THE STATISTICAL EVALUATION OF THE FACTORS AFFECTING THE ACADEMIC PERFORMANCE OF THE CHEMISTRY EDUCATION STUDENTS

Yard. Doç. Dr. A. Seda YÜCEL
Yard. Doç. Dr. Nilgün SEÇKEN
Prof. Dr. F. İnci MORGİL
Hacettepe Üniversitesi
Eğitim Fakültesi OFMA Bölümü Kimya Eğitimi Anabilim Dalı

Özet

Bu çalışma Hacettepe Üniversitesi Eğitim Fakültesi Kimya Eğitimi Anabilim dalında öğrenim gören öğrencilerin başarılarında etkisi olduğu düşünülen faktörleri saptamak amacıyla yapılan bir çalışmadır. Günümüzde kişilerin sosyo-ekonomik düzeyleri, hayatta belirli bir yere gelmelerinde ve başarılı olmalarında olumlu ya da olumsuz etkisi olan en önemli unsurlardan biridir. Kimya öğretmeni yetiştiren bu kurumlarda okuyan öğrencilerin **"akademik performansları"** olarak adlandırılan ve başarılarını etkileyen bu şartlar; öğrencilerin öğretmenlik mesleğinin gerektirdiği şekilde davranış gösterecek becerileri kazanmaları açısından kendilerine ve bu davranışların onlara kazandırılması açısından da, gerek eğitimciler gerekse yöneticiler tarafından, ciddiye alınması gereken unsurlardır. Çalışma, uygulanan anket sonuçlarının istatistiksel veriler haline dönüştürülerek değerlendirilmesi esasına dayanmaktadır. Çalışmada, akademik performansa etkisi olabileceği düşünülen 13 kriter saptanmış, yapılan istatistiksel çalışmalar sonunda bu kriterlerden üçünün istatistiksel açıdan anlamlı olduğu saptanmıştır.

Anahtar Kelimeler: İstatistiksel Değerlendirme, ekonomik performans, kimya eğitimi

Abstract

This study was carried out on students studying in the Chemistry Education Department of Hacettepe University, Faculty of Education in order to determine the factors, which are thought to influence the success of the students. The socio-economic level of an individual is one of the primary factors which has a significant effect upon the individuals status he or she reaches in the social system and influences his or her success in life. This study is based upon the evaluation of the questionnaire findings after converting them into statistical data. There were 13 criteria determined, which may effect the academic performance, and the statistical

evaluation revealed that only three criteria among these were statistically significant.

Keywords: The statistical evaluation, academic performance, chemistry education.

1-INTRODUCTION

Education is an activity to furnish the present generations with the necessary skills; knowledge and understanding improve their personalities to take place in the social life (Gagne, 1984). The goals of the education are stated as furnishing the individual with the skills, knowledge and behavior necessary for her /him to adapt the social life. The education is most effective if we have enough knowledge on not only the effects of school but also on the effects of outside-school media. A person acquires his/her behavior through his/her life. The acquirement of new behavior and replacement of the undesirable ones with the desirable ones are dependent upon the person's own life (Douglas, 1964). The life of a person is constituted by his/her family life, the social status of his/her family, the schools he/she has been educated in, the grades he/she obtains etc. in other words all his/her school and outside-school activities. These activities may not be dynamic and successful every time thus there may be both successful and unsuccessful students coming from a good background. The opposite of these cases is also possible. In other words the students find themselves in an entirely new medium when they come to the higher education stage no matter what sort of lives they might have had before. The university is a medium where the individual can make his/her own decisions and shape his/her personality. The academic performance is defined as the success of the individual in the university. This success effects both of his/her school and social lives. The economic and social levels of the people at the university stage have a very big influence upon the university they aim to enter and their future careers. The determination of the academic performances of the students studying in education institutes and the factors which effect their academic performance are of great importance as regards of the virtues our future teachers are supposed to have. The teacher candidates are supposed to possess the following virtues (Capel et all 1996):

1) Organizational planning and educational approach
2) Occupational professionalism
3) Social skills

The academic performance of the students and the factors affecting it, are of great importance in acquiring these virtues. We are in the opinion that

this study will be of great help for us to evaluate the mass of students who preferred Chemistry Education Department of the Educational faculties of the Turkish universities and clarification of their general situation

2-METHODOLOGY

This study concerns with the determination of the relation between the academic performance of the students and the socio-economic factors. This study aiming to determine the difficulties caused by the socio-economic factors for academic performance is an attempt to explain the interactions between various situations taking into account the relations between the present cases with those took place in the past (Kaptan, 1986).

Space and Sampling

The sampling was carried out among the final year students studying in the Chemistry Education Department of the Education faculty of Hacettepe University.

Data Collection

This study is based upon the data collected from the final year students studying in the Chemistry department of the Education faculty of Hacettepe University. The major factors considered to effect the academic performance were grouped into three groups and the questionnaire forms were prepared according to this grouping as follows:

a) Personal and family information
b) The data related to high school education
c) The information concerned with the university entrance.

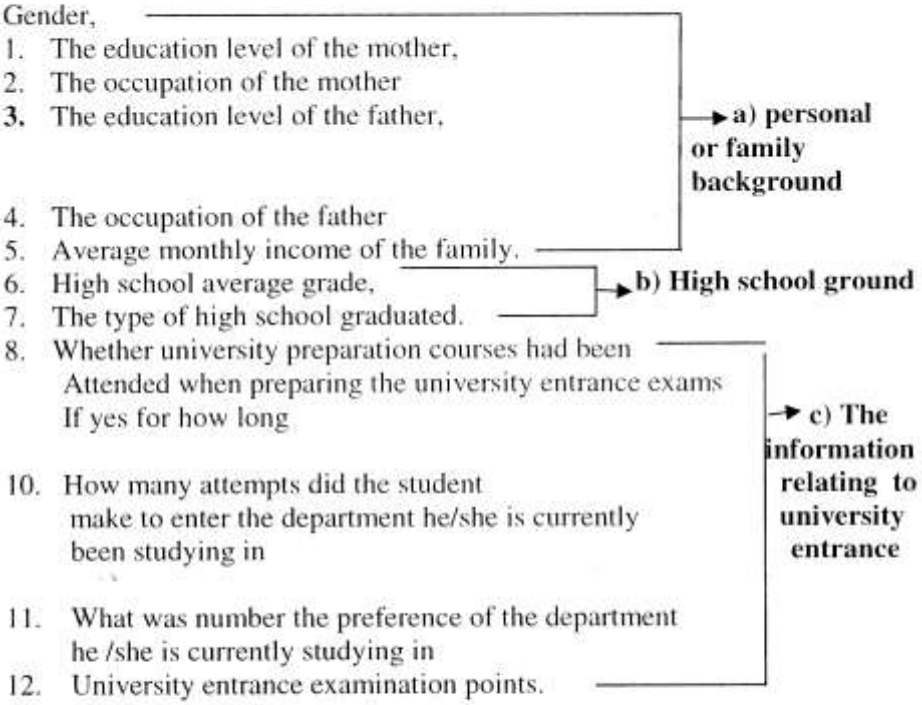
The factors, which are though to influence the academic performance, are the following.

Experts were consulted in order to ensure the applicability of this survey form

Evaluation of the data

Pearson moment's products coefficient technique was employed in order to determine the statistically significant relations between the factors stated above and the academic average, an indicator of the academic performance. The fact that whether the correlation coefficients obtained have levels significantly different than zero, was determined by the Anova test . In the cases when the F values obtained after the Anova test were significant,

Tukey test was employed in order to determine which groups have significant difference. The average grades of the students were obtained from the students department of the Hacettepe University and the data analyses were carried out by the use of Microsoft Excel (Akpınar, 1996).



3-FINDINGS

A. Correlation analysis of the results

The fact that whether there is any relation between two or more variables can only be determined by the correlation models (Neter at. all 1990). For instance in two previous studies the relations between the mean grade, an indicator of the academic performances, of the students of French (Alper, 1998) and English and German language (Alper,1990) teaching departments were determined by the use of these models . The value of the correlation coefficient is given as

$$r = \frac{S_{xy}}{\sqrt{S_{xx}}\sqrt{S_{yy}}}$$

Here S shows the variance the relation between x and y or the correlation, in order to obtain the result we need to know in n number of (x,y) set. The correlation coefficient defined in this equation changes between +1 and –1. The value of this coefficient shows us whether there is a linear relation between the sets. The closer the value of r to +1 the more positive is the relation. If the value of r is close the zero it indicates the relation between the x and y sets is very negligible. This study will be concerned with the correlation analysis between the two data sets as explained before.

- The results of the correlation analysis between the academic average grade, the indication of the academic performance and the personal and family background are tabulated in Table 1.

Table 1. The data obtained by the correlation analysis of the academic average, the major indication of the academic performance, and the factors relating to personal and family background of the students studying in the Chemistry Education Department

	Gender	Education level of the mother	Occupation of the mother	Education level of the father	Occupation of the father	Average monthly income of the family
Academic performance	-0.047	0.032	0.058	0.218	0.142	0.034
Sig. (2-Tailed) Academic performance	0.728	0.813	0.670	0.106	0.297	0.806

As a result of the correlation analysis between average grades of the students studying in the chemistry department and the gender, the education level of the mother and the average monthly income of the family, the correlation coefficients were observed to be close to zero. This indicates that the influence of these factors upon the academic performance is negligible. Similar results were observed in by Özgüven (1970). Although the educational level and the occupation of the father have higher influence upon the academic performance (close to unity) one cannot directly conclude that they have higher linear relations than the factors discussed above. The fact that whether these two factors cause any difference upon the academic performance has been tested by Anova analysis. The related data are tabulated in Table 4.

- The results of the correlation analysis in investigate whether the high school background has any effect upon the academic performance are given in Table 2.

Table 2. The correlation results of the high school background with the academic performance

	High school graduation grade	The type of the high school graduated
Academic performance	0.096	0.109
Sig. (2- Tailed) Academic performance	0.484	0.423

As seen from this table that the high school graduation grade of the student and the type of the high school graduated do not have a significantly linear relation with the academic performance. However the correlation value between the type of the high school graduated and the academic performance is much closer to unity. The fact that whether the relation is significant or not can only be explained by the Anova test (Table 4)

- The correlation data evaluating the university entrance points of the students are listed in Table 3.

Table 3. The correlation analysis data relating to entrance points of the students to the university

	Whether taken any university preparation courses when preparing the university	How long were the courses followed	The number of attempts before entering the current department	The number of the preference of the department being studied.	University entrance point
Academic performance	0.405**	0.308*	0.004	-0.001	0.479**
Sig. (2-Tailed) Academic performance	0.002	0.021	0.974	0.997	0.000

** Correlation is significant at the 0.01 level.
* Correlation is significant at the 0.05 level.

Table 3 reveals that there is a significant relation between attending the university preparation courses and the academic performance at the level of 0.01. In other words the academic performance of the students who had

taken such courses before the university entrance exam is higher than those who had not taken them. There is a highly significant positive correlation at 0.05 significance level between the period of attending these university preparation courses and the academic performance. However there found no linear correlation between the academic performance and the number of the preference or the number of attempts to enter the university. The correlation values of these data sets are close to zero. The most striking relation was obtained between the university entrance point and the academic performance. The students with the higher points are observed to have better academic performance. There is a quite a high correlation value between the university entrance points and the academic performance at the significance level of 0.01. These data were supported with the Anova test (Table 4).

A. Anova Analysis results

One-way variance analysis (One-way ANOVA) was performed in order to support the correlation data obtained and make it more objective. Anova test (Variance analysis) tests whether there is any difference between various hypotheses by comparing the mean values of two or more groups. The variance analysis can be single or multiple factored. One-way variance analysis tests whether there is any difference between the arithmetic means (μ_x, μ_y etc..) of the various groups (Akpınar, 1996). Then there are two hypothesis made about the difference between the groups. If H_1 hypothesis is accepted it is concluded that the arithmetic means are different, while the acceptance of H_0 hypothesis shows that the arithmetic means are the same. Table 4 lists the results of the variance analysis made in this study.

When one investigates Table 4 one can see that three factors have significant influence upon the academic performance.

- The first one is whether university preparation courses were attended before the university. There is a significant difference between the academic performances of the students who attended these university preparation courses compared with those students who did not. The academic averages of the students who declared to have gone the university preparation courses before the university was 2.46 and the average grade of the students who had not taken such courses was 1.70. Table 5 lists the correlation data between the academic performance and attending the university preparation courses.

Table 4. The results of the Anova analysis of the various sets of the students studying in Department of Chemistry Education and their academic performance.

ONE-WAY ANOVA		Sum of Squares	df	Mean Squares	F ratio	Sig.
1. Variable Gender	Between Groups	2.9E-02	1	2.9E-02	0.122	0.728
	Within Groups	12.887	54	2.9E-02		
	Total	12.916	55			
2. Variable The educational level of the mother	Between Groups	5.2E-02	3	1.7E-02	0.70	0.976
	Within Groups	12.864	52	0.247		
	Total	12.916	55			
3. Variable The occupation of the mother	Between Groups	9.8E-02	3	3.3E-02	0.132	0.941
	Within Groups	12.818	52	247		
	Total	12.916	55			
4. Variable The educational level of the father	Between Groups	0.632	3	0.211	0.892	0.452
	Within Groups	12.284	52	0.236		
	Total	12.916	55			
5. Variable The occupation of the father	Between Groups	0.809	4	0.202	0.852	0.449
	Within Groups	12.107	51	0.237		
	Total	12.916	55			
6. Variable The level of income	Between Groups	0.796	3	0.265	1.138	0.343
	Within Groups	12.121	52	0.233		
	Total	12.916	55			
7. Variable high school graduation grade	Between Groups	0.375	2	0.188	0.793	0.458
	Within Groups	12.541	53	0.237		
	Total	12.916	55			
8. Variable The type of the high school graduated	Between Groups	1.145	5	0.229	0.973	0.444
	Within Groups	11.771	50	0.235		
	Total	12.916	55			
9. Variable Whether attended and private tuition classes	Between Groups	2.117	1	2.117	10.59	0.002
	Within Groups	10.799	54	0.200		
	Total	12.916	55			
10. Variable The period of private tuition classes were attended	Between Groups	3.631	3	1.210	6.777	0.001
	Within Groups	9.285	52	0.179		
	Total	12.916	55			
11. Variable The number of attempts	Between Groups	0.615	3	0.205	0.867	0.464
	Within Groups	12.301	52	0.237		
	Total	12.916	55			
12. Variable The number of the preference	Between Groups	0.726	5	0.145	0.595	0.704
	Within Groups	12.190	50	0.244		
	Total	12.916	55			
13. Variable University entrance point	Between Groups	3.210	5	0.642	3.307	0.012
	Within Groups	9.706	50			
	Total	12.916	55			

Table 5. The change of the academic performance with attending university preparation courses

	N	Mean	Std. Deviation
Were university preparation courses attended?			
Yes	52	2.460	0.4317
No	4	1.705	0.6566
Total	56	2.406	0.4846

• The second factor, which has an important effect upon the academic performance, is the period of the university preparation courses attended. The resulting data lead us to accept a hypothesis that the academic performance is dependent upon the period that these university preparation courses were attended. There is a significant difference between the academic performance of the students who never attended such courses whatsoever and those who attended these courses for a period of two and three years. The change of the academic performance with the period of university preparation courses is shown in Table 6.

Table 6. The change of the academic performance with the period of university preparation courses

	N	Mean	Std. Deviation
The period of attendance			
Not attended	2	1.180	0.381
For one year	24	2.368	0.351
For two years	27	2.546	0.486
For three years	3	2.267	0.271
Total	56	2.406	0.484

The Tukey test revealed that this difference was mainly caused by those who never followed any university preparation courses. The academic averages of these students are much lower than those who attended these sorts of courses for one two or three years. Table 7 shows the results obtained after the Tukey test.

- The third factor which influences the academic performance is the grades they obtained from the university entrance exam. In order to determine the way in which the university entrance grades effect the academic performance, first the change of the academic performance with the range of the university entrance grades was examined. Table 8 shows the way, which the academic performance changes with the university entrance points.

Table 7. Tukey test results showing the relation between attending the university preparation courses and the academic performance.

(I) The period of attending university preparation courses	(J) The period of attending university preparation courses	Mean Difference (I-J)	Std. Error	Sign.	95% Confidence Interval	
					Lower Bound	Upper Bound
0.0	0.00	-1.1879*	0.311	0.002	-2.0134	-0.3625
	1.00	-1.3663	0.310	0.000	-2.1882	-0.5444
	3.00	-1.0867	0.386	0.034	-2.1105	-6E-02
1.0	0.00	1.1879	0.311	0.002	0.3625	2.0134
	2.00	-0.1784	0.119	0.442	-0.4930	0.1363
	3.00	0.1012	0.259	0.979	-0.5856	0.7881
2.0	0.00	1.3663*	0.310	0.000	0.5444	2.1882
	1.00	0.1784	0.119	0.442	-0.1363	0.4930
	3.00	0.2796	0.257	0.699	-0.4029	0.9622
3.0	0.00	1.0867*	0.386	0.034	6.3E-02	2.1105
	1.00	-0.1012	0.259	0.979	-0.7881	0.5856
	2.00	-0.2796	0.257	0.699	-0.9622	0.4029

Table 8. The change of the average academic performance with the university exam grades

	N	Mean	Std. Deviation
Range of university exam grades			
1(400-420)	5	2.004	0.454
2(421-435)	6	2.052	0.592
3(436-450)	21	2.371	0.335
4(451-470)	11	2.433	0.556
5(471-480)	8	2.758	0.408
6(481-)	5	2.760	0.398
Total	56	2.406	0.485

The hypothesis of **"academic performances taken from six different student sets are different from each other"** has to be accepted since the F value of Anova analysis for university exam results is 3.307 and the critical F value is bigger than 2.37 (the results are tabulated in Table 4). The fact that the result obtained from the F test is significant shows that the average academic performance between at least two groups is significantly different. The results of the Tukey test carried out to determine which group shows the most significant difference among them are given in Table 9

Table 9. The results of the Tukey test in order to determine the group, which causes the difference.

(II) Univ. entr. Grade.	(J) Univ. entr. Grade	Mean Difference (I-J)	Std. Error	Sign.	95 % Confidence Interval	
					Lower Bound	Upper Bound
1.0	2.00	-4.77E-02	0.267	1.000	-0.8382	0.742
	3.00	-0.3670	0.219	0.555	-1.016	0.282
	4.00	-0.4287	0.238	0.472	-1.0132	0.275
	5.00	-0.7535*	0.251	0.046	-1.497	-9E-03
	6.00	-0.7560*	0.279	0.090	-1.581	7E-02
2.0	1.00	4.77E-02	0.267	1.000	-0.742	0.838
	3.00	-0.3193	0.204	0.624	-0.923	0.285
	4.00	-0.3811	0.224	0.536	-1.043	0.281
	5.00	-0.7058*	0.238	0.050	-1.410	-8E-04
	6.00	-0.7083*	0.267	0.103	-1.498	82E-02
3.0	1.00	0.3670	0.219	0.555	-0.282	1.016
	2.00	0.3193	0.204	0.624	-0.285	0.923
	4.00	-6.18E-02	0.164	0.999	-0.547	0.424
	5.00	-0.3865	0.183	0.298	-0.929	0.155
	6.00	-0.3890	0.219	0.491	-1.038	0.260
4.0	1.00	0.4287	0.238	0.472	-0.275	1.132
	2.00	0.3811	0.224	0.536	-0.281	1.043
	3.00	6.18E-02	0.164	0.999	-0.424	0.547
	5.00	-0.3248	0.205	0.611	-0.931	0.281
	6.00	-0.3273	0.238	0.740	-1.031	0.376
5.0	1.00	0.7535*	0.251	0.046	9.2E-03	1.497
	2.00	0.7058*	0.238	0.050	7.7E-04	1.410
	3.00	0.3865	0.183	0.298	-0.155	0.929
	4.00	0.3248	0.205	0.611	-0.281	0.931
	6.00	-2.5E-03	0.251	1.000	-0.746	0.741
6.0	1.00	0.7560*	0.279	0.090	-7E-02	1.581
	2.00	0.7083*	0.267	0.103	-8E-02	1.498
	3.00	0.3890	0.219	0.491	-0.260	1.038
	4.00	0.3273	0.238	0.740	-0.376	1.031
	5.00	2.5E-03	0.251	1.000	-0.741	0.746

*The Mean difference significant at the 0.05 levels

As seen from Table 9 there observed significant differences between the students at 1. and 2.grade ranges compared with those at 5. And 6 grade ranges, at 0.05 significance level. This can be attributed to the facts that the students at 5^{th} and 6^{th} levels were much more successful in the university exam compared with those at 1^{st} and 2^{nd} levels and they choose the departments they are currently study in much more willing and conscious way.

4-RESULTS AND DISCUSSION

The institutions which educate teachers for the secondary schools and the high schools (or lycees) are the education faculties. There are 2500 students in

12 education faculties currently present in Turkey today (İvme ve Zafer Dershaneleri Rehber Kitapçıkları 2000-2001). There are 230 students in the Hacettepe University, department of Chemistry, Faculty of EDUCATION, which constitute the working space of this research. The socio-economic criteria, which influence the academic performance of the students, were determined after through examination of the socio economic conditions of the students. Table 1 indicates that the positive correlation between the occupation and the education of the father and the academic performance is much higher than the occupation and the education of the mother. However the Anova analysis carried out for these four data groups revealed that there were not significant differences between the academic performances of the students whose mothers and fathers are in different occupational categories. The personal and parental criteria covering the monthly average income of the family also affect the academic performance of the students. Özgüven (1970) made a similar study upon a different department between 1968-1969. He investigated the effects of university entrance exam and non-intellectual factors upon the academic performance and deduced that the parental structure did not have any effect upon it. This result is in good compliance with our findings.

It is very natural that the academic performance of the students in a certain department is quite similar since the students accepted there are selected from those who obtained similar marks from the university entrance exam. Therefore the university entrance points of the students are quite similar irrespective of their high school grades or the type of high school they were graduated from. In other words the high school performance and the type of the high school graduated do not have any effect upon the academic performance. The analysis supports this fact. However Özgüven (1970) found significant relations between the academic performance of the students and their pre university education. He emphasized that there was a significant relation between the academic performance and high school performance of the students. These results contradict with our findings. The issue of entrance to the university is a problem which concern a wide section of the society .The increase in the population and number of schools in Turkey, increases the number of students graduating from high schools (Yücel, 1993).

It became almost a must for the students to attend secondary educational institutes sole aim of which is preparing the students to the university entrance exam and the students begin to feel obliged to attend these university preparation courses in order to enter the faculty they desire. Almost all the children of the people who have high level of income follow these courses. The families, which have much, lower incomes also try very hard to send their children to these courses. ***These secondary university preparation courses are***

much more successful in giving the students the virtues of regular studying, being organized and practical thinking compared with diploma giving high schools as well as preparing the student to the university entrance exam (Özel Dershaneler Birliği Dergisi, 1999). It is natural that the academic performance of the students who attend these courses before the university is much higher than the others. These statistical calculations reveal that there is a difference between the academic performances of the students who attend these courses than those who do not at the significance level of 0.05. The period of attending these courses is also effective on the academic performance. There are significant differences between the academic performances of the students who attended these courses 0 to 3 years (Table 4). The difference is caused by those who did not attend these courses at all who take the lowest level of academic performance. Thus the attendance of the students to these university preparation courses and the period of attendance have positive affect upon their academic performance. These results are not surprising under conditions of Turkey. Our study completely supports it. Some students prepare the university entrance exams by taking private tuition. There are so many students who follow 2nd and 3rd years of the high school taking private tuition and attend university preparation courses at the same time. One of the questions asked in the survey form is the university entrance exam grade. It was found that this grade has a direct influence upon the performance of the students as a result of correlation analysis and Anova test. The correlation of 0.479 obtained between the academic performance and the university entrance grade show that the higher the university entrance grades the better the academic performance. The number of attempts at the university entrance and the number of the choice of the current faculty do not effect the academic performance. This is an unexpected case. The fact that the students prefer their current departments as their top choices means that they have positive attitudes and expectations from them. This is supposed to increase the academic performance. However the strict rules of ÖSYM when making the choices of universities and the people entering a certain faculty have similar grades and expectations, decrease the influence of these factors upon the academic performance.

REFERENCES

Akpınar, H. (1996). Functions, Data Analysis and Problem Solving in EXCEL. İstanbul University, Faculty of Management.

Alper, A. (1998). "An Investigation of Some Factors Students' Performance in the Teaching of French Language through Statistical Methods" Gazi University, Journal of the Faculty of Education, Vol. 18, 2, 73-82.

Alper, A. (1990). "An Investigation of Some Factors Students' Performance in the Teaching of English and German Language through Statistical Methods" Gazi University, Journal of the Faculty of Education, Vol. 20, 1,127-144.

Brown, W. and Thornton, W. (1965). "Higher Education" Translated by Oğuzkan, F., Akgün, A., Uysal, Ş., Ministry of National Education Press.
Capel. S. (1996). "Learning to Teach in the Secondary School. Companion to School Experience" Routledge 11. New Fetter Lane. London.
Douglas, R. H. (1964). "The High School Curriculum" Third Edition, The Ronald Press Company.
Gagne, N. L. and Berliner, D.C. (1984). "Educational Psychology" Third Edition, Boston: Houghton Miffin Company.
İvme Fen Dershanesi Kitapçığı, 2000-2001 Guide Book.
Journal of the Union of Private Schools. (1999).
Kaptan, S. (1986). "Research Methods and Statistical Techniques"Ankara: Olgaç Printing Office.
Neter, J., Kutner, M. H., Nachtsheim, C. J. and W. Wasserman (1990). Applied Linear Statistik Models, Irwin Chicago.
ÖSYM, (2000). Guide Book of Students for ÖSS.
Özgüven, İ. E. (1970). "Affective Factors and Achievement of Undergraduate Students" Unpublished PhD Dissertation. Hacettepe University, Ankara.
Yücel, A. S. (1993) "Studies to Improve Chemistry Training in Turkey." Unpublished MSc Thesis. Hacettepe University.
Zafer Dershanesi 2000-2001. Guide Book.

Yazışma Adresleri
Yard. Doç. Dr. A. Seda YÜCEL
Tel:0-312-297 67 83
Fax: 0-312-297 86 03
aseda@hacettepe.edu.tr

Yard. Doç. Dr. Nilgün SEÇKEN
Tel:0-312-297 67 46
Fax: 0-312-297 86 03
nsecken@hotmail.com

Prof. Dr. F. İnci MORGİL
Tel:0-312-2978618
inci@hacettepe.edu.tr