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DIFFERENTIAL APPTITUDE TESTS (DAT) and COGNITIVE PROCESSING STYLES

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COGNITIVE PROCESSING STYLES IN DIFFERENTIAL APPTITUDE TESTS (DAT)

Abstract: *This research was conducted on the students who study in the faculties of Technical Education, Economics and Administrative Sciences and Arts at the Marmara University in Istanbul in Turkey. 107 students from four departments (Electric-electronic, Textile, Labor Economics and Industrial relations and Industrial Design) of these faculties were randomly chosen as subjects for this study. Their age were between 18 and 24 years. Taggart's Human Information Processing Survey was used in order to examine left and right hemispheric preferences. Differential Aptitude Test was applied in order to determine different kinds of aptitude in different areas. The application of test forms was done in one session during morning hours. Previous studies claimed that left hemisphere is mainly used in the tasks that require numerical and analytical thought and right hemisphere is mainly used for intuitive and relational activities. Pursuing of previous studies, the Pearson Correlation Coefficient between left hemispheric sore and numerical comprehension test score was found significantly positive (r = 0.30) and it was found that there is no relation between right hemispheric preference and numerical ability. Furthermore, the right hemisphere which is well known in processing perceptional processing is observed to be positively related with space relations test score apart from other hemispheric preferences in this research (r= 0.12 and correlation between left and space relations test score r= -0.23) As a result, Differential Aptitude Test might be accepted as a good predictor to determine hemispheric preferences.*

Keywords: Hemisferic Preferences, Differential Apptitudes

FARKLI BECERİ İŞLEMLER TESTİNDE YARIKÜRE TERCİHLERİ

ÖZET: *Araştırma, Marmara Üniversitesi Teknik eğitim, İktisadi İdari Bilimler ve Güzel Sanatlar Fakültelerinden Elektrik-Elektronik, Tekstil terbiye, Çalışma Ekonomisi ve Endüstri Ürünleri tasarımı olmak üzere toplam dört bölümün öğrencileri üzerinde gerçekleştirilmiştir. 18-24 yaşları arasındaki denek grubu, 107 kişiden oluşmaktadır. Sağ ve sol beyin yarıküreleri tercihlerini belirlemek amacıyla Taggart'in "Human Information Processing Survey" testi kullanılmıştır. Farklı alanlarda becerileri belirlemek amacıyla ise Farklı Beceri İşlemler Testi (DAT- Differential Aptitude Test) uygulanmıştır. Test formlarının uygulanması bir oturumda sabah saatlerinde gerçekleştirilmiştir. Önceki araştırmalarda sol beynin sayısal, analitik düşünce gerektiren işlemlerde daha ağırlıklı olarak kullanıldığı, sağ yarıkürenin ise, ilişkisel ve sezgisel faaliyetlerde ağırlıklı olarak kullanıldığı öne sürülmüştür. Bu araştırmada da önceki araştırmaların doğrultusunda, Pearson korelasyon analizlerinde sol yarıküre puanı ile sayısal test puanı arasında pozitif ilişkiye rastlanırken (r= 0.30) sağ yarıküre tercihi puanı ile sayısal test puanı arasında negatif ilişki; ya da ilişki yok denecek kadar azdır. Yine algısal işlevlerde etkinliği gözlenen sağ yarıkürenin bu araştırmamızda, diğer yarıküre tercihlerinden farklı olarak uzaysal işlemlerle pozitif ilişkisi gözlemlenmiştir (r= 0.12, sol ve uzaysal test puanı korelasyonu r= -0.23). Sonuç olarak, Farklı Beceri İşlemler testinin (DAT) yarıküre tercihlerini belirlemede uygun bir test olabileceği öngörüsel olarak kabul edilebilir.*

Anahtar Kelimeler: Yarıküre Tercihleri, Farklı Beceri İşlemler

I. INTRODUCTION

The studies for the functions of two hemispheres of brain have been continued through the last century. The research about brain hemispheres claimed that left hemisphere is used for the tasks, which require numerical and analytical process, and right hemisphere is used for the tasks, which require intuitive and relational activities and process [1].

A village doctor, Dax determined that the disabilities of speech mainly lie on the result of the damage on left hemisphere in 1836 [2]. After examining 40 patients Dax found that almost all the patients' speech disorders were resulted from left hemispheric damage. This indicates that the behavioral dysfunction is related to the functions of brain localizations. In other words, cerebral localization is defined as the reflection of dysfunction of any local area of brain on the behavior. However, besides left hemisphere, which is dominant and is examined in detail, right hemisphere has also got very important functions. For example; dysfunctions behind perceptual process mainly lie on the damage of right hemisphere.

A research about university students investigated which hemisphere is preferred by music majors and computer programmers on the problem-solving task [3]. The research was done on 112 students in Texas state

university. 54 students were studying in the last year of the music department and 58 students were studying in the computer programming department. Taggart's "Human Information Processing Survey" was used in order to determine the left and right hemispheric preferences. As a result, music majors and computer programmers were found to be using right hemisphere equally on the problem solving tasks. However, the differences of hemispheric preferences were observed on the integration of two hemispheres and left process between two groups. Musicians comparing to computer programmers preferred more integration of two hemispheres than programmers. Taggart and Torrance [4] indicated that the individuals who accepts integration model are more creative and more problem solver than the others who prefer lateralization or prefer only left or only right hemispheric process. Computer programmers apply mainly left process more than music majors during problem solving. This finding also indicates that when computer programmer students encode computer programmes they study on the system belongs to the analytical and rational strategies. Heninger [5] claimed about left hemispheric process that tasks are differentiated belonging parts and the elements in the certain order and in the analytical system. According to Henninger, each hemisphere has own process depending on the different conditions. The tendency of left hemisphere process is to perceive the elements in the certain order and the system as a whole. Leafter [6] and Paterson and Bradshaw [7] concluded that verbal and analytical abilities belong to left hemisphere at the end of the studies of interaction between left and right brain.

Torrance [8] declared that right hemisphere is used effectively for creative thought in his study of creative thought and hemispheric preferences. Following studies determined the functions of the mind into two processes. Rational and logical mind has got dominant role in one of these functions, intuitive and illogical conditions of consciousness or no consciousness is dominant in the other. Torrance declared that critical intelligence is the characteristics of left hemispheric process and creative thought is the characteristics of right hemisphere by following Osborne [9]' study. According to Taggart and Torrance [4] both creative thought and problem solving behavior require both hemispheric processes.

Finally, this research was done in order to investigate whether right and left hemispheric preferences and differential aptitude test scores would be differentiated according to literature or not. As it was well known left hemisphere is mainly used for analytical and numerical abilities and right hemisphere is mainly used on the tasks, which require perceptual ability. The relationship between hemispheric preferences and differential abilities were investigated by measuring verbal, numerical, abstract and perception of space abilities. The hypotheses of this research were as follows:

1-) The one who gets high score on numerical abilities on DAT would prefer left hemisphere more than the others.

2-) The one who gets higher score on space relations test which requires perceptual activity would prefer right hemisphere more than the others.

3-) The differences of hemispheric preferences would be observed according to features of the departments. For example; art students due to be oriented towards more creative thought and spending more effort on the perceptual tasks they will prefer more right hemisphere than the others. On the other hand the students who study in the departments like the Electric, Computer and Economics due to spending time on analytical areas will prefer more left hemisphere than the others.

II. METHOD

Subjects: 108 students were chosen randomly as subjects for this study from four departments (Electric-electronic, Textile Education, Labor economics and Industrial relations and Industrial Design) of three faculties at Marmara University in Istanbul in Turkey. Their age was between 18 and 24 years. 60 of them were male and 48 of them were female students. According to the classification of the departments 35 of them from electric-electronic, 31 of them from labor economics, 26 of them from industrial design of art faculty, and 14 of them from textile education department were accepted as subjects of this research.

Scales: Students filled the forms of the "**Human Information Processing Survey** " [8], which has got 40 questions. The test is made up of 40 questions, which measure left, right and integrative preferences. Each question is given into there items. After raw scores are taken standard scores are determined from handbook of HIPS. The studies of validity and reliability of the test were done on American sample. Firstly, HIPS was distributed and after a week another test called " your style of learning and thinking" was distributed. Pearson Product- Moment Correlation coefficient between two tests was 0.84 for right hemisphere, 0.86 for left hemisphere and 0.82 for integrative function.

The validity and reliability studies were done on Turkish students sample for this study. According to the analysis of reliability correlation coefficient that is Cronbach Alfa was found to be 0.55. The test can be accepted as a reliable test since we got value over 0.50. However, a significant positive relation between numerical test score in DAT and left hemisphere preference score and a significant negative relation between left hemispheric preference score and space

relations in DAT indicates that HIPS is also reliable test for Turkish sample. (see Table.3).

DAT (Differential Aptitude Test) is a useful test to understand different aspects of students and to determine their important characteristics. This test, which was developed, for an American sample was also used for Turkish sample in order to develop Turkish standardization studies. This test is made up of four tests, which measure verbal, numerical, abstract and space relations skills. Verbal thinking skill test has got 25 questions and it takes 20 minutes. Numerical test has got 20 questions and takes 20 minutes. Abstract thinking skill test has got 25 questions and takes 20 minutes long. Space relation skill test has got 30 questions and takes 20 minutes. 100 last year students from Ankara Ataturk Anatolian High School were chosen in order to test whether DAT is reliable test for Turkish sample or not. The arithmetic mean, standard deviation scores were taken from this sample. According to the data analyzed by Kuder Richardson21 formula reliability coefficients were as follows: 0.77 for verbal thinking skill, 0.84 for numerical thinking, 0.72 for abstract thinking and 0.70 for space relations.

Therefore, the correlations between DAT and the end of the year satisfaction scores from school were as follows: Verbal thinking skill (r= 0.67), numerical thinking skill (r= 0.86), abstract thinking skill (r= 0.82), space relations thinking skill (r= 0.77).

Procedure: This research was conducted on the students of three faculties of Marmara University during morning hours. The tests were distributed for 2 hours by blocking morning lectures.

III. RESULTS

In Table.1.a, according to the comparison of arithmetic mean, the students from Labour economics (2) and Electronic-Electric (1) preferred more left hemisphere comparing to the others due to studying on the areas require analytical thought. In the case of art students, it was observed that the students preferred more right and integrative hemispheres than the others. Furthermore, art students were the subjects who preferred less left hemisphere than the others. The students of labour economics, electric-electronic and textile education showed higher satisfaction on the tests of verbal and numeric than the art students. Art students on these kinds of skills indicated lower satisfied scores than the others. However they got higher scores on the space relation test that requires perceptual and creative intelligence than the other students.

In Table.1.b. it was not found significant differences according to age. In Table.1.c, when female students indicated higher satisfaction scores on verbal test than male students, male students showed higher scores on the space relation test than female students. There was no differences in the case of preferring left hemisphere. However there was found to be differences for right and double hemisphere preferences. While male students preferred more right hemisphere than female students, female students preferred more double function more than the male students.

Table.1.a. The Arithmetic Mean of Independent Variable of Department on Hips and on DAT
DEPARTMENT * HEMİSPHERE* SKILL

DEPT.	LEFT	RIGHT	DOUBLE	VERBAL	NUMERIC	ABSTRACT	SPACE
1 MEAN	12,2	15,62	12,17	21,39	17,83	21,21	19,66
1 N	35	35	33	30	30	33	33
1 sd	3,25	4,35	4,09	1,56	1,31	2,32	5,56
2 MEAN	12,9	13,96	13,09	21,06	14,7	20,41	17,45
2 N	31	31	31	31	31	31	31
2 sd	3,88	3,79	4,35	2,27	2,83	3,18	5,27
3 MEAN	9,26	15,57	15,19	19,88	8,57	16,46	22,11
3 N	26	26	26	26	26	26	26
3 sd	2,76	2,74	4,1	3,84	4,22	4,62	5,36
4 MEAN	11	14,28	14,71	20,92	14,71	19,85	19,5
4 N	14	14	14	14	14	14	14
4sd	2,74	4,42	3,85	2,16	2,3	3,88	4,73
total mean	11,55	14,89	13,51	20,87	14,1	19,65	19,64
N	107	107	107	107	107	107	107
sd	3,52	3,9	4,25	2,6	4,51	3,92	5,52

Table.1.b. The Arithmetic Mean of Independent Variable of Age on HIPS AND DAT

AGE	LEFT	RIGHT	DOUBLE	VERBAL	NUMERIC	ABSTRACT	SPACE
19 MEAN	10,5	17,75	11,75	21,75	12,5	16,5	21,5
N	4	4	4	4	4	4	4
Sd	0,57	3,5	3,3	1,5	6,4	4,43	6,07
20 MEAN	10,72	14,31	14,72	21,22	14,38	20,52	20,9
N	22	22	22	22	21	21	21
Sd	3,45	3,77	3,13	2,13	3,87	3,84	4,71
21 MEAN	11,55	15,17	13,27	21,2	14,6	19,84	19,69
N	40	40	40	40	40	39	39
Sd	3,2	32	3,96	1,77	4,68	4,22	5,36
22 MEAN	12,68	14,15	13,09	19,76	14	19,65	18,59
N	32	32	32	30	29	32	32
sd	4,18	4,1	4,43	3,84	4,73	3,76	5,64
23 MEAN	10	17,5	13,25	21,5	13,25	19,5	22,5
N	4	4	4	4	4	4	4
sd	1,82	8,58	9,53	0,57	6,5	3,1	5,25
24 MEAN	10,2	15,2	14,6	21,2	12,25	18,6	18,4
N	5	5	5	5	4	5	5
sd	2,77	3,11	5,68	0,83	1,5	3,64	7,95
27 MEAN	9	14	17	23	14	19,5	22,5
N	1	1	1	1	1	1	1
sd							
total mean	11,53	14,87	13,55	20,84	14,15	19,68	19,62
N	108	108	108	106	103	106	106
sd	3,51	3,89	4,25	2,6	4,51	3,92	5,5

Table.1.c. The Arithmetic Mean of Independent Variable of Gender on HIPS AND DAT

GENDER	LEFT	RIGHT	DOUBLE	VERBAL	NUMERIC	ABSTRACT	SPACE
M MEAN	11,2	15,7	13,05	20,68	14,01	19,37	20,37
N	60	60	60	58	55	58	59
Sd	3,19	3,98	4,35	2,99	5,34	4,38	5,75
F MEAN	11,95	13,83	14,18	21,04	14,31	20,08	18,68
N	48	48	48	48	48	48	47
Sd	3,86	3,56	4,07	2,04	3,37	3,28	5,09
TOTAL	11,53	14,87	13,55	20,84	14,15	19,69	19,62
N	108	108	108	106	103	106	106
Sd	3,51	3,89	4,25	2,6	4,51	3,92	5,5

As we indicated before, in Table.2.a, according to the analysis of one way anova, it was found to be significant difference between the departments on the left hemispheric preference. The departments of the students like electric-electronic and labour economics prefer more left hemisphere than the art students ($p < 0.001$).

Table.2.a. One Way Anova of the Departments on the Left Hemispheric Preference

	sum of squares	df	Mean Square	F
Between groups	217.42	4	54,261	5,025
Within groups	1.101.425	102	10,798	
Total	1.318.467	106		

Table.2.b. One Way Anova of the Departments on the Right Hemispheric Preference

	sum of squares	df	Mean Square	F
Between groups	97,527	4	24,382	1,636
Within groups	1520,342	102	14,905	
Total	1617,869	106		

Table.2.c. One Way Anova of the Departments on the Double Hemispheric Preference

	sum of squares	df	Mean square	F
Between groups	34,504	1	34,504	1,925
Within groups	1900,163	106	17,926	
Total	1934,667	107		

In Table.3 the correlations were observed between hemispheric preferences and the scores of differential apptitude tests. It was found to be significant between left hemispheric preference and numeric test score (r = 0.30) at 0.05 significance level. The negative correlation between space relations score and left hemispheric preference score (r = -0.23) also found to be significant at 0.05 significance level. The correlation between space relations and right hemispheric preference was found to be positive. And the relation between integrative function and numerical score was found to be negative.

Table.3. The Correlation Coefficient Between HIPS and DAT

	LEFT	RIGHT	DOUBLE	VERBAL	NUMERIC
LEFT PEARSON CORR.	1	-0,364	-0,504	0,094	0,306
LEFT SIG.	,	0	0	0,339	0,002
N	108	108	108	106	103
RIGHT PEARSON CORR.	-0,364	1	-0,613	-0,058	-0,063
RIGHT SIG.	0	,	0	0,557	0,529
N	108	108	108	106	103
DOUBLE PEARSON CORR.	-0,504	-0,613	1	-0,005	-0,213
DOUBLE SIG.	0	0	,	0,963	0,031
N	108	108	108	106	103
VERBAL PEARSON SIG.	0,094	-0,058	-0,005	1	0,35
VERBAL SIG	0,339	0,557	0,963	,	0
N	106	106	106	106	103
NUMERIC PEARSON CORR.	0,306	-0,063	-0,213	0,35	1
NUMERIC SIG.	0,002	0,529	0,031	0	,
N	103	103	103	103	103
ABSTRACT PEARSON CORR.	0,074	-0,043	-0,032	0,285	0,716
ABSTRACT SIG.	0,45	0,658	0,742	0,003	0
N	106	106	106	104	102
SPACE PEARSON CORR.	-0,23	0,124	0,076	0,18	-0,055
SPACE SIG.	0,018	0,204	0,44	0,067	0,587
N	106	106	106	104	101

IV. DISCUSSION

According to the hypotheses of this research it was expected that there would be high positive correlation between left hemispheric preference and numerical score. Secondly, it was claimed that the one who gets high scores on the space relations test he/ she will prefer right hemisphere more than the others. And finally, it was hypothesised that there would be differences on the hemispheric preferences according to the departments.

In fact, according to these hypotheses, it was found that the one who got higher scores on the numerical test preferred left hemisphere to the others. Henninger [5]

suggested left hemispheric processing characteristics when noting that the left "... hemisphere processes material in an analytical fashion, breaking the stimulus into elements and processing them sequentially " Papcun [10] wrote that "... the propensity of the left hemisphere is to deal with sequential elements that comprise a whole. DAT is made up of some tasks like numerical or verbal to break into elements and to process sequentially. Paterson and Bradshaw [7] (cited in Chesson and Munday [3]) studied the interaction between the left and right brain and ascribed verbal and analytic abilities to the left hemisphere. Therefore, the high correlation between numerical score and left hemispheric preference supports the previous studies. Right hemisphere has got the capacity, which works with the variables more than one. It has also got institutional causality. The positive correlation between space relations test score and right brain preference should not be accepted as a chance since space relations test requires perceptual ability and right brain works with perceptual capacity [2]. Therefore, these correlation scores between HIPS and DAT supported by the previous studies indicates that HIPS can also be accepted as reliable test for Turkish sample.

It was found to be differences between the departments according to the hemispheric preferences. When the students of electric and economics prefer left-brain to the art students, the art students prefer more right and integrative function than the others. College music majors and college computer science majors use similar cerebral hemispheric dominant and right preferences for problem solving in the study of Munday and Dinnah [3]. However they observed the differences on the integrative function and left hemispheric processing preference. Music majors are more likely to use integrated processing. And, computer science majors are more likely to use a left processing mode than are music majors. In this research, especially students of electric- electronic department like art students prefer the right brain similarly. However it was found that the difference for integrative function and left-brain processing preference. Art students comparing to the others prefer less left-brain processing and more integrated function. The activities such as creative and perceptual in art might push the students to prefer more right brain and integrated function.

IV. CONCLUSION

Using HIPS in the areas like personnel training, personnel selection and vocational guidance may be useful in order to throw the light for understanding individuals' tendencies better. However the application of the forms in the industry might provide more knowledge to increase productivity and effectiveness.

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