THE IMPACT OF HIGH SCHOOLS OUTPUTS ON STUDENTS ACHIEVEMENT IN THE COLLEGE OF SCIENCES AT AL-HUSSEIN BIN TALAL UNIVERSITY

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Abstract: The purpose of this study is to examine the effects of the high school outputs on the students' achievement in the College of Sciences at Al-Hussein Bin Talal University. Since students' achievement is correlated with all major educational elements such as students, instructors, university administration, supervision, school administration, and other more, two elements are discussed in this study. These two elements are the high school students' achievements and the time of graduation. The sample of this study is applied on the 324 students of the College of Sciences at Al-Hussein Bin Talal students who attended the college on the academic years of 2004/2005, 2005/2006, 2006/2007, and 2007/2008; and those who graduated on the academic years 2007/2008, 2008/2009, 2009/2010, and 2010/2011. The first finding of the study is that students' College GPAs depend on their GPAs in high school and GPAs in their College freshman year? Another finding is also indicates that the students achievement in the College differs according to different high schools and different students' batches. Evidence is also found of the interaction between high schools and the time of graduation. Finally, the time factor is significantly associated with changes of students' attitude toward education and their vision toward future.

1. Introduction

The paper is aimed at examining the effects of the high school outputs on the students' achievement in the College of Sciences at Al-Hussein Bin Talal University. Students' achievement correlates to all major educational elements that include: Student, instructor, university administration, supervision, school administration, and other more. In spite of the many elements that affect students' achievement, two specific elements are believed to be the most important ones in this occasion. The first element is the high school students' achievements which are impacted by all the variations of teachers' abilities and quality, school administration, and its geographical location. These issues are believed to be an effect on the current and future student's achievement. The second element is the time of graduation from the College which reflects the change of human behavior on all levels of students. This would include educational practices where thinking levels and the ability of students may differ over time and cultural interests and future vision may differ, as well.

The sample of this study is applied on the 324 students of the College of Sciences at Al-Hussein Bin Talal students who attended the college on the academic years of 2004/2005, 2005/2006, 2006/2007, and 2007/2008; and those who graduated on the academic years 2007/2008, 2008/2009, 2009/2010, and 2010/2011. It should be indicated that those students were coming from different high school levels across geographic locations in Jordan which covers the 12 governorates in Jordan. The reason of choosing this sample is the direct influence of this College's graduates on the educational, economical, and social aspects of the community. Another reason of choosing this sample is the long time work experience of the current researcher at this College who noticed that students' achievement is declining.

The study is aimed at answering the following questions: (1) Does graduate students' GPAs depend on their GPAs in high school and GPAs in their College freshman year? (2) Does the College graduates' achievement differ according to different high schools? (This question is tested by parallelism hypothesis of high schools achievement), (3) Does the time factor has any effect in changing students' attitude toward education and their vision toward future? (This question is tested by parallelism hypothesis of the students' achievement across batches), (4) Does the College graduates' achievement differ according to dif-

ferent high schools and different batches? (This question tests the interaction between time and high school). The answers of these questions are found in Linear Regression Analysis, Profile Analysis, and Two-Way Multivariate Analysis of Variance ($MANOVA$) in this study.

Findings of this study are shown as follows: The first finding is that the level of academic achievement of the graduated students depends significantly upon the average of their grades achieved in the high school and upon their average in the first year of the University. The second finding is that the levels of the academic achievement of students are significantly different from high school to another and from batch of students to another. The time element has a strong effect on changing in the students' preferences and their future vision.

The remainder of this study is structured as follows: in Section 2, the methodology issues are discussed. In Section 3, the applied issues are reported by the results of the study. The last section is the conclusion and remarks.

2. Methodology

2.1. Linear Regression Analysis

Regression analysis is the statistical methodology for predicting values of one or more response (dependent) variables from a collection of predictor (independent) variables values. It can also be used for assessing the effects of the predictor variables on the responses.

Let $X_1, X_2, \cdots, X_p$ be p predictor variables thought to be related to a response variable Y, then the linear regression model with a single response which takes the following form:

$$Y = X\beta + u \cdots, \tag{1}$$

where:

$Y : (n \ x \ 1)$ Vector represents the response variable for n observations.

$X : (n \ x \ p)$ Matrix represents the independent variables for n observations.

$\beta : (p \ x \ 1)$ Vector represents the parameters of the model.

$U : (n \ x \ 1)$ Vector represents the random error terms assumed to be uncorrelated, and $E(u) = 0, cov(u) = E(uu') = \sigma^2 I$.

The least squares estimator of β in model (1) is:

$$\widehat{\beta} = (X'X)^{-1}X'Y \cdots \tag{2}$$

To test the hypothesis:$H_0 : \beta = 0$, we compute the following statistics:

$$F = \frac{\widehat{\beta}' X' X \widehat{\beta}/p}{\left(Y'Y - \widehat{\beta}' X' X \beta\right)/(n-p)}. \tag{3}$$

The test statistics in (3) has the F-**distribution** with p and $n-p$ degrees of freedom. We reject H_0 with a test of level α if: $F > F_\alpha(p, n-p)$.

In this analysis, the study also uses the structural change test of Chow (1960). The classical linear regression model (1) assumes that the parameters are the same for all observations. In order to test this crucial hypothesis, the sample is split in say k sub samples of sizes $n_1, n_2, \cdots, n_k$, respectively, with $n = \sum_{i=1}^{k} n_i$ and $n_i > p$, where the parameters are allowed to be different across sub samples. For each sub sample **i** we can write the model in matrix form as:

$$Y_i = X_i \beta_i + u_i, \quad i = 1, 2, \cdots, k. \tag{4}$$

And stacking all these equations yields the unrestricted model:

$$\begin{pmatrix} Y_1 \\ Y_2 \\ \vdots \\ Y_k \end{pmatrix} = \begin{pmatrix} X_1 & & & 0 \\ & X_2 & & \\ & & \ddots & \\ 0 & & & X_k \end{pmatrix} \begin{pmatrix} \beta_1 \\ \beta_2 \\ \vdots \\ \beta_k \end{pmatrix} + \begin{pmatrix} u_1 \\ u_2 \\ \vdots \\ u_k \end{pmatrix}. \tag{5}$$

Note that the total number of parameters is (kp). It is not difficult to verify that the least squares estimators $\widehat{\beta}_i$ of the parameter vectors β_i are:

$$\widehat{\beta}_i = (X_i' X_i)^{-1} X_i' Y_i, \tag{6}$$

and that the $RSS_u = \sum_{i=1}^{k} RSS_i$ of model (5) is just the sum of the residuals sums of squares RSS_i of the regression (4).

The null hypothesis that model (4) is correct corresponds to the set of hypotheses:

$$H_0 : \begin{array}{ccc} \beta_1 & = & \beta_2 \\ \beta_2 & = & \beta_3 \\ \vdots & \vdots & \vdots \\ \beta_{k-1} & = & \beta_k \end{array}. \tag{7}$$

Hence the total number of restrictions is $(K-1) \, xP$, therefore the chow test

of the hypothesis (8) is:

$$W_p = \frac{(RSS - \sum_{i=1}^{k} RSS_i)/(k-1)p}{(\sum_{i=1}^{k} RSS_i/(n-kp)}.$$ (8)

Here RSS is the residual sum of squares of the restricted model (1). Under the null hypothesis involved this W_p statistics is $F[(K-1)p, \ (n-Kp)]$ distributed. We reject H_0 with a test of level α if $W_p > F_\alpha[(K-1)p, (n-Kp)]$.

2.2. Profile Analysis

Profile analysis is the multivariate equivalent of repeated measures or mixed ANOVA. Profile analysis is most commonly used in two cases:

1. Comparing the same dependent variables between groups over several times – points or observations.

2. When there are several measures of the same dependent variable.

Suppose that p commensurable responses have been collected from independent sampling units grouped according to k treatments. The observations are arranged as in Table 1.

Let the model for the ith observation on the kth response under treatment (**group**) **j** is:

$$X_{ijh} = \mu_{jh} + e_{ijh} , i = 1, 2, ..., N_j; j = 1, 2, ..., k; \ h = 1, 2, ..., p,$$ (9)

where: X_{ijh}: the parameter matrix of order $(k \ x \ p)$, e_{ijh}: the vector of residuals $e'_{ij} = [e_{ij1}, \ \cdots, \ e_{ijp}]$ of the ij**th** sampling unit has the multi-normal distribution with null mean vector and some unknown nonsingular covariance matrix $\sum$.

The profile analysis provides tests of the three profile hypotheses of parallelism of the treatment mean profiles, equal treatment levels, and equal response means.

a) The parallelism hypothesis of the treatment mean profiles

$$H_{oa} : C_1 \mu M_1 = 0.$$

Treatment	Response			Unite Total
	1	$\cdots$	P	
1	X_{111}	$\cdots$	X_{11P}	R_{11}
	$\cdots$	$\cdots$	$\cdots$	$\cdots$
	X_{N_111}	$\cdots$	X_{N_11P}	R_{N_11}
Total	T_{11}	$\cdots$	T_{1P}	C_1
$\cdots$	$\cdots$	$\cdots$	$\cdots$	$\cdots$
K	X_{1K1}	$\cdots$	X_{1KP}	R_{1K}
	$\cdots$	$\cdots$	$\cdots$	$\cdots$
	X_{N_KK1}	$\cdots$	X_{N_KKP}	R_{N_KK}
Total	T_{K1}	$\cdots$	T_{KP}	C_K
Grand Total	G_1	$\cdots$	G_P	G

Table 1: Profile Observations

Here:

$$C_1 = \begin{pmatrix} 1 & -1 & 0 & \cdots & 0 \\ 0 & 1 & -1 & \cdots & 0 \\ & & \vdots & & \\ 0 & 0 & 0 & \cdots & -1 \end{pmatrix}, \quad M_1 = \begin{pmatrix} 1 & 0 & \cdots & 0 \\ -1 & 1 & \cdots & 0 \\ 0 & 1 & \cdots & 0 \\ 0 & -1 & \cdots & 0 \\ 0 & 0 & \cdots & -1 \end{pmatrix} \quad (10)$$

There are $(k-1)xk$ and $px(p-1)$ cases of the transformation matrix.

The test of H_{oa} amounts to a one-way multivariate analysis of variance on the $(p-1)$ differences of the observations of the adjacent responses from each sampling unit. It can be carried out in the fashion by post-multiplying the data matrix by M_1 and computing the matrices H and E which their rs**th** elements will be found to be:

$$\begin{cases} h_{rs} = \sum_{j=1}^{k} \frac{1}{N_j} T_{jr} T_{js} - \frac{1}{N} G_r G_s \\ e_{rs} = \sum_{j=1}^{k} \sum_{i=1}^{N_j} X_{ijr} X_{ijs} - \sum_{j=1}^{k} \frac{1}{N_j} T_{jr} T_{js}, \end{cases} \quad (11)$$

where $X_{ijr} = i$th observation on response r under treatment j,

$T_{jr} = \sum_{i=1}^{Nj} X_{ijr} =$ Sum of all observations on rth response in presence of treatment j,

$G_r = \sum_{j=1}^{k} T_{jr} =$ Grand total of all observations on rth response,

$$N = N_1 + N_2 + \dots \dots \dots + X_k.$$

To test the parallelism hypothesis H_{oa}, first we calculate the characteristic roots (eigenvalues) λ_i of HE^{-1}, and then one of the following multivariate test statistics can be used:

1. Wilks' lambda statistics: $\Lambda = \frac{|E|}{|H+E|}$, which is equivalent to the likelihood ratio test.

2. Lawley – Hotelling Trace statistic: $T_0^2 = tr\left[HE^{-1}\right]$.

3. Pillai Trace: $V = tr\left[H(H+E)^{-1}\right]$.

4. Roy's largest root statistic = maximum eigenvalue of $E(H+E)^{-1} = \theta_s = \frac{\lambda_s}{1+\lambda_s}$. Where λ_s is the greatest characteristic root of HE^{-1}.

b) The hypothesis of equal treatment effects, $Hob : C_1 \mu m_2 = 0$, where C_1 is the first matrix of (10) and $m_2' = [1, \cdots , 1]$ contains P ones.

The test of equal treatment effects is carried out by a one-way univariate analysis of variance on the sums of the responses of each sampling unit across the k treatment group's. It is usually more efficient to make the transformation:

$$R = Xm_2, \tag{12}$$

to the row sums of Table 1 at the outset and carry out the test as an analysis of variance on the response totals.

Since:

$$R_{ij} = \sum_{h=1}^{p} X_{ijh}, \tag{13}$$

is the total for the ith unit in the jth treatment group. Then the statistics for the generalized likelihood – ratio test of H_{ob} is:

$$F = \frac{N-K}{N-1} \cdot \frac{SST}{SSE}, \tag{14}$$

where:

$$\begin{cases} SST = \sum_{j=1}^{k} \frac{1}{N_j} C_j^2 - \frac{1}{N} \left(\sum_{j=1}^{k} C_j\right)^2 \\ SSE = \sum_{j=1}^{k} \sum_{i=1}^{N_j} R_{ij}^2 - \sum_{j=1}^{k} \frac{1}{N_j} C_j^2 \\ C_j = \sum_{i=1}^{N_j} R_{ij}, \end{cases} \tag{15}$$

H_{ob} is accepted at the α level if $F \le F_\alpha(K-1, N-K)$.

c) The hypothesis of equal response effects.

As in the preceding test it will be assumed that the parallelism, or interaction, hypothesis is tenable. Then the hypothesis can be stated in matrix form as: $Hoc : C_2' \mu m_1 = 0$, where: $C_2' = [1, 1, \cdots , 1]$ contains k ones, and M_1 is the

$px(p-1)$ matrix defined in (10). The test of equal response effects H_{oc} can be carried out by the Hotelling T^2 statistics as:

$$T^2 = N\bar{X}' M_1 \left[M_1' S M_1\right]^{-1} M_1' \bar{X}. \tag{16}$$

$\bar{X}$ is the grand mean vector with hth element $\bar{X}_h = G_h/N$, and $S = E/(N-K)$ is the usual $(p \ x \ p)$ within-treatments sample covariance matrix. When H_{oc} is true,

$$F = \frac{N-K-P+2}{(N-K)(P-1)} T^2 \tag{17}$$

has the F distribution with degrees of freedom $(p-1)$ and $(N-K-P+2)$, and we would accept the hypothesis of equal response effects at the α level if $F \le F_\alpha(p-1, N-k-P+2)$.

If the hypothesis of parallel-treatment population profiles cannot be accepted, it will be necessary to test the equality of the treatment effects separately for each response by p univariate analysis of variance.

2.3. Two-Way Multivariate Analysis of Variance (MANOVA)

The two-way analysis of variance on p responses with n independent observation vectors in each combination can be presented as follows:

Let

$$X_{ijkh} \ (i = 1, 2, ..., r; \ j = 1, 2, ..., c; \ k = 1, 2, ..., n; \ h = 1, 2, ..., p),$$

denote the kth observation on the hth response obtained under the ith treatment of the first (or row) way of classification and the jth treatment of the second (or column) set. We let:

$$X_{ijk}' = (X_{ijk1}, \cdots, \ X_{ijkp}). \tag{18}$$

The data obtained from a two-way design with r rows and c columns can be arranged according to Table 2.

The linear model for the general observation is

$$X_{ijkh} = \mu_h + \alpha_{ih} + \tau_{ijh} + \eta_{ijh} + e_{ijkh}, \tag{19}$$

where:
μ_h = general-level parameter of hth response,
α_{ih} = effect of ith row treatment on h^{th} response,
τ_{ijh} = effect of jth column treatment on h^{th} response,

Row treatments	Column treatments		
	1	$\cdots$	C
1	X'_{111} $\vdots$ X'_{11n}	$\cdots$	X'_{1c1} $\vdots$ X'_{1cn}
$\cdots$	$\cdots$	$\cdots$	$\cdots$
r	X'_{r11} $\vdots$ X'_{r1n}	$\cdots$	X'_{rc1} $\vdots$ X'_{rcn}

Table 2: Observations from the two-way layout

η_{ijh} = effect of interaction of ith and j^{th} treatment on h^{th} response,
e_{ijkh}= usual multi-normal random variable term.

The procedure for this analysis begins by defining the following totals of the observations on each response:

1. Cells: $C_{ijk} = \sum_{k=1}^{n} X_{ijkh}$,

2. Column treatments: $T_{jh} = \sum_{i=1}^{r} \sum_{k=1}^{n} X_{ijkh}$,

3. Row treatments: $R_{ih} = \sum_{j=1}^{c} \sum_{k=1}^{n} X_{ijkh}$,

4. Grand total: $G_h = \sum_{i=1}^{r} \sum_{j=1}^{c} \sum_{k=1}^{n} X_{ijkh}$.

These totals are computed for all combinations of the treatment and response subscripts. Then the matrices of error and hypotheses sums of squares and products are computed as in Table 3, $u, v = 1, \cdots, p$.

For each of the five matrices, for the tests of three hypotheses of: no row effects, no column effects, and no interaction effects, it is first necessary to invert E and then to form the products:

$$H_1 E^{-1}, \ H_2 E^{-1}, \ H_3 E^{-1}.$$

From these the greatest characteristic roots $\lambda_{1s}, \lambda_{2s}, \lambda_{3s}$ are extracted and their statistics $\theta_{is} = \lambda_{is}/(1 + \lambda_{is})$ referred to the Heck Charts.

Source	Sums of squares and products	
	Matrix	General element
Row treatments	H_1	$h_{1uv} = \frac{1}{cn} \sum_{i=1}^{r} R_{iu} R_{iv} - \frac{G_u G_v}{rcn}$
Column treatments	H_2	$h_{2uv} = \frac{1}{rn} \sum_{j=1}^{c} T_{ju} T_{jv} - \frac{G_u G_v}{rcn}$
Interaction	H_3	$h_{3uv} = t_{uv} - h_{1uv} - h_{2uv} - e_{uv}$
Error	E	$e_{uv} = \sum_{i=1}^{r} \sum_{j=1}^{c} \sum_{k=1}^{n} X_{ijku} X_{ijkv} - \frac{1}{n} \sum_{i=1}^{r} \sum_{j=1}^{c} C_{iju} C_{ijv}$
Total	T	$t_{uv} = \sum_{i=1}^{r} \sum_{j=1}^{c} \sum_{k=1}^{n} X_{ijku} X_{ijkv} - \frac{G_u G_v}{rcn}$

Table 3: Matrix elements for the two-way analysis of variance

3. Application Section

This section discusses the sample study and the statistical analysis for the hypotheses tested. These hypotheses depend on the statistical techniques used in the previous sections (2.1, 2.2, and 2.3), which concentrate on high schools, time elements and how those two elements interact with each other.

3.1. The Organization of Data

The sample study involves students' who began their study in the College of Sciences at Al-Hussein Bin Talal University (AHU) in the academic years 2004/2005, 2005/2006, 2006/2007 and 2007/2008 respectively. In addition, it involves 324 students who came from different high schools from 12 Jordanian governorates. Table 4 explains the number of students' who engaged in their bachelor degree studies in the College of Sciences at AHU. It shows the distribution of those students' in terms of the high schools in their governorates, where they graduated from and the year of entry to the university.

The following variables and measures are reported for every student (male or female), whose involved in this study:

X_1: The average of student grades in the high school certificate.

X_2: The average of student grades in the first year at the university.

X_3: The average of student grades in the graduation year from the university. It involves his/her average of grades in the last two stages at university (the third and the fourth year).

We collect all of the data from personal files existed in the admission and register unit at AHU.

Governorates High school / Academic years	Irbid 1	Mafraq 2	Jarash 3	Ajloun 4	Amman 5	Balqa 6	Zarqa 7	Madaba 8	Karak 10	Tafilah 11	Ma'an 12	Aqaba 13	Total
2004/2005	6	4	4	2	6	4	4	6	5	10	10	5	66
2005/2006	5	5	5	5	4	4	5	8	10	8	12	8	79
2006/2007	6	8	8	4	6	7	7	5	7	9	12	6	85
2007/2009	7	5	4	9	6	8	10	8	6	6	15	10	94
Total	24	22	21	20	22	23	26	27	28	33	49	29	324

Table 4: The number of accepted students in the college of sciences distributed according to their governorate high schools and the year of entering the college

3.2. Statistical Analysis

The sample study is divided into 12 groups, every group represents the high schools for every governorate and for every student either male or female from these governorates, depends upon the classification reported in Table 4, the data has been managed to generate the variables X_1, X_2 and X_3.

Depending on the statistical techniques used in this study (in Sections 2.1, 2.2 and 2.3), the researcher will perform the suitable statistical analysis which answers the basic questions in the study. The statistical analysis focus on the main elements of the study, which are the high school, the time of graduation, the interaction between the high school and the time of graduation. The statistical analysis is explained as follows:

Firstly: The high school element

In terms of the regression technique, a multiple linear regression model is built for every group of the 12 groups of high schools as follows:

$$X_3 = \alpha + \beta_1 X_1 + \beta_2 X_2 + u. \tag{20}$$

The empirical results of model (20) are shown in Table 5.

j	N_j	Estimated model for each group of high schools	F_j
1	24	$X_3 = 7.1 + 0.63X_1 + 0.25X_2$	3.95
2	22	$X_3 = 14.1 + 0.23X_1 + 0.47X_2$	8.43
3	21	$X_3 = 13.8 + 0.22X_1 + 0.44X_2$	8.85
4	20	$X_3 = 6.9 + 0.62X_1 + 0.17X_2$	4.22
5	22	$X_3 = 13.9 + 0.26X_1 + 0.53X_2$	7.33
6	23	$X_3 = 5.8 + 0.67X_1 + 0.21X_2$	4.63
7	26	$X_3 = 15.5 + 0.15X_1 + 0.53X_2$	10.31
8	27	$X_3 = 60.1 - 0.26X_1 + 0.38X_2$	5.78
9	28	$X_3 = 61.3 - 0.21X_1 + 0.30X_2$	6.28
10	33	$X_3 = 93.1 - 0.58X_1 + 0.39X_2$	5.74
11	49	$X_3 = -59.9 + 1.15X_1 + 0.30X_2$	13.40
12	29	$X_3 = 22.3 + 1.18X_1 + 0.42X_2$	14.52

Table 5: The multiple linear regression models for each group of high schools

Table 5 shows that there is a significant evidence for all the estimated models, indicating that all of the 12 groups of high schools play a significant and a positive role in affecting the academic achievements of graduators from the college of sciences.

To compare the schools across the 12 groups of schools, for the purpose of determining whether the effect of these 12 groups of high schools were equals on the level of academic achievements of the students, the hypothesis number 7 is tested by using Chow test, which is specified in form number 8.

The result of this test is:

$$W_p = 61.22 \, (w_p > F_{0.01}(22, 300)) \,.$$

Therefore, the null hypothesis is rejected, indicating that it is more likely that there are significant differences between some of the 12 groups of high schools, which reflect the difference between students' in terms of their level of achievement across different schools.

The profile analysis technique has been used on the 12 groups of high schools ($K = 12$) to treat every group independently from other groups in terms of the three responses ($p = 3$) which are: X_1, X_2 and X_3. The results of testing the hypotheses H_{oa}, H_{ob} and H_{oc} are:

a. The parallelism hypothesis of the treatment(group) mean profiles; H_{Oa} : $C_1 \mu \, M_1 = 0$.

To test the parallelism hypothesis H_{Oa}, first we compute the matrices H and E, which their rs^{th} elements defined in Equation (11), a computer calculation yields:

$$H = \begin{pmatrix} 857.25 & -331.39 \\ & 450.55 \end{pmatrix}, \qquad E = \begin{pmatrix} 14343.72 & 8910.82 \\ & 18367.37 \end{pmatrix}.$$

And the characteristic roots of HE^{-1} are $\lambda_1 = 0.164$ and $\lambda_2 = 0.005$. Then one of the following multivariate test statistics, which are summarized in Table 6, can be used to test the hypothesis H_{0a}.

Test statistic	Wilk's Λ	Lawley hotelling T_0^2	Pillai V	Roy's θ_s
Calculated value	**0.917**	**0.168**	**0.146**	**0.141**

Table 6: Multivariate test statistics

In Table 6, it is noted that the majority of statistical tests show significant evidence in rejecting the null hypothesis (H_{0a}), which indicating that schools in the 12 governorates are not parallel (different) in their achievement in providing the college of sciences with good graduates.

b. The hypothesis of equal treatment (groups of high schools levels) effects: $H_{Ob} : C_1 \mu m_2 = 0$.

The test for the hypothesis H_{Ob}, led to this analysis of variance table on the subject totals.

source	Sum of squares	Degrees of freedom	Mean square	F_c
Between groups	2699.84	11	245.44	3.44
Within groups (error)	22232.53	312	71.26	
Total	24932.37	323		

Since $F_c > F_{0.01}(11, 312)$, we reject H_{Ob}, this means that the effect of schools are not similar on the levels of achievement students' in the college of sciences. This can be interpreted as the level of achievement of students' reflects the difference between the achievement levels of schools.

c. The hypothesis of equal response means effects, $H_{Oc} : C_2' \mu M_1 = 0$.

Since the parallelism hypothesis H_{Oa} is rejected, therefore it will be necessary to test the hypothesis of equal effects H_{Oc} separately for each response

j	N_j	T^2	F_c
1	24	44.70	21.38
2	22	58.76	27.98
3	21	60.23	28.61
4	20	61.00	28.89
5	22	55.90	26.62
6	23	62.20	29.69
7	26	96.45	46.30
8	27	59.60	28.65
9	28	77.20	37.17
10	33	42.90	20.78
11	49	87.44	42.81
12	29	52.24	25.19

Table 7: Summarized of applying statistic (16) for each group

by P univariate analysis of variance, that is using statistic (16) for each group. Table 7 summarized of applying statistics (16) for each group.

Since $F_c > F_{0.01}(2, N_j - 2) \, \forall j$, we reject H_{0C}, this means that the results reported in Table 8 suggest that; the effects of average of responses are not equal for every group on the achievement level of students. These results, are consistent with the results reported previously in the regression analysis in terms of the role of the school in providing the college of sciences with high achievement level of students.

Secondly: The time element

To report the results of the statistical analysis for the time element, the sample study has been divided into four groups ($K = 4$). Every group represents batch of students' for a specific year which is explained previously in Table 4. Reference to the classification in Table 4, the statistical analysis for the time element is conducted.

When conducting the regression analysis, the researcher builds the following statistical regression model to analysis the time element for every batch of students as follows:

$$X_3 = \alpha + \beta_1 X_1 + \beta_2 X_2 + u. \tag{21}$$

The estimated results of model (21) are displayed in Table 8.

Years(time of graduation)	j	N_j	Estimated model for each batch	F_c
2007/2008	1	66	$X_3 = 57.9 - 0.30x_1 + 0.51X_2$	19.6
2008/2009	2	79	$X_3 = 168.9 - 1.40X_1 + 0.36X_2$	14.1
2009/2010	3	85	$X_3 = 17.5 + 0.15X_1 + 0.48X_2$	22.9
2010/2011	4	94	$X_3 = 93.5 + 0.02X_1 + 0.26X_2$	4.2

Table 8: The multiple linear regression for each batch

From Table 8, it is noted that all the estimated models for the four batches of students' are significant which confirms the positive role of the high school teachers on the quality of College's alumni.

To compare also between the four batches of students in terms of the time element of whether their level of achievement are equal (to know if the time has an effect on changing the students preferences), the following hypotheses ($H_O : \beta_1 = \beta_2 = \beta_3 = \beta_4$) are tested using Chow test. When the form of this test is applied, the researcher found $w_p = 58.5(w_p > F_0.01(6, 316))$. Hence, the null hypotheses are rejected, which indicating that the achievement of students' is different across the four batches. The time element has a strong effect on changing in the students' preferences and their future vision.

The profile analysis in this study is applied on the four batches of students, under the assumption that these batches are treated independently from each other. This means that every batch of students represents a year. In terms of the existence of the three responses ($p = 3$) which are X_1, X_2 and X_3, the results of testing of the hypotheses H_{Oa}, H_{Ob} and H_{OC} are reported as follows:

a. The parallelism hypothesis of the students' achievement across batches, $H_{Oa} : C_1 \mu M_1 = 0$.

According to (11), computer calculations yield:

$$H = \begin{pmatrix} 2138.04 & -1193.29 \\ & 729.16 \end{pmatrix} , \ E = \begin{pmatrix} 13062.8 & -8048.9 \\ & 18088.8 \end{pmatrix}.$$

And the characteristic roots of HE^{-1} are $\lambda_1 = 0.065$ and $\lambda_2 = 0.023$. To test H_{Oa}, one of the following multivariate test statistics which are summarized in Table 9 can be used.

Test statistic	Wilk's Λ	Lawley hotelling T_o^2	Pillai V	Roy's θ_s
Calculated value	0.855	0.088	0.083	0.061

Table 9: Multivariate test statistics

The results of all statistical tests reported in Table 9 are significant confirming that the null hypothesis (H_{oa}) is rejected. This rejection suggests that there is no parallel of achievement between these four batches of students.

b. The hypothesis of equal treatment (batches of students levels) effects, $H_{0_b} : C_1 \mu m_2 = 0$.

The test for H_{0b} led to this analysis of variance table on the subject totals:

source	Sum of squares	Degrees of freedom	Mean square	F_c
Between batches	1840.2	3	613.4	8.69
Within batches (error)	22592.0	320	70.6	
Total	24432.2	323		

Since $F_c > F_{0.01}(3, 330)$, we reject H_{0b}, this means that there are significant difference between the four batches of students. This means that the time factor has a significant effect on the students' academic achievements.

c. The hypothesis of equal response (means) for the four batches effects, $H_{0C} : C_2' \mu M_1 = 0$. Since, the parallelism hypothesis H_{Oa} is rejected, therefore, it will be necessary to test H_{OC} separately for each response by P univariate analysis of variance using statistic (16) for each batches.

F_c	T^2	N_j	J
30.5	**61.92**	**66**	**2007/2008**
35.0	**70.89**	**79**	**2008/2009**
39.8	**80.53**	**85**	**2009/2010**
22.3	**45.11**	**94**	**2010/2011**

Table 10: Summarized of applying statistic (16) for each batches

Since $F_C > F_{0.01}(2, N_j - 2)$, we reject H_{OC}, this means that the effects of the average of responses are not equal for every batch of students on the level of the students' achievements. In addition, the results of the profile analysis are consistent with the results of the regression analysis in terms of the time of graduation. The time of graduation has a significant influence on the level of the academic achievement of students at the College of Sciences.

Thirdly: The effect of the difference of high schools in terms of the difference of batches (the effect of the interaction between high schools and time of graduation).

We use the two-way multivariate analysis of variance **(MANOVA)**. Since the first way represents $r = 12$ group of high schools, and the second way represents $c = 4$ number of batches, and $P = 3$, a computer calculations yield the following matrices which their general elements defined in Table 11.

Source	**Matrix**	**Test Statistic θ_i's**	**Critical Value**
Time	$H_1 E^{-1}$	**0.08**	**0.040**
High school	$H_2 E^{-1}$	**0.73**	**0.023**
Interaction	$H_3 E^{-1}$	**0.15**	**0.035**

Table 11: Test statistics θ_i's and its critical value

$$H_1 = \begin{pmatrix} 684.95 & & \\ -293.74 & 376.50 & \\ 164.88 & 173.15 & 278.99 \end{pmatrix}, \quad H_2 = \begin{pmatrix} 11.83 & & \\ -41.49 & 561.89 & \\ 3.64 & 204.62 & 394.85 \end{pmatrix}$$

$$H_3 = \begin{pmatrix} 41.88 & & \\ 54.11 & 819.97 & \\ 69.98 & 452.49 & 845.78 \end{pmatrix}, \quad E = \begin{pmatrix} 269.35 & & \\ 285.95 & 11927.06 & \\ 35.52 & 4920.33 & 10210.99 \end{pmatrix}$$

$$T = \begin{pmatrix} 1008.01 & & \\ 4.83 & 13685.42 & \\ 274.02 & 5750.59 & 11.73061 \end{pmatrix}.$$

For the tests of the three hypotheses, H_{O1}: no row effects, H_{O2}: no column effects, and H_{O3}: no interaction effects, it is necessary to invert E and then to form the products $H_1 E^{-1}$, $H_2 E^{-1}$, and $H_3 E^{-1}$, from these we find the θ_i's test statistic. The θ_i's statistic and its critical value are summarized in Table 11.

In the light of the results in Table 11, the three hypotheses H_{O1}, H_{O2} and H_{O3} are rejected which indicate that high schools are absolutely different in their achievement and their influence on students' academic achievement. In addition, the academic achievement of students is also different across the four batches and their achievement is also different across school and batches.

4. Conclusions

The purpose of this study is to determine the real reasons influencing the academic level of students in the College of Sciences at AHU, who entered the college in the academic years of 2004/2005, 2005/2006, 2006/2007, and 2007/2008 and graduated in years 2007/2008, 2008/2009, 2009/2010, and 2010/2011. The study focuses on the two most important elements affecting; the students' level of academic achievement which are: the time of entering to and graduating from the college and the high schools. To achieve the goal of the study the following statistical techniques are used: Regression Analysis Method, Profile Analysis Method, and Multivariate Analysis of Variance **(MANOVA)**.

The most important results and conclusions achieved by this study are:

1. The findings of this study indicate that, from the regression analysis perspective, the level of academic achievement of the graduated students depends significantly upon (1), the average of their grades achieved in the high school and (2). Upon their average of grades in the first year of the University for all groups of schools across governorates and for all batches of students. In this light of these findings, governments should adopt specific policies to develop the main elements of the education process. This is to provide the local and international labor markets with very good outputs of high school students, who are committed to improve the academic achievements of the College of Sciences.

2. The results of this study, maintained by regression analysis, show also that the profile analysis results confirm the significant, relationship between schools and professional preparing of students. The levels of the academic achievement of students are significantly different from school to another. In response to these results, it is wise to draw the following conclusion that for the four different batches of students the levels of academic achievement are different from year to another. This different of academic achievement, across batches confirms the view that students in these batches are more likely to change their visions to the future.

3. The findings of this study, reported by the multivariate analysis of variance **(MANOVA)**, also show that the interaction between the high schools and the time is significantly evident. This means that the academic achievement of students is significantly different from school to another and from batch of students to another.

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