

Assessing the Academic Performance at Pre-College, College, and Post-College Levels for Universities in Saudi Arabia

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Abstract

Purpose: *The goal is to illustrate an approach to assessing the academic performance of college students in Saudi Arabia on (a) prior-to-college admission tests, (b) college GPA and coursework grades, and (c) post-college outcomes such as teacher licensure tests.*

Method: *Data on pre- and post-college measures are available for a nationally representative sample across universities in Saudi Arabia. For a targeted college from this sample, (a) the performance on pre- and post-college tests is compared to that of other colleges with the same profile of major, (b) college GPA and coursework grades are analyzed for problematic aspects of student performance across semesters, and (c) pre-college admission tests are investigated for predictive validity on college grades and post-college professional outcomes.*

Results: *With data for a specific college, the results indicated that (a) the college performance is at the national average on pre-college tests and post-college teacher licensure and aptitude tests, (b) the admission tests are valid predictors for college success and post-college outcomes, with unique contribution of some pre-college measures, and (c) there are some sharp fluctuations in GPA profiles across semesters and areas of major that need an investigations for problems associated with curricula, prerequisites for courses and so forth.*

Keywords: *Evaluation Model; General Aptitude Test (GAT); Standard Achievement Admission Test (SAAT); NCA Teacher Test; General Aptitude Test for University Graduates (PGAT)*

Introduction

Tools such as accreditation and evaluation are applied in higher education as mechanisms to ensure and improve the quality of the institution (Cook, 2004). For example, a comprehensive evaluation model was constructed by Al-harbi (2006) to assess impacts of Arabic Institution on student-related outcomes. Al-harbi's (2006) model is based on meta-analyses conducted by Feldman and Newcomb (1994), which uses nearly 1,500 research studies, and Pascarella and Terenzini (1991), which uses about 2,600 studies. The present study uses eight elements of the evaluation model developed by Al-harbi (2006). A brief description of these eight elements is provided next.

Institution's Outcomes (IO)

The first element is to specify *institution's outcomes (IO)* that define the content and scope of the evaluation model used to investigate the impact of an institution on students. As some researchers have noted, the areas and factors that affect student development and change in a particular institution should be clearly defined (e.g., Pascarella & Terenzini, 1991). In other words, the function of the IO element is to determine the magnitude and direction of institution outcomes across its conditions, activities, and experiences during a period of time.

Change During Institution (CDI)

The second element is to determine the student *change during institution (CDI)* on IO during the period of time the students spent in the institution. Specifically, the magnitude and direction of student development and changes on IO should be determined for the period of time between the freshman and senior classes. The student changes and development on IO that occur during this period of time is usually considered to be the greatest effect among the institutions impact on students (see, Pascarella & Terenzini, 1991; Feldman & Newcomb, 1994; Bowen, 1977). It should be noted that there are other factors that can also influence a student during his or her stay in an institution, such as maturation or improvement that may occur between two administrations of the same assessment tool (Pascarella & Terenzini, 1991).

Net Effects of Institution (NEI)

The third element is to determine the *net effects of an institution (NEI)* on a wide range of institution outcomes that are specified in the first step, but with the focus being on a change that is attributable to attendance rather than other causes or influences such as maturation and differences in background traits between those attend and those who do not attend the institution (Pascarella & Terenzini, 1991). Thus, such net effects assess the change in freshman and senior students on a wide range of specific institution outcomes but after controlling the non-institutional sources of changes (Feldman & Newcomb, 1994).

Between-Institution Effects (BIE)

The fourth element is to determine *the between-institutions effects (BIE)* on a wide range of institution outcomes, which are specified in the first step, to assess how different institutions may cause different types of influence on student change or development during the stay in the institution. Such effects are investigated to determine the discernible differences in student development or the outcomes of institution that are attributable to the characteristics of the

particular institution attend, such as institutional type, student body, selectivity, size, and financial resources (see, Pascarella & Terenzini, 1991; Feldman & Newcomb, 1994).

Within-Institution Effects (WIE)

The fifth element is to determine the *within-institution effects* (WIE) on a wide range of institution outcomes, which are specified in the first step, to assess the effect of different environments, subenvironments, or experiences within the same institution, such as residence arrangement, academic major, quality of institution, peer group involvement, extracurricular activities, and interaction with faculty, that may have influences on student change or development (Pascarella & Terenzini, 1991).

Conditional Effects of Institution (CEI)

The sixth element is to determine the *conditional effects of an institution* (CEI) on a wide range of institution outcomes, which are specified in the first step, to assess changes and development that are differentially related to students' characteristics. Conditional effects include influential collegiate experiences that vary in their influences for students with different characteristics, such as gender, minority status, or level of aptitude. In general effects, all students have the same magnitude and direction of experience whereas in conditional effects, the students differ in the magnitude and direction of experience because of their characteristics (Pascarella & Terenzini, 1991). For example, a specific experience may have stronger development effects on male students compared to female students.

Long-Term Effects of Institution (LTEI)

The seventh element is to determine the *long-term effects of an institution* (LTEI) on a wide range of institution outcomes, which are specified in the first step, to assess student changes that are attributable to institution attendance over a long period of time. The long-term effects of an institution have much in common with the net impact of the institution both conceptually and methodologically. That is, long-term effects of an institution are similar to net impact of an institution but they extend over time (Pascarella & Terenzini, 1991; Feldman & Newcomb, 1994).

Purpose of the Study

The purpose of this study is to illustrate the above approach to assessing changes in IO related to the academic performance of college students in Saudi Arabia on (a) prior-to-college admission tests, (b) college GPA and coursework grades, and (c) post-college outcomes such as teacher licensure tests. Specifically, the A-harbi's (2006) model was used with data for students from a College of Science at the Saudi University from three perspectives.

The first perspectives is to determine the institution's outcomes based on several tests constructed by the National Center for Assessment in Higher Education (NCA) and GPA and course grades on Math, Physics, Chemistry, Science, Computer, Education, General course, and English.

The second perspectives is to (a) investigate the students' performance on conditional effects of institution (CEI) based on the *prior-to-college* measures obtained through the NCA tests General Aptitude Test (GAT) and Standard Achievement Admission Test (SAAT), and (b)

investigate the students' performance on net effects of Institution (NEI), within-institution effects (WIE)), and long-term effects of institution (LTEI) based on *during college* GPA and course grades on Math, Physics, Chemistry, Science, Computer, Education, General course, and English; and *post-college* measures through the NCA Teacher Test and General Aptitude Test for University Graduates PGAT (GAT for College Graduates).

The third perspectives is to compare the College of Science with other colleges that have the same major areas (Science and Information, Physics, and Math) on between-institution effects (BIE) and change during institution (CDI) based on *prior-to-college* performance (GAT, SAAT) and *post-college* performance (PGAT and Teacher Test).

Method

Sample

The data for this study come from two samples. The first sample consists of 184 graduates from one of the College of Science at the Saudi University. The sample makeup by major is (a) 62 in Computer Science and Information, (b) 75 in Math, and (c) 47 in Physics. The second sample consists of 8,664 graduates from colleges across other universities and includes students with the same major areas (Computer Science and Information, Math, and Physics). By major, the distribution of this sample is (a) 3,448 in Computer Science and Information, (b) 3,325 in Math, and (c) 1,891 in Physics.

The IO Measures

Three types of measures for institution's outcomes (IO) was used in this study, namely: prior-to-college, during-college, and post-college measures.

Prior-To-College Measures

Two tests of the National Center for Assessment in Higher Education (NCA) tests were used as prior-to-college assessment of high school graduates who apply to colleges or universities in Saudi Arabia — the General Aptitude Test (GAT) and the Standard Achievement Admission Test (SAAT). The first test, GAT, has two parts referred to as GAT-Verbal and GAT-Quantitative. The second test, SAAT, is divided into five subdomains referred to as SAAT-Biology, SAAT-Chemistry, SAAT-Physics, SAAT-Math, and SAAT-English

During-College Measures

The during-college measures in this study are represented by the college GPA of the students (total and across 12 semesters) as well as their course grades on Math, Physics, Chemistry, Science, Computer, Education, General course, and English.

Post-College Measures

The post-college measures in this study are represented by the students' scores on the NCA Teacher Test and PGAT (GAT for College Graduates). The NCA Teacher Test is for college or universities graduates who seek to become teachers. It measures five subareas: Verbal Skills, Numerical Skills, Educational Skills, All Skills, and Major. The General Aptitude Test for University Graduates (PGAT) is a test for GAT for College or universities Graduates. It measures two different cognitive areas: PGAT-Verbal and PGAT-Quantitative.

Data Analysis

The data analysis was performed through the use of (a) descriptive statistics such as means, standard deviations, and frequencies (counts and percentages), (b) graphical depictions of

frequency distributions, GPA profiles across semesters, and box-plots (c) correlation coefficients for linear relationships among study measures, and (d) *t*-test statistics for comparisons of the College of Science with similar colleges from other universities on *prior-to-college* measures (GAT and SAAT) and *post-college* measures (PGAT and Teacher Test).

Results

Science College Performance on CEI Based on Prior-to-College GAT and SAAT

The student performance on the NCA tests GAT and SAAT is summarized in Table 1. Given that the GAT and SAAT scores are standardized on a scale with a mean equal to 65 and standard deviation equal to 10 ($M = 65$, $SD = 10$), the results indicate that the overall students' performance is slightly higher than the average scale norm on the total GAT test and each of its two parts (GAT-Verbal and GAT-Quantitative). However, the students' performance on SAAT is substantially below the average scale norm (about 1.5 standard deviations). The same holds for the performance on the five SAAT. For example, as the scores on each of these subscales vary from 0 to 20, the average score of 6.40 on Math should be a serious concern. Given the ranges of the GAT and SAAT distributions (over three standard deviations) is from 35 to 85, the SAAT performance is problematic indeed.

Table 1

Means and Standard Deviations of Student Performance on GAT and SAAT

College of Science Saudi University	All Students ($N = 184$)		Computer Science & Info ($N = 62$)		Physics ($N = 47$)		Mathematics ($N = 75$)	
	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>
GAT-Total	67.68	7.53	69.85	7.92	66.61	6.38	66.53	7.56
GAT-Verbal	68.05	8.30	70.98	8.41	68.12	7.14	65.56	8.16
GAT-Quantitative	68.43	8.38	69.88	8.95	66.25	6.99	68.57	8.50
SAAT-Total	38.84	10.18	42.79	11.50	36.21	6.69	37.58	10.28
SAAT-Biology	8.48	2.80	9.21	3.36	8.14	2.46	8.16	2.48
SAAT-Chemistry	8.64	3.29	9.61	3.48	7.43	2.25	8.69	3.50
SAAT-Physics	8.74	3.34	9.48	3.62	7.79	2.81	8.78	3.36
SAAT-Math	6.40	2.55	6.67	2.62	6.64	2.78	6.04	2.35
SAAT-English	6.58	2.78	7.82	3.38	6.21	2.32	5.91	2.26

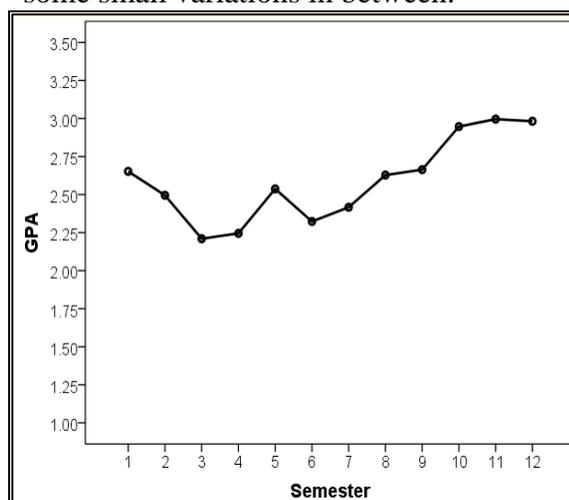
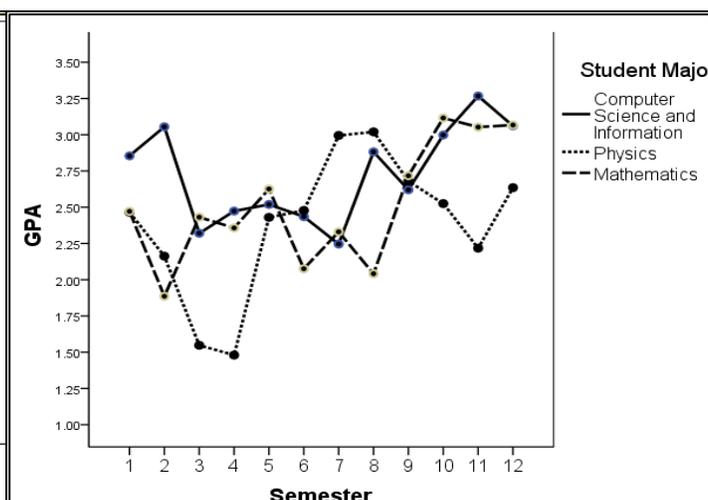
Science College Performance on NEI, WIE, and LTEI Based on GPA and Course Grades

The results on students' performance by GPA and course work during college are summarized in Table 2. As can be seen, the GPA performance of the students is above the average ($GPA = 3.19$), with the highest GAP for students in Computer Science and Information (3.27) followed by the GPAs for students in Mathematics (3.17) and Physics (3.13). Across subject matters, the GPAs vary from 2.64 to 4.02, with the two highest GPAs being on the General course (4.02) and Education (3.46), whereas the two lowest GPAs are on the Computer course (2.64) and Mathematics (2.70).

Table 2*Means and Standard Deviations of Student Performance on College Courses*

College of Science Saudi University	All Students (N = 184)		Computer Science & Info (N = 62)		Physics (N = 47)		Mathematics (N = 75)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
GPA	3.19	0.62	3.27	0.60	3.13	0.60	3.17	0.66
Computer	2.64	0.83	3.08	0.72	2.26	0.85	2.49	0.75
Science	2.94	0.78	3.17	0.80	2.52	0.72	3.02	0.72
Physics	2.76	0.90	2.74	0.99	2.91	0.69	2.68	0.95
Chemistry	2.85	1.05	3.55	1.05	2.57	0.93	2.66	1.00
Math	2.70	0.77	2.72	0.76	2.36	0.68	2.90	0.76
General course	4.02	0.62	4.18	0.51	3.97	0.75	3.91	0.59
Education	3.46	1.03	3.75	0.95	3.07	1.07	3.46	1.00
English	2.83	0.82	3.26	0.82	2.46	0.48	2.70	0.85

The GPA profile across 12 semesters for the entire sample and by major are depicted in Figures 2 and 3, respectively. For the entire sample, there is an initial decrease in GPA from the first to the third semester followed by an increase over the next nine semesters (see Figure 1). However, when developed by student major (Computer Science and Information, Physics, and Math), the GPA profiles across 12 semesters vary substantially (see Figure 2). For example, the GPA profile for students in Math exhibits (a) a sharp decrease over the first four semesters, (b) a steady or increase over the next four semesters, (c) a sharp decrease again over the following three semesters, and (d) a pick up at the last semester. In contrast, the GPA profile for students in Computer Science and Information starts with an increase over the first semester followed by a decrease over the second semester and then by a substantial increase to the end semester, with some small variations in between.

**Figure 1.** Students' GPA profile across 12 semesters**Figure 2** Students' GPA profile across 12 semesters by students' major

Science College Performance on NEI, WIE, and LTEI Based on Post-College Measures (PGAT and Teacher Test)

The results on post-college measures (PGAT and Teacher Test) for the College of Science are summarized in Table 3. The student's performance is slightly above the average scale norm on the General Aptitude Test for Graduate Schools (PGAT). The students did better on the quantitative part (about one half standard deviation higher) compared to the verbal part of the test. This finding can be expected given that the students major in Computer Science and Information, Physics, and Mathematics. On the Teacher Test, the students' performance is lower (by one standard deviation) than the average scale norm on the test. The students from Computer Science and Information scored higher (by half a standard deviation) than the students from Physics and Mathematics. By subdomains of the Teacher Test, the highest performance is on Numerical Skills (one standard deviation above the average), followed by the performance on Verbal Skills (close to average) and then by Education Skills, All Skills and Major (all three about one standard deviation below average).

Table 3

Means and Standard Deviations of Student Performance on Post-College Assessments (PGAT and Teacher Tests)

College of Science Al-Majma'ah University	All Students (N = 184)		Computer Science & Info (N = 62)		Physics (N = 47)		Mathematics (N = 75)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
PGAT-Total	63.43	8.56	65.93	8.54	62.66	8.37	61.37	8.23
PGAT-Verbal	60.43	11.57	63.53	11.89	60.13	10.74	57.38	11.21
PGAT-Quant	66.51	6.99	68.43	6.59	65.09	7.02	65.51	7.10
Teacher Test-Total	53.44	9.91	60.25	10.18	50.53	7.86	50.89	8.83
Verbal Skills	62.56	15.14	61.36	17.03	67.40	12.58	60.29	14.84
Numerical Skills	70.97	16.24	70.97	16.24	—	—	—	—
Education Skills	54.34	12.17	51.61	9.72	56.95	11.58	54.45	13.64
All Skills	57.40	11.26	58.26	9.46	59.56	10.38	55.49	12.59
Major	51.31	13.63	62.57	13.28	43.31	9.62	49.13	11.26

Correlations Among Scores on Prior-to College Tests, GPA, and Post-College Tests for NEI, WIE, and LTEI Effects

The correlations among the students' scores on prior-to-college tests (GAT and SAAT), college GPA, and post-college tests (PGAT and Teacher Test) are provided in Table 4. As can be seen, there are substantial relationships between the post-college Teacher Test scores and the prior-to-college assessments by GAT ($r = .578$) and SAAT ($r = .650$). However, the correlations between the prior-to-college assessments with the college GPA is much lower ($r = .236$ between GAT and GPA and $r = .251$ between SAAT and GPA). The conclusion is that GAT and SAAT measures do not relate strongly to college GPA of the students, but they have a good predictive validity on standardized outcomes measured by the Teacher Test.

Table 4

Correlations Among the College GPA of the Students and Their Performance on Pre-College Tests (GAT and SAAT) and Post-College Tests (PGAT and Teacher Test)

	GAT	SAAT	PGAT	Teacher Test
GPA	.236	.251	.172	.260
GAT		.668	.789	.578
SAAT			.520	.650
PGAT				.509

Note. All correlation coefficient in bold are statistically significant ($p < .001$).

Prediction of GPA and Post-College Test Scores from Prior-to-College Test Scores for NEI, WIE, and LTEI Effects

Further analyses were conducted using multiple regressions for the prediction of GPA and Teacher Test scores from seven subdomains of GAT and SAAT, namely: GAT-Verbal, GAT-Quantitative, SAAT-Biology, SAAT-Chemistry, SAAT-Physics, SAAT-Math, and SAAT-English. **Regarding the prediction of GPA**, the results indicated that all subdomains of GAT and SAAT together provide a statistically significant prediction of GPA scores ($p = 0.032$). Also, 14.4% of the variation in GPA scores is explained by all seven subdomains of GAT and SAAT. The highest unique contribution to the prediction of GPA is provided by the students' scores on SAAT-Chemistry, which contributed 9.12% to the prediction, over and above the contribution of the remaining six subdomains of GAT and SAAT (none of which had a statistically significant unique contribution to the prediction over and above the contribution of the other six predictors).

Regarding the prediction of Teacher Test scores, all seven subdomains of GAT and SAAT provided a statistically significant prediction of the Teacher Test scores ($p < .001$). Also, 52.7% of the variation of Teacher Test scores is explained by all seven subdomains of GAT and SAAT; (note that that this is much higher compared to the 14.4% for the prediction of GPA). Unlike the prediction of GPA, where only SAAT-Chemistry has a statistically significant unique contributions to the prediction of GPA, there are three subdomains of GAT and SAAT with their own statistically significant unique contribution to the prediction of Teacher Test scores, namely: GAT-Verbal ($p = 0.031$), SAAT-Biology ($p = 0.010$), and SAAT-Chemistry ($p = 0.018$). The highest unique contribution to the prediction of Teacher Test scores (over and above all other six subdomains) is provided by SAAT-Biology (3.72%) followed by SAAT-Chemistry (3.03%) and GAT-Verbal (2.50%). The multiple regression results for the prediction of GPA and Teacher test scores from the subdomains of GAT and SAAT are summarized in Table 5.

Table 5

Multiple Regression for the Prediction of GPA and Teacher Test Scores From GAT and SAAT Subdomain Scores

	Prediction of GPA			Prediction of Teacher Test Score		
	Regression coefficient	<i>p</i> -value	% unique contribution	Regression coefficient	<i>p</i> -value	% unique contribution
Intercept	2.983	.000	not sign.	7.366	.329	not sign.
GAT-Verbal	-0.005	.618	not sign.	0.297	.031	2.50%
GAT-Quant.	0.002	.799	not sign.	0.116	.326	not sign.
SAAT-Biology	-0.018	.492	not sign.	0.895	.010	3.72%
SAAT-Chemistry	0.073	.002	9.12%	0.718	.018	3.03%
SAAT-Physics	-0.004	.834	not sign.	0.497	.071	not sign.
SAAT-Math	0.018	.477	not sign.	-0.436	.191	not sign.
SAAT-English	-0.008	.710	not sign.	0.249	.399	not sign.
	$R^2 = 0.144$ (14.4% prediction)			$R^2 = 0.527$ (52.7% prediction)		

Comparison of Science College of Science to Other Colleges of Science for BIE and CDI Effects

The Science College of Science was compared to Other Colleges of Science (with the same major areas: Computer Science and Information, Physics, and Math) on prior-to-college measures (GAT and SAAT) and post-college measures (PGAT and Teacher Test). The results indicated that there are *no* statistically significant differences *neither* on the total score for GAT, SAAT, PGAT, and Teacher Test scores *nor* on each of the subdomains of these four tests. The means and standard deviations on the prior-to-college and post-college measures are provided in Tables 6 and 7, respectively.

Table 6

Means and Standard Deviations on Pre-College GAT and SAAT Tests for Students from the College of Science at Saudi University and Colleges of Science from Other Saudi Universities with the Same Major Areas (Computer Science and Information, Physics, and Mathematics)

	College of Science at Saudi University (<i>N</i> = 184)		Colleges of Science in Other Universities		
	<i>Mean</i>	<i>SD</i>	<i>N</i>	<i>Mean</i>	<i>SD</i>
GAT-Total	67.68	7.53	8,361	68.14	7.08
GAT-Verbal	68.05	8.30	8,361	68.25	7.80
GAT-Quantitative	68.43	8.38	8,361	68.39	7.75
SAAT-Total	38.84	10.18	4,769	37.88	8.83
SAAT-Biology	8.48	2.80	4,768	8.28	2.87
SAAT-Chemistry	8.64	3.29	4,765	8.16	2.95
SAAT-Physics	8.74	3.34	4,768	8.32	2.90
SAAT-Math	6.40	2.55	4,764	6.68	2.44
SAAT-English	6.58	2.78	4,763	6.46	2.57

Note. The mean difference is *not* statistically significant for any of the GAT and SAAT measures ($p > .05$).

In addition, the comparison of Science College of Science to Other Colleges of Science on PGAT subdomains (Verbal and Quantitative) and on Teacher Test Skills (Verbal, Numeric, and Educational) by using the box-plots showed that the range for the middle 50% of the score distributions is also about the same for the Science College of Science and Other Colleges of Science on subdomains of the PGAT and Teacher Test.

Table 7

Means and Standard Deviations on Post-College GAT (PGAT) and Teacher Tests for Students from the College of Science at Saudi University and Colleges of Science from Other Universities with the Same Major Areas (Computer Science and Information, Physics, and Mathematics)

	College of Science at Saudi University (N = 184)		Colleges of Science in Other Saudi Universities		
	<i>Mean</i>	<i>SD</i>	<i>N</i>	<i>Mean</i>	<i>SD</i>
PGAT-Total	63.43	8.56	4,261	63.02	8.32
PGAT-Verbal	60.43	11.57	4,261	60.63	11.27
PGAT-Quantitative	66.51	6.99	4,261	64.78	10.10
Teacher Test-Total	53.44	9.91	8,664	54.38	10.80
Verbal Skills	62.56	15.14	8,664	63.24	14.84
Numerical Skills	70.97	16.24	3,447	66.77	17.61
Educational Skills	54.34	12.17	8,664	55.22	13.31
All Skills	57.40	11.26	8,664	58.39	11.76
Major	51.31	13.63	8,664	58.39	11.76

Conclusions

The following main conclusions stem from the evaluation of the IO on academic performance for students in the College of Science used in this study.

1. On the NCA admission tests, the students perform slightly above the average scale norm on GAT but substantially below the average on SAAT.

2. On college course assessments, the students' GPA is above the average (3.19) but the variation of GPA profiles across semesters and major (Computer Science and Information, Physics, and Math) deserves a closer look to identify possible causes of such fluctuations (e.g., problems with curricula, prerequisites for some courses, and so forth).

3. On post-college assessments, the students perform slightly above the average of PGAT, but substantially below the average scale norm on the Teacher Test. They perform above the average on Numeric Skills, close to average on Verbal Skills, and below the average on Educational Skills, All Skills, and Major.

4. The NCA admission tests (GAT and SAAT) predict well the students' performance on the Teacher Test, but to a lesser degree the overall GPA on college coursework.

5. Compared to similar colleges from other universities, there are no differences in the mean and the range of the middle 50% scores, but the presented College of Science students are represented at higher rate (%) at the extreme categories (low and high) of the five performance levels on GAT, SAAT, PGAT, and Teacher Test.

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