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Scholastic Aptitude Test, Sex and Department as Predictors of University Academic Performance: The Case of Addis Ababa University

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Abstract

The objective of the present study was to assess the predictive power of SAT, Sex and Department in AAU College of Science and Social Science. To analyse and interpret the collected data, both descriptive and inferential statistics were used. Pearson Product-Moment Correlation was employed to see the magnitude and direction of the relationship between the predictor variables and the criterion measure. To see the percentage of variance in students first year CGPA that can be explained by predictor variables multiple regression was used. Lastly, to identify relative contribution of predictor variables (or to identify the best predictor variable step-wise regression was employed. Predictor variables are statistically significant predictors of college academic performance for all participants 17.6% (R^2=0.176, F (3, 296)=21.068, P<0.05). Regarding the gender, there is a significant difference between male and female students college academic performance. A large amount of variance accounted for was found for female students 22% (R^2=0.220, F (2, 95)=13.362, P<0.05) than for males 13.2% (R^2=0.132, F (2,199) =15.095, P<0.05). When the disciplines are considered, College of Science was found to be a more significantly predicted field of studies 17.5% (R^2=0.175, F(3, 151)=10.697, P<0.05) than Social Science 8.4%(R^2=0.084, F(3, 141)=4.317, P<0.05). Regarding the relative contribution of each predictor variables, the study result showed that department was the best predictor followed by SAT. Sex was a non-significant predictor of college CGPA. Hence, further investigation is required to conduct a study on the predictive power of sex.

Keywords: Predictive validity; Academic performance; Gender; AAU

Introduction

Almost always educators are concerned with decision making and prediction in education and psychology about learner's behaviour particularly an individual's learning ability. For this reason, they use test to help them in making prediction. Thus, either directly or indirectly aptitude tests as well as achievement tests are used to make predictions. But in this particular paper, the researcher deal with aptitude test particularly Scholastic Aptitude Test (SAT), Sex and Departments that were believed to be a useful in predicting academic success.

According to Ebel and Frisbie aptitude tests are used to predict how well an individual may learn and best able to predict future scholastic success. Similarly, Mehrens and Lehmann states aptitude tests as a measure of individual's ability to learn new tasks. Other authors Cronbach [1] also said that aptitude tests are constructed for the purpose of predicting student's future academic performance. By supporting the idea of Cronbach [1], recently reported that if the author's purpose is to develop a predictive instrument, he will no doubt call it an aptitude test.

Furthermore, the studies conducted in the past Ghiselli indicated that the correlations between aptitude test scores and success in college training programs tend to run between 0.40 and 0.50. Since aptitude tests are most useful in predicting future school success, some authors have suggested that the phrase scholastic aptitude is the most honest and descriptive. The primary role of the aptitude test is to predict students' likely performance on a university course [2].

Little or no information on the predictive validity of SAT, Sex and Departments in a sufficient detail exist in our country. The present study, thus, was tried to investigate in a sufficient detail of the problem under investigation. Hence this attracts the interest of the researcher to conduct a study on the relationship of SAT, Sex and Departments with university academic performance within Addis Ababa university College of Social Sciences and Sciences [3].

Given the implications of existing research findings reviewed previously, the following research questions were formulated for the present study. More precisely, the purpose of this study was to assess the relationship between SAT, Sex, Departments and university academic performance. To this end, the following leading questions were formulated.

Is there a significant relationship between the predictor variables (SAT, Sex and Departments) and college academic performance? Is there a significant sex difference in college academic performance of first year students?

Is there any statistically significant difference in academic performance of students from College of Science and Social Science? What are the relative contributions of each predictor variables in predicting college academic performance?

Methodology

Correlation and regression method was employed to determine the degree and direction of relationship between the predictor variables and criterion measure. The target group of this study was batch of 2009/2010 academic year undergraduate degree entrants, College of Social Sciences and Sciences from AAU. They joined the college after passing EHEECE.

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Participants were 300 first year students enrolled to Addis Ababa University in the academic year 2009/2010. Of these participants 98 (32.7%) and 202 (67.3%) were females and males respectively [4-6]. The sample students were extracted from about 800 students in 13 departments of College of Science and Social Science. In this research paper the independent variables were the students' score of SAT, Sex and Departments. Similarly, the dependent variable was the students' university academic performance.

To analyse and interpret the collected data, both descriptive and inferential statistics were used [7-10]. Pearson Product-Moment Correlation was employed to see the magnitude and direction of the relationship between the predictor variables and the criterion measure. To see the percentage of variance in students first year CGPA that can be explained by predictor variables multiple regression was used. Lastly, to identify relative contribution of predictor variables (or to identify the best predictor variable step-wise regression was employed).

Results and Discussion

Descriptive statistical results

To show the general feature of predictor variables (SAT, Sex and Department) and criterion (university academic performance) variable, descriptive statistics are used. With reference to the statistical results, descriptive measures that involve means and standard deviation of independent and a dependent variable. For the total group and each sub-group based on the categories made by department, and sex of first year students have been presented in Table 1.

Upon entering the university, the entire study participants in the sample had a mean age of 18.61 with a standard deviation of 3.781. The mean of aptitude test score was 55.92 with a standard deviation of 13.034. As can be seen from the above table, at departmental level, the mean and standard deviation of SAT varied from 46.78 to 63.89 and from 8.383 to15.595, respectively. On the other hand, regarding the gender, we can understand from this table that the mean and standard deviation of aptitude test scores were varied for sex. The result in this table indicates that many male students on average were scored higher on aptitude test [11,12]. And the standard deviation indicates that there is sufficient variation in a female aptitude test scores compared to male. But in the case of criterion measure considerable variations were obtained for male students compared to female students.

Concerning the criterion measure, the mean CGPA achieved in first year is 2.65 for the total participants with a standard deviation of 0.467 and varied from 2.39 to 2.97 and from0.237 to 0.572 respectively at departmental level. Particularly students who enrolled in college of Social Science on average have higher mean CGPA of 2.77 when compared to those of Science participants who had mean CGPA of 2.53. More specifically, from this descriptive statistics, one can understand

	Statistics					Age	
	Mean SAT	**St.dev**	**Mean CGPA**	**St.dev**	**N**	**Mean**	**Std.dev**
SAT							
Total	55.92	13.034	------	-----	300		
Male	58.37	11.833	------	-----	202		
Female	50.88	13.977	------	-----	98		
SEX							
Total	-----	-----	2.65	0.467	300		
Male	-----	-----	2.7	0.472	202		
Female	-----	-----	2.54	0.44	98		
Department 300							
Science	57.98	13.793	2.53	0.403	155	18.61	3.781
Mathematics	63.89	11.318	2.39	0.237	27		
Physics	63.87	8.383	2.47	0.522	15		
Biology	56.76	12.44	2.55	0.407	37		
Chemistry	52.92	15.595	2.45	0.437	26		
Statistics	62.33	12.714	2.67	0.411	16		
Earth Science	53.31	15.414	2.64	0.407	32		
Social Science	53.72	11.824	2.77	0.497	145		
Geography	51	12.546	2.72	0.425	24		
History	57.18	13.001	2.71	0.433	17		
Sociology	58.24	11.569	2.77	0.516	29		
Anthropology	51.41	10.773	2.87	0.508	22		
PSIR	55.42	10.885	2.97	0.54	26		
Philosophy	46.78	9.944	2.51	0.421	18		
Archeology	54.44	10.841	2.77	0.572	9		
CGPA							
Total	-----	-----	2.65	0.467	300		
Male	-----	-----	2.7	0.472	202		
Female	-----	-----	2.54	0.44	98		

Note: Values are for all participants.

N=300.

SAT: Scholastic Aptitude Test; CGPA: Cumulative Grade Point Average.

Table 1: Mean and standard deviation of the variables in the study(for total participants(N=300).

that the mean value of CGPA across the department indicates that on average the entire study participants were medium in their university academic performance [13-16]. The standard deviation values on the other hand indicate that there is a considerable variation in CGPA particularly in the department of Archaeology, PSIR, Sociology and Social Anthropology among others [17,18]. Whereas in the department of Mathematics and Biology the variation of CGPA were found to be modest compared to the other departments among college of Science and Social Science.

Analysing the characteristics of the distribution of variables considered in the study, the degree of variability within CGPA is smaller in the criterion measure than the dispersion of predictor variables (SAT, Sex and Departments) across the participants. This means that the standard deviation found for CGPA is smaller than the standard deviation of the independent variables. One can understand from this that the range of restriction is seen highly in the criterion measure (CGPA) than the predictor variables.

Correlation analysis

From the inter correlation matrix displayed in Table 2, we can understand that all the considered predictor variables are related positively with each other except for Department(X_3) which was negatively related with SAT(X_1). All the relationships between the predictor variables are statistically significant (at P<0.01).

While conducting these analyses, multi co-linearity was diagnosed between predictor variables in the present study (SAT, Sex and Department) (Table 2). "If two independent variables are correlated at level greater than r= 0.70, some authors Zizzi, cited in Aboma suggest removing one of the variables from multiple regression analysis." However, in our case, there was no such problem of co-linearity among the predictor variables (Table 2).

Variables	SAT	Sex	Department	CGPA
Sat	1			
Sex	0.270**	1		
Department	-196**	.193**	1	
CGPA	0.218**	.156**	.308**	

Values are for all participants.

**P<0.01, 2-tailed.

SAT: Scholastic Aptitude Test; CGPA: Cumulative Grade Point Average.

Table 2: Inter correlation matrix between the predictor variables and the criterion variable.

Pearson correlation indicates that the relationship between the predictor variables and university academic performance are statistically significant (at P< 0.01 and N=300). From this inter correlation matrix, we can understand that all the considered variables in the present study are related positively with university academic performance. Though all the relationships are statistically significant, Departments(X_3) is highly related with first year CGPA(Y) followed by SAT test scores (X_1) and Sex (X_2) was the least correlated predictor variable with CGPA compared to the other two variables(SAT and Department). From the results depicted in Table 2, one can understand that the correlation of SAT and Department with CGPA were medium (r=.218) and (r=.308) respectively [19-21].

Multiple regression analysis

Regression Equation, $Y' = 0.287X_1 + 0.008X_2 + 0.363X_3 + 1.706$

Where, X_1= Scholastic Aptitude Test

X_2=Sex, Sex is dummy coded, Male=1, Female=0

X_3=Department, all Departments are categorized into Science and Social Science for our purpose, then dummy coded, in this case, College of Science= 20, College of Social Science= 40. One can understand from the multiple regression result displayed in the above table, SAT and Department were the only significant predictors of university academic performance. The result of multiple regression analysis also showed the use of SAT, Sex and Department in combination to predict the entire study participants' CGPA accounted for 17.6% (R^2=0.176, F (3, 296)=21.068, P<0.05) of the total variance in students' first year CGPA. In the model, only SAT and Department were the significant predictors of college academic performance (*B*=.363 for Department) and (*B*=.287 for SAT). However, sex was failed to be a significant predictor of college CGPA.

When the sex is considered, a large amount of variance accounted for was found for female students 22% (R^2=0.220, F (2, 95)=13.362, P<0.05) than for male students 13.2% (R^2=0.132, F (2, 199)=15.095, P<0.05). Predictor variables explained more of the variance in college CGPA for females than for male students. More specifically the study result indicated that the variance in females' first year CGPA accounted for by SAT and Department 12.9% and 9.1%, respectively (Table 3). On the other hand, the variance in males' first year CGPA that accounted for by SAT and Department were found to be 5.3% and 7.9%, respectively. From these findings, one can easily understand that the correlation between aptitude test and first year CGPA were

St. group	N	Predictors	b	B	t	R	R^2	F-ratio
All	300	Constant	1.706		12.893			
		SAT	.010	.287	5.057*			
		Sex	.008	.008	.140	.419	.176	21.068*
		Department	.048	.363	6.519*			
Male	202	Constant	1.793		9.369			
		SAT	.009	.236	3.466*			
		Sex	.004	.005	.676	3.63	.132	15.096*
		Department	.044	.338	4.973*			
Female	98	Constant	1.561		7.756			
		SAT	.012	.378	3.958*			
		Sex	.003	.002	.334	.469	.220	13.362*
		Department	.067	.420	4.399*			

Values are for all participants.

*P< 0.05.

SAT: Scholastic Aptitude Test..

Table 3: Multiple Regression Analysis of predicting college academic performance by using SAT, Sex and Department.

Stud Group	N	Model	Predictors	R	R^2	Adj. R^2	F-Ratio
All	300	1	Department	.308	.095	.092	31.342*
		2	Department SAT	.419	.176	.170	31.696*
Male	202	1	Department	.282	.079	.075	17.229*
		2	Department SAT	.363	.132	.123	15.095*
Female	98	1	Department	.301	.091	.081	9.592*
		2	Department SAT	.469	.220	.203	13.362*

Values are for all participants.

*P<.05.

SAT=Scholastic Aptitude Test.

Table 4: Final Summary of Step-Wise Multiple Regression of predicting college academic performance from SAT and Department.

higher for females than for males [22,23]. Generally this implies that the model in the present study was stronger for predicting first year students CGPA for females than for males. This finding was consistent with the previous findings. For instance, Mattern et al [3] reviewed the literature on differential validity and prediction by gender which comprised 48 validity studies and prediction studies, arrived at similar conclusions [24]. Accordingly the predictive validity for college success almost always higher for females than males.

Step-wise multiple regression analysis

As can be seen from the above Table 4, stepwise multiple regression analysis revealed that Department (B=.308, P<0.05) was the most important predictor of first year college academic performance followed by SAT scores (B=0.111, P<0.05) for all participants [25-27]. The variance accounted for by Department was 9.2% ($AdjR^2$=.092, F (1, 198)=31.342, P<0.05) and the combination of Department and SAT on model two accounted 17% ($AdjR^2$=0.170, F (2, 197) =31.696, P<.05). From the above value in the combination of Department and SAT on model two, 7.8% ($AdjR^2$=0.078) was accounted for by SAT alone. The findings of this study indicated that both Department and SAT scores were significant predictors of college CGPA. These results were consistent across the gender. Accordingly, Department explained 8.1% ($AdjR^2$=0.081, F(1,96)=9.592,P<0.05) and the combination of Department and SAT 20.3% ($AdjR^2$=.203,F(2,95)13.362, P<.05) for females than Department 7.5% ($AdjR^2$=.075, F(1,200)=17.229, P<.05) and the combination of Department and SAT on model two 12.3% ($AdjR^2$=0.123, F(1, 199)=15.095, P<.05) for males. However, in the present study, Sex was failed to be a significant predictor of college CGPA.

Discussion

In the present study, aptitude test, Sex and Department were used as predictor variables of university academic performance. The major findings of this study will be discussed in the light of the research questions raised in the introductory part of the study.

As to the predictive power of SAT, Sex and Department, the results indicate that there is statistically a significant relationship between the predictor variables and criterion measure 17.6% (R^2=1.176, F (3, 296)=21.068, P<.05). Particularly SAT and Department were found to be a significant predictors of college academic performance.

The findings concerning sex difference in college academic performance, gender difference was observed in the present study. Predictor variables explained more of the variance in college CGPA for female students than for male students [28,29]. This implies that the model was stronger for predicting first year CGPA for female than foe males. These findings are in agreement with that of Bridgeman, Mc Camley and Ervin cited in Young et al. According to these authors the differential validity results showed that females college CGPA was more predicted by aptitude test than those of males.

Whenever the disciplines categorized as College of Science and Social Science, College of Science as a whole were found to be a more significantly predicated field of studies by aptitude test and Department. These findings confirm the previous findings. For example, according to Pearson although prediction of college academic performance by aptitude test across all disciplines is modest, there was a wide variation at department level. A finding by this author shows that prediction of Sciences to be generally more accurate than of Social Sciences.

Concerning with identifying the relative contribution of each predictor variables, as can be understand from the present study, step-wise multiple regression analysis revealed that Department (B=.308, P<0.05) was the most important predictor of first year college academic performance followed by SAT scores (B=0.111, P<0.05) for all participants. The variance accounted for by Department was 9.2% ($AdjR^2$=0.092, F (1, 198) =31.342, P<0.05) and the combination of Department and SAT on model two accounted 17% ($AdjR^2$=0.170, F (2, 197) =31.696, P<0.05). From the above value in the combination of Department and SAT on model two, 7.8% ($AdjR^2$=0.078) was accounted for by SAT alone [30,31].

Conclusion

The results of the predictive power of SAT, Sex and Departments are observed in the previous chapter. The following conclusions are made on the basis of the findings.

1. There is a significant relationship between aptitude test, Sex, Department and first year college academic performance as measured by CGPA.
2. There is a significant Sex difference in college academic performance. Females' first year CGPA were found to be more predicted than those of male students.
3. There is a significant difference between the Science and Social Science departments' CGPA prediction. Accordingly, College of Science was more predicted in the model than those of Social Sciences.
4. Department was the best predictor of college CGPA followed by SAT. However, sex was found to be a non-significant predictor of college academic performance.

Generally, the findings of this study reveal that males and Science

students' college academic performance on average are over-estimated while females and Social Science students are under-estimated particularly when aptitude test is used to predict college CGPA.

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