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Amrit Research Journal December 2022, Vol. 3, Issue 1, 108-116
ISSN: 2738-9553
RESEARCH ARTICLE

A Statistical Analysis of College Students Academic Performance: A Case Study of Amrit Campus

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(Received: August 18 2022, Received in revised form: November 15, Accepted: December 2, 2022, Available Online)

Highlights

- Gender doesnot affect on performance of students.
- Subjective group, academic level and system has significant impact on academic performance.
- The performance of semester system is better than that of yearly system.
- Biological group students take exam more seriously than Physical group students.

Abstract

Every Universities/Colleges want their more students are able to pass their exams. That is why they are looking for effective policies and programs. This study helps them to make new policies for the betterment of the students and change inefficient old policies if any in their Universities/Colleges. This investigation's purpose is to evaluate the consequences of gender, level, group and system on students' academic performance by taking students in Amrit Campus. After analyzing through chi-square and logistic regression, it is found that except gender other three variables have significant impact on performance. The performance of biological group students is better than physical group students. Likewise, bachelor level students have performed well as compared to master level. Additionally, semester students pass at a higher rate than those enrolled in the yearly system. Among various combinations of bachelor level, EBC (Environment, Botany, and Chemistry) and among Master level Zoology students are more serious about their exam.

Keywords: *academic performance, chi-square, group, level, logistic regression, system assessing and evaluating one's academic achievement and abilities*

Introduction

Normally, the examination is the process of evaluating one's academic achievement and abilities. Additionally, it tests a student's knowledge by asking them written or spoken questions based on the assigned material within a predetermined time frame [1]. Education, the most important component of development of human is taken as center of life in the society. In addition, it is a cultural artifact that represents ambitions for the welfare and advancement of the society it is meant to serve. [2]. Any organization's ability to be successful is based on its management plan for better performance for quality output [3] .In most of colleges around the world students' academic performance is measured by marks/grade secured by them in an examination. Students' academic research has been area of interest for educational institutions because of which it has become a growing topic of investigation in higher educational circle [4]. Academic excellency is crucial for any academic institution to achieve an excellent output that result in future job success [5]. The country's economy may be negatively impacted by the low rate of academic success [6].

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In Tribhuvan University (T.U), there is annual system as well as semester system in Bachelor level whereas there is only semester system in master level. Because of availability of data and considering the normal period throughout the year, the study is based on results of 2075 BS (2018/19 AD). According to Tribhuvan University Office of Controller of Examination, 13,347 students have appeared in B.Sc. first year exam where only 2, 808 students passed the exam which means pass percentage is 21.03% The corresponding figures for B.Sc. second year are 10, 522; 3,214 and 30.545%. Out of 7,222 appeared in B.Sc. third year exam only 3,076 (42.592%) were able to clear the exam. In B.Sc. fourth year exam only 2,916 (56.53%) students passed where 5,158 students have sit in the exam.

Students' performance of different years as well as different semesters of bachelor level and even in different semesters of master level are not same. There might be some factors affecting their performance. But research on factors affecting college students' performance in the context of Nepal have been rarely been found. Even around the world, the perspectives used in this study have rarely been noticed. So, the aim of this study is to find the impact of gender (Male/Female), system (annual/semester), group (physical/biological) and level (bachelor/master) on the performance of the students by taking Amrit Campus as a reference.

Around the world, several researches have been carried out on performance of students. Hansen [7] did research on students' performance where he noticed that students' achievement is affected by diverse elements such as learning capability, gender and race. Chansarkar and Michaeloudis [8] investigated student's performance based on age, qualification and distance from learning center. They deduced that the student's achievement is not influenced by age, gender and hometown, but is affected by qualification in quantitative subjects. Beaumont-Walters and Soyibo [9] analyzed the high school students' performance where they found significant difference of performance with respect to sex, level, location of school, type of school and student; and socio-economic background. According to Ghazvini and Khajehpour [10] results, girls are more dedicated to their academic obligation but in mathematics, significantly higher marks is not achieved.

Aggarwal [11] emphasized that only good educational system can ensure effective learning which leads to success. So, students must be given instruction prior to shiftifting from yearly system to semester system or semester to quarter system. According to Malik, et al. [12] various countries, particularly in the west, the yearly system is called "Tuition Assistance Programme (TAP)". Yearly system was in existence in British universities fifty years ago. Yousaf and Hashim [13] conducted research on government college of management science to compare the examination system of annual and semester system and found that semester system not only provides better grading system but also in semester system students can secure better marks. Khattak, et al. [14] investigated students' perception about annual and semester system. According to their findings even though semester system helps to improve the skills of students, assessment system of annual system is better than semester system.

Comparative studies on the educational achievement of graduate and undergraduate newcomers have found a very narrow variation, but a higher grade achievement was seen in graduate-entry students at the beginning of medical course [15]. A study from medical school in UK showed few academic advantages for graduate-entry students [16]. Kay-Lambkin, et al. [17] have noticed a couple of variation in the academic achievement of graduate and undergraduate fresher at the beginning of the course. Dodds, et al. [18] investigated the educational achievement of graduate and undergraduate-entry medical students and found graduate-entry students showed consistent performance which was slightly better than undergraduate-entry students on the appraisal of clinical skills and bio-science over a period of two years.

Materials and Methods

This study is based on secondary data only where students' academic performance is taken as dependent variable and gender, system, group and level are taken as independent variables. Data provided by Exam Section, Amrit Campus were used for analysis. In order to include information from all running programs of Amrit Campus, results of 2075 BS (2018/19 AD) were considered in this study. Academic performance is measured in terms of Pass or Fail. Only results of regular students were used for analysis but the study did not include the students who were absent, partially absent and expelled. Because of result of dissertation M.Sc. fourth semester were also not included in the analysis. Frequency, percent followed by Chi-square test [19] and Binary Logistic Model [20] were used while analyzing data. Adequacy of the model was also checked through various tests.

The test statistic of Chi-square test as test of independent attribute can be stated as

$$\chi^2 = \sum \frac{(f_o - f_e)^2}{f_e} \quad (1)$$

Where,

f_o = Observed frequency

f_e = Expected frequency

This test is especially useful for measuring relationship between categorical variables. Binary regression model is applicable for the case in which dependent variable is of dichotomous nature and to measure the effects of independent variables on dependent variable. The model can be stated as

$$\text{Log}\left[\frac{p}{(1-p)}\right] = b_o + b_1\,(\text{Gender}) + b_2\,(\text{Group}) + b_3\,(\text{Level}) + b_4\,(\text{System}) + e_i \quad (2)$$

Where,

b_o = Constant

b_i = Regression coefficients

p = The probability of a student who is able to pass an exam

Gender = 1if a student is Female, 0 otherwise

Group = 1 if a student is from physical group, 0 otherwise

Level = 1 if a student is from bachelor level, 0 otherwise

System = 1 if a student is from annual system, 0 otherwise

e_i = Error term

Results and Discussion

Descriptive Analysis

Descriptive analysis was performed to see the characteristics of sample according to variables.

Table 1. Distribution of Variables

Variable	Category	Frequency	Percent
Gender	Male	1147	72
	Female	446	28
Group	Biological	663	41.6
	Physical	930	58.4
Level	Bachelor	1238	77.7
	Master	355	22.3
System	Annual	802	50.3
	Semester	791	49.7
Result	Fail	765	48
	Pass	828	52
	Total	1593	100

Table 1 show that 52% of the students got passed and 48% got failed. 77.7% of students are from bachelor level whereas 22.3% are from master level. The ratio of biological and physical students is almost 2:3. Percentage of students from annual system and semester system is almost same. 72% are boys and 28% are girls.

Inferential Analysis

Inferential analysis was applied to check the relationship between different variables. In the process of analysis, at first Chi-square test was performed by splitting sample into various groups. Then, Binary Logistic Regression was used without splitting sample.

Table 2. Results of General BSC students according to Combination

Combination*	Result			Chi-square (p-value)
	Fail	Pass	Total	
CBZ	95 (61.3%)	60 (38.7%)	155 (100%)	
EBC	28 (42.4%)	38 (57.6%)	66 (100%)	
EPM	53 (80.3%)	13 (19.7%)	66 (100%)	
EZC	47 (52.8%)	42 (47.2%)	89 (100%)	30.678**
M1BC	19 (54.3%)	16 (45.7%)	35 (100%)	(0.0001)
M1ZC	46 (47.9%)	50 (52.1%)	96 (100%)	
PCM	45 (60%)	30 (40%)	75 (100%)	
SPM	144 (65.5%)	76 (34.5%)	220 (100%)	
Total	477 (59.5%)	325 (40.5%)	802(100%)	

**Significant at 1%

*B = Botany, C= Chemistry, E = Environment, M = Math, P = Physics, S = Statistics, Z = Zoology, M1=Microbiology

Table 2 shows Chi-square and its p-value which indicates that there is evidence of association between results of B.Sc. students and combination. Moreover, Phi and Crammer's V values are found to be 0.196 and the values are_significant_at_1%_level of_significance. Hence, the_degree of association between two variables is weak. From Table 2, it can be observed that pass percentage is higher in the combination EBC and M1ZC whereas lower in SPM.

Chi-square and its p-value showed by Table 3 supports the association between results of B.Sc. students and Year. In addition, there is moderate degree of association between two variables as Phi and Crammer's V values are 0.429 and significant at 1% level of significance. Furthermore, the pass percentage is improved from_first_year_second year, second_year_to third_year and third_year_to fourth_year.

Table 3. Results of General B.Sc. students according to Year

Year	Result			Chi-square (p-value)
	Fail	Pass	Total	
BSCI	172 (80.8%)	41 (19.2%)	213 (100%)	147.77*
BSCII	160 (75.1%)	53 (24.9%)	213 (100%)	(0.0001)
BSCIII	98 (48.5%)	104 (51.5%)	202 (100%)	
BSCIV	47 (27%)	127 (73%)	174 (100%)	

*Significant at 1%

Table 4. Results of M.Sc. students according to Subject Major

Subject	Result			Chi-square (p-value)
	Fail	Pass	Total	
Botany	16 (29.1%)	39 (70.1%)	55 (100%)	48.529*
Chemistry	35 (35.4%)	64 (64.6%)	99 (100%)	(0.0001)
Physics	84 (58.7%)	59 (41.3%)	143 (100%)	
Zoology	5 (8.6%)	53 (91.4%)	58 (100%)	
Total	140 (39.4%)	215 (60.6%)	355(100%)	

*Significant at 1%

Evidence of association between results of M.Sc. students and subject major is justified by Chi-square and its p-value presented in Table 3. Moreover, Phi and Crammer's V values are significant at 1% level of significance and the values are observed as 0.370 indicating weak degree of association. Pass percentage is higher in case of Zoology where lower pass percentage is observed in case of Physics.

Table 5. Results of MSC students according to Semester

Semester	Result			Chi-square (p-value)
	Fail	Pass	Total	
M.Sc.I	56 (53.8%)	48 (46.2%)	104 (100%)	18.056*
M.Sc.II	47 (41.2%)	67 (58.8%)	114 (100%)	(0.0001)
M.Sc.III	37 (48.5%)	100 (51.5%)	137 (100%)	

Significant at 1%

Chi-square and its p-value of Table 5 show that there is evidence of association between results of M.Sc. students and Semester. In addition, Phi and Crammer's V values are 0.226 and the values are found_to be_significant_at 1% level_of_significance. Hence, degree of association between these two variables is weak. Furthermore, pass percentage of M.Sc. first semester to third semester is in increasing form.

Binary Logistic Regression Model

The characteristics of predector and explanatory variables influence on the selection of best suited model. When the predictor variable is dichotomous, as in case of result, where the pass and fail of the students defines the dichotomous nature, the logistic model is suitable. The unit of study is a student so the observations are independent in nature and the sample size is sufficiently large the binary_logistic_regression model is appropriate for the analysis. Results of the model are presented in the tables below.

Table 6. Omnibus Tests of Model Coefficients

Step 1	**Chi-square**	**df**	**Sig.**
Step	129.660*	4	0.0001
Block	129.660*	4	0.0001
Model	129.660*	4	0.0001

*significant at 1%

The model is significant_at 1% level_of_significance as confirmed by the _Chi-square value and p-value of Table 6. -2Loglikelihood value presented in Table 7 also supports the significance of the model. So, binary logistic regression model can be used for analysis.

Table 7. Model Summary of Binary Logistic Regression

Step	**-2Loglikelihood**	**Cox and Snell R-square**	**Nagelkerke R-square**
1	2076.215	0.078	0.104

Table 7 shows that according to Cox and Snell 7.8% of variation in academic performance is successfully explained by the model in terms of changes in log-likelihood. According to Nagelkerke, the corresponding figure is 10.4%.

Table 8. Variables in the Equation of the Model on Step 1

Covariates	**B**	**S.E.**	**Wald**	**df**	**Sig.**	**Odd ratio**
Gender	-0.008	0.138	0.004	1	0.951	0.992
Group	-0.795	0.142	31.319*	1	0.0001	0.452
Level	0.695	0.166	17.631*	1	0.0001	2.004
System	-1.510	0.146	107.353*	1	0.0001	0.221
Constant	0.766	0.144	28.505*	1	0.0001	2.152

*Significant at 1%

According to Table 8, variables group, level, and system are significant_at 1% level_of_significance whereas the variable gender is not found to be significant. Moreover, the odd of passing the exam for physical group students is likely to be 0.452 times lower than biological group students. Likewise, the odd of passing the exam for the students from annual system is likely to be 0.221 times lower than students from semester. Similarly, the odd of passing the exam for bachelor level students is likely to be 2.004 times higher than master level students.

Model Adequacy

Standard Errors (S.E.) of all independent variables are presented in Table 8 and the values are less than 2 in all cases which mean there is no problem of multicollineartiy. Moreover, the accuracy rate computed by SPSS (Statistical Package for Social Science) software is 63.1% which is larger than_the_proportional by_chance accuracy_criteria of 62.6% (1.25 x 50% = 62.6%). As a result, the requirement for categorization accuracy is justified. Therefore, the criterion for classification accuracy is satisfied. Chi-square and p-value of Hosmer and Lemeshow Test is presented in Table 9. The test is not significant_at 5% level_of_significance which confirms the goodness of fit of the model.

Table 9. Result of Hosmer and Lemeshow Test

Step	Chi-square	df	Sig.
1	9.753	7	0.203

The study analyzed students' academic performance by taking results of students of Amrit Campus. The analysis was done by using various statistical tools and techniques. At first, only general B.Sc. students were considered for analysis and found that students of EBC combination have done better than students of other combination. The association between performances of B.Sc. students and Year was also checked through Chi-square test where it was observed that B.Sc. fourth year students were performed well as compared to first, second and third. Likewise, findings while taking only M.Sc. students showed that there is association between subject major and performance and students of Zoology did better than other. Moreover, performance of M.Sc. third semester students is better than first and second.

According to the findings of Binary Logistic Regression of this study, there_is_no significant_difference in performance between male_students and female_students. Cheryan [21] has similar findings as this study where he found that performance in math by men and women are equal not only in high school but also in college. Likewise, Lindberg, et al. [22] conducted research on a_meta-analysis of more than 200 articles and discovered that there is no disparity in the sexes in term of performance. Boyer and Hickman [23] investigate the effect of gender on semester GPA and their result is also matched with this study. However, there are some researches which are not in line with this study. Sax and Harper's [24] research of thousands of students on more than 200 institutions found that women had higher GPAs than males. According to Conger and Long [25], men_are likely to have low GPA as compared to women.

While analyzing the effect of physical and biological group on academic performance, it was found that students from biological group did better than physical group. According to the findings of this study, the performance of bachelor level student is better than master level students. Babamohamadi, et al. [26] also found that B.Sc. students of nursing scored higher compared to M.Sc. students, although the difference was not significant. Yousaf and Hashim [13] compared the results of annual and semester system and found that pass percentage_of_semester system is higher than yearly_system. The finding of this study is in line with their results. Likewise, Malik, et al. [12] concluded that_there is significant_difference in academic performance between the students_of annual and semester system. So, it is a good idea to replace annual system by semester system in order to improve students' academic performance.

Conclusions

After analyzing results of students of Amrit Campus, it can be concluded from this study that group, level and system have significant impact on students' academic performance whereas gender does not influence the performance. Both male and female pupils are capable of passing a test. Biological group students are more sincere about their study than physical group. Even though M.Sc. students are more mature, Bachelor level students are hardworking and result oriented. Moreover, semester system seems to be more effective in improving the pass percentage of students than annual system. Among various combinations

in bachelor level, students of EBC combination are more serious about their study and exam than other combinations. Such seriousness is found in case of Zoology students among master level with different majors.

Acknowledgements

We would like to thank Exam Section, Amirt Campus for providing data without which this research is not possible.

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