Jones, 1998).

Decision Support System

Today, many instances people are involved can be accessed in terms of decision making techniques by using mathematical models. When defined as a model, ; X_1, X_2, X_3, … X_n inputs are put in operation with f(x) operator and weights such as W_1, W_2, W_3,.., W_n , the numerical result seems to be f(X_1, X_2, X_3, … , X_n). Many problems in daily life can be modelled as linear functions. (Yarman et. al. 2006)

The benefits of Decision Making Strategies can be listed as below; (Phillips-Wren et. Al. 2011; Holsapple, & Sena, 2005; Şen, 2011)

Decision Making Strategies;

provide better data processing and more alternatives.
help to deal better with complex problems.
shorten decision making duration.
reduce decision making costs.
provide more research/ discovery possibilities.
offer fresh perspectives and new approaches.
provide proof support (provide proof to support decision or confirm a present hypothesis)
provide more credibility (increases the credibility of decision processes or the results)
maintain better communication (strengthen the communication among the participants during a common decision process)
maintain better co-ordination. (better co-coordination among the participants during a common decision process)
maintain better satisfaction (increases satisfaction with decision making processes and their results)
strengthen decision making mechanisms.
provide competition advantage
affect validity of the decision positively.

Decision Making Strategies that offer a mathematical method in the decision making mechanism of people and is designed to develop decision making process, can be used to define by means of which learning style students can learn.

In this study; a model is aimed to be established to define by means of which method students can learn better and to challenge effectiveness of this model.

METHOD

Two different case groups have been used during the research. The first case group is made up of 10 specialists in Istanbul University Hasan Ali Yucel Faculty of Education. The second case study is made up of 3rd year students of Hasan Ali Yucel Faculty of Education. "Learning Styles Inventory" with 30 questions developed by Nancy (1996) has been used to assess learning styles of the students. The students have given answers in the inventory from 1 point to 4 points. The number of students who answered choices from 1 to 4 has been counted and Wi / W_{sum} calculated.

Then10 specialists were asked to give answers from 1 to 5 to define the learning strategy by means of which the articles in this inventory could be provided. The same process done in learning styles inventory was done here also. Lastly, utility function was calculated by using Wi / W_{sum} in learning styles inventory.
The necessary features for any alternative that will be used in this study to be evaluated by the same criteria are listed below as:

x_1: I feel the best way to remember something is to picture it in my head
x_2: I follow oral directions better than written ones
x_3: I often would rather listen to a lecture than read the material in a textbook
x_4: I am constantly fidgeting (e.g. tapping pen, playing with keys in my pocket)
x_5: I frequently require explanations of diagrams, graphs, or maps
x_6: I work skilfully with my hands to make or repair things
x_7: I often prefer to listen to the radio than read a newspaper
x_8: I typically prefer information to be presented visually, (e.g. flipcharts or chalkboard)
x_9: I usually prefer to stand while working
x_{10}: I typically follow written instructions better than oral ones
x_{11}: I am skillful at designing graphs, charts, and other visual displays
x_{12}: I generally talk at a fast pace and use my hands more than the average person to communicate what I want to say
x_{13}: I frequently sing, hum or whistle to myself
x_{14}: I am excellent at finding my way around even in unfamiliar surroundings
x_{15}: I am good at putting jigsaw puzzles together
x_{16}: I am always on the move
x_{17}: I excel at visual arts
x_{18}: I excel at sports
x_{19}: I'm an avid collector
x_{20}: I tend to take notes during verbal discussions/lectures to review later
x_{21}: I am verbally articulate and enjoy participating in discussions or classroom debates
x_{22}: I easily understand and follow directions on maps
x_{23}: I remember best by writing things down several times or drawing pictures and diagrams
x_{24}: I need to watch a speaker's facial expressions and body language to fully understand what they mean
x_{25}: I frequently use musical jingles to learn things
x_{26}: I often talk to myself when alone
x_{27}: I would rather listen to music than view a piece of art work
x_{28}: I need to actively participate in an activity to learn how to do it
***x_{29}*:** I frequently tell jokes, stories and make verbal analogies to demonstrate a point
x_{30}: I frequently touch others as a show of friendship and camaraderie (e.g. hugging)

FINDINGS

In this study a decision support system is developed to identify the students' learning styles. Wi / W_{sum} have been defined for each level of students' learning styles (audio, visual, tactile and kinaesthetic). Maximum values for X_1, X_2, X_3, … , X_n have been found and normalized matrix have been made for all values. The independent variables of the study have been given in Table 1. In a similar way Karataş et al. (2013) also developed a decision support system for Content Management System. Hence while making a fast and right choice, usage of decision support systems will be beneficial for the teachers who do not have enough information about which students are inclined to which learning style or for the ones who wants to have more information.

Table 1. Learning Levels Independent Variables

	FEATURE	4	3	2	1	TOTAL	POINT (Wi)	Wi / Wsum
AUDIO	X_2	14	7	11	10	42	109	0,103
	X_3	7	13	13	9	42	102	0,096
	X_5	13	7	12	10	42	107	0,101
	X_7	7	12	15	8	42	102	0,096
	X_{13}	10	13	7	12	42	105	0,099
	X_{21}	10	10	13	9	42	105	0,099
	X_{25}	13	7	8	14	42	103	0,097
	X_{26}	12	10	7	13	42	105	0,099
	X_{27}	11	12	10	9	42	109	0,103
	X_{29}	13	11	9	9	42	112	0,106
		GENERAL TOTAL (Wsum)					**1059**	**1**
VISUAL	X_1	12	10	8	12	42	106	0,099
	X_8	15	8	13	6	42	116	0,109
	X_{10}	15	9	7	11	42	112	0,105
	X_{11}	8	9	14	11	42	98	0,092
	X_{15}	15	4	12	11	42	107	0,100
	X_{17}	11	13	16	2	42	117	0,110
	X_{20}	13	7	14	8	42	109	0,102
	X_{22}	6	8	11	17	42	87	0,082
	X_{23}	11	13	9	9	42	110	0,103
	X_{24}	11	10	9	12	42	104	0,098
		GENERAL TOTAL (Wsum)					**1066**	**1**

Table 1. Learning Levels Independent Variables (Continued)

	FEATURE	4	3	2	1	TOTAL	POINT (Wi)	Wi / Wsum
TACTILE-KINEASTHETIC	X_4	5	12	10	15	42	91	0,083
	X_6	12	6	10	14	42	100	0,091
	X_9	12	11	4	15	42	104	0,094
	X_{12}	12	12	8	10	42	110	0,100
	X_{14}	15	11	8	8	42	117	0,106
	X_{16}	14	12	9	7	42	117	0,106
	X_{18}	18	11	4	9	42	122	0,111
	X_{19}	14	18	7	3	42	127	0,115
	X_{28}	14	10	8	10	42	112	0,102
	X_{30}	6	15	12	9	42	102	0,093
		GENERAL TOTAL (Wsum)					1102	1

In this application, the variables in the table are taken into consideration; designated weights and normalized matrix are multiplied to define which teaching styles appeal to which learning style of the student. In the results derived, the choice that has the highest value is the first in the row. Similarly, the results of teaching styles are shown in Table 2. Learning style results are shown in Table 2 and when utility function is calculated for every type of student it has been well understood that an audio learner is better at learning with presentation methods, a visual learner is better at learning with finding methods and an tactile and kinaesthetic learner is better at leaning with research methods.

Table 2. Learning Styles Result

		NORMALIZED VALUES				UTILITY FUNCTION		
AUDIO	FEATURE	PRESENTATION	FINDING	RESEARCH	Weights (Wi)	PRESENTATION	FINDING	RESEARCH
	S2	1,00	0,67	0,33	0,103	0,103	0,069	0,034
	S3	0,60	1,00	0,80	0,096	0,058	0,096	0,077
	S5	1,00	1,00	0,50	0,101	0,101	0,101	0,051
	S7	0,67	0,67	1,00	0,096	0,064	0,064	0,096
	S13	0,40	1,00	0,20	0,099	0,040	0,099	0,020
	S21	1,00	0,67	1,00	0,099	0,099	0,066	0,099
	S25	1,00	0,33	0,67	0,097	0,097	0,032	0,065
	S26	1,00	1,00	1,00	0,099	0,099	0,099	0,099
	S27	1,00	1,00	0,25	0,103	0,103	0,103	0,026
	S29	1,00	0,75	1,00	0,106	0,106	0,079	0,106
					TOTAL	**0.870**	0.809	0.673

Table 2. Learning Styles Result (Continued)

		NORMALIZED VALUES				UTILITY FUNCTION		
	FEATURE	PRESENTATION	FINDING	RESEARCH	Weights (Wi)	PRESENTATION	FINDING	RESEARCH
VISUAL	S1	0,20	1,00	0,20	0,099	0,020	0,099	0,020
	S8	0,40	1,00	0,60	0,109	0,044	0,109	0,065
	S10	0,60	1,00	0,60	0,105	0,063	0,105	0,063
	S11	0,25	0,25	1,00	0,092	0,023	0,023	0,092
	S15	0,50	0,50	1,00	0,100	0,050	0,050	0,100
	S17	1,00	1,00	0,20	0,110	0,110	0,110	0,022
	S20	1,00	0,40	0,20	0,102	0,102	0,041	0,020
	S22	0,25	1,00	1,00	0,082	0,020	0,082	0,082
	S23	1,00	0,40	0,80	0,103	0,103	0,041	0,083
	S24	1,00	0,50	0,50	0,098	0,098	0,049	0,049
					TOTAL	**0,633**	0,709	0.596

Table 2. Learning Styles Result (Continued)

	NORMALIZED VALUES				UTILITY FUNCTION		
	PRESENTATION	FINDING	RESEARCH	Weights (Wi)	PRESENTATION	FINDING	RESEARCH
TACTILE-KINESTHETIC	0,75	0,25	1,00	0,083	0,062	0,021	0,083
	1,00	0,33	0,67	0,091	0,091	0,030	0,060
	1,00	1,00	0,75	0,094	0,094	0,094	0,071
	0,50	1,00	0,25	0,100	0,050	0,100	0,025
	0,20	1,00	0,60	0,106	0,021	0,106	0,064
	1,00	0,60	0,80	0,106	0,106	0,064	0,085
	1,00	0,33	1,00	0,111	0,111	0,037	0,111
	0,50	0,50	1,00	0,115	0,058	0,058	0,115
	0,60	1,00	0,60	0,102	0,061	0,102	0,061
	0,40	0,20	1,00	0,093	0,037	0,019	0,093
				TOTAL	0,691	0,630	**0,767**

CONCLUSION

Learning Styles are innate and they are characteristic specialities that affect the individual's success. Learning styles that are one of the most fundamental steps of learning how to learn are required to be known by the whole society, especially students and teachers.

Knowing learning styles will help to understand the fact that many students we consider as lazy or naughty, can't learn and/or behave in an undesired way because of not knowing their own styles or taking them into consideration.

As a result of this study, the most dominant learning style of the individual has been defined by means of a mathematical method. Utility functions are calculated according to normalized values and the highest value is taken among these values. Thus the choice to

be taken is identified. This model shows that for an audio learner presentation methods, for a visual learner finding methods and for a tactile and kinaesthetic learner research methods should be picked as a teaching style. Activities that are marked in the same quantity can be found in different sections. This shows the fact that in learning environments all three learning styles are used equiponderantly.

Thanks to this model developed, which learning style can be used in a class being thought can be decided upon easily. Consequently, while the needs of one student are met, the other students' needs will not be neglected.

In addition to this; It will be easier to define the most dominant learning style;as it will be more sensible;if utility function of learning level's independent learning variable is calculated including more expert views.

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