Factors Affecting Academic Performance of M. Sc. Level Students at Tribhuvan University

Sudhir Tamang[1*] and Shankar Prasad Khanal[2]

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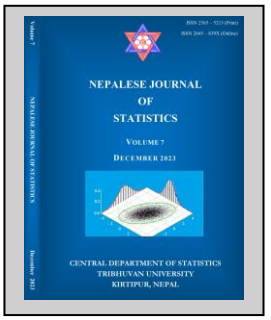

ABSTRACT

Background: Several factors contribute to a student's academic performance. Studies have examined the direct impact of student-related factors and the broader influence of social and economic factors.

Objective: To identify the important factors influencing the academic performance of Master's level students at the Institute of Science and Technology (IoST), Tribhuvan University (TU).

Materials and Methods: Primary data of 251 master's level students was collected with a questionnaire adapted and developed from similar studies. The data was collected using convenience sampling. In addition to demographic and categorical questions, five-point Likert scale questions were also used. Data analysis involved fitting a multiple linear regression (MLR) with the identified significant independent variables. The goodness of fit of the model was evaluated to assess the accuracy and reliability of the final model in explaining variations in students' SGPA (Semester Grade Point Average).

Results: The study revealed that students' motivation, study habits, and communication skills significantly influenced their SGPA. Study habits showed a coefficient of 0.118 ($p < 0.001$), indicating a positive and significant relationship with SGPA. Student motivation had a coefficient of 0.19 ($p < 0.001$). Similarly, Higher levels of motivation were linked to improved SGPA outcomes. Communication skills exhibited a coefficient of 0.086 ($p < 0.001$) at a 5% level of significance. All these factors had a positive coefficient which means students better on these factors on an average will tend to have better academic performance.

Conclusion: Study habits, motivation, and communication skills were found to have a significant effect on students' SGPA. Therefore, we can conclude that at the master's level in IoST, TU, the primary determinants of students' SGPA are their characteristics such as their motivation, study habits, and communication skills.

Keywords: Academic performance, ANOVA, multiple linear regression, M. Sc. level students, Tribhuvan University.

Address correspondence to the author: Central Department of Statistics, Institute of Science and Technology, Tribhuvan University, Kirtipur, Kathmandu, Nepal[1, 2].
Email: sudhirtamang5@gmail.com[1*](Corresponding author email); drshankarcds@gmail.com[2]

INTRODUCTION

Education is a fundamental aspect of life, providing knowledge and skills that are paramount in a fast-paced technologically advancing world. It is a key factor for personal and societal growth, enabling individuals to thrive in a competitive environment and escape poverty (Van der Berg et al., 2011). Academic performance, which reflects students' achievements, plays a crucial role in identifying and nurturing talented individuals who can become future leaders and contribute to a nation's economic and social development (Ali et al., 2009). It is widely recognized that quality education and strong skills are vital for survival in a competitive society, economic growth, and alleviating poverty (Van der Berg et al., 2011). Fuente and Cardelle-Elawar's (2009) studies have cemented how the students' approach and study habits can affect their examination results. The study further evidenced a significant correlation between how students put their study habits, whether they are hardworking or used to the intelligent study approach. Fuente and Cardelle-Elawar (2009) have also concluded that student study planning and strategy have been the best option for students of top scorers because of their effectiveness. On the other hand, studies by Indreica et al. (2011) showed that time wasting had been the most defining difference that makes students struggle before the final exam. From the study, approximately 73 per cent of students started to struggle at the last minute for the final exam. Students fail to be organized in their studies, which leads them to perform worse than in previous examinations performance (Indreica et al., 2011). A correlational study of 252 students done by Amrai et al. (2011) found a significant relationship between academic achievement and academic motivation. The findings were in good agreement with other similar studies which investigated motivation and academic performance (Sh, 2004; Ali et al., 2009). Another study (Kusurkar et al., 2013) using the structural equation modeling analysis technique studied the motivation of medical students on their performance. They found that the student's motivation positively associated with academic performance through higher study effort and deep strategy towards study.

Students lacking communication skills are more likely to do poorly in their academics (Aina et al., 2013). Also, Su and Ow (2004) observed that a high aptitude for English and communication skills contributed to improved performance in computer science. Another study (Aina et al., 2013) found that academic performance in science is positively associated with students' aptitude for English language and communication skills. At the same time, other studies have found that inefficiency in language and communication skills leads to poorer academic performance (Ayodele,

1988; Falayajo, 1997). Similarly, much effort has also been made to determine differences, if there are any, in academic performance due to gender. Haist et al. (2000) found that women outperform men in some settings while men perform better than women in others. However, Borde (1998) found no differences. The study by Ballard and Johnson (2005) examined the differences between males' and females' ability to cope with accounting subjects. The study's outcome has concluded that women were likely to perform less than men, and the gender variable has shown a significant relationship to academic performance. The other studies by Binti et al. (2010) examined the academic performance of mathematics students according to their gender. The result showed that women achieve better academic performance than men in their CGPA, where 0.5 percent of first-class degree receivers were 88% female and another 12% men. The same pattern goes for a second-class degree (Binti et al., 2010). However, McDowall and Jackling (2010) found opposing features citing no significant relationship among genders toward accounting academic success.

Amutabi (2003) discusses the effect of socioeconomic status on children's willingness for school: The segregating nature of the social class and ethnicity may well reduce the variety of inspiring experiences assumed to be a prerequisite for creating a willingness to learn among children. Even in families with above-average salaries, parents often lack the time and vigor to devote entirely to their children's school preparation (Ominde, 1964). They occasionally face a limited range of choices for high-quality child care both before their children start schooling and during the early school years. Annette (2003) state that "low maternal education and minority-language status are most consistently associated with fewer signs of emerging literacy and greater difficulties in preschoolers." One of the interesting factors that our research focuses on is parents' level of education and its effect on the student's academic performance at the Master's level. A study by Idris et al. (2020) found a large and significant correlation between parents' education and their children's academic achievement. Using systematic random sampling, he collected data on 10^{th} standard government high school students. Furthermore, this study found that the children of parents with high educational degrees have accomplished much better (87.67% passing percentage) than those of less educated and illiterate parents (56.89% passing percentage). Khan et al. (2015) did another study at the secondary level of education with same result. Samples of two hundred students of Grade 10th were taken. The analysis was performed using an independent Z-test (Zcal = 3.87) at a 5% significance level.

The Nepalese government recognizes the importance of education in nation-building (MoE, 2018). Tribhuvan University (TU) holds the distinction of being Nepal's largest public university, offering numerous courses and accommodating a large student body across affiliated campuses. TU carries the primary responsibility of nurturing talented individuals to drive the country's development. The central departments within TU, notably the Institute of Science and Technology (IoST), hold significant roles in producing highly skilled graduates, particularly those

with Master's degrees. Ensuring that these academic institutions produce exceptional graduates who can advance and represent the nation is crucial. However, limited research has been conducted on the factors influencing academic performance specifically among students at TU. Hence, by considering the multifaceted factors influencing academic performance, our research aims to investigate the key determinants affecting students' academic performance in graduate studies, providing valuable insights to enhance educational outcomes and contribute to individual and societal development.

METHODOLOGY

Study area

The research was conducted at the Central Departments of the IoST, located at the central campus of TU in Kirtipur, Kathmandu. This study specifically focused on the 12 Central Departments in IoST at Kirtipur (Table 1), excluding the Central Department of Food Technology as it is outside of Kathmandu Valley. Furthermore, the study excluded a newly established school offering a Data Science program in its first semester, as there were no eligible students for the study. This research focused on 1st-semester students' semester grade point average (SGPA) who were currently studying in their 4th semester. Data collection commenced on January 3, 2022, and concluded on April 2, 2022, after ensuring a sufficient quantity of high-quality data had been obtained.

Data

To ensure objectives are met, a meticulously designed structured questionnaire was employed to gather reliable, accurate, and unbiased data. The questionnaire was developed specifically for this research based on similar studies (Hongbin et al., 2020; Omran & Saleh, 2019; Rabia et al., 2017). Data collection methods encompassed the utilization of either Google Forms or in-person interviews, depending on the most suitable approach for each situation. Prior to the main data collection, a pilot survey was conducted involving 25 participants from 9 different departments. The estimated variance of SGPA of the population from the pilot survey was used in sample size calculation and the required sample was estimated to be 210. The estimated standard deviation of SGPA was estimated to be 0.37. So, at 5% level of significance, the sample size was obtained as follows:

$$n = \left(z \times \frac{\sigma}{d}\right)^2 = \frac{(1.96 \times 0.37)^2}{0.05^2} = 210(\text{approx.})$$

where n is the sample size, d is the margin of error, and z is the Z-score. However, we took 251 samples for a greater representation of the targeted population. So, a total of 251 responses were obtained using convenient sampling, with 203 responses collected through online submissions via Google Forms, 28 responses gathered via phone interviews, and 20 responses collected through

face-to-face interactions. This study aims to initiate research on academic performance at TU for which the preliminary findings/research are a great way to start. Also, the difficulties due to the Covid-19 pandemic we had to compromise on sampling methods and had to go with convenience sampling. Much thought was given during the proposal period of the research considering the time limit of this masters' research. In instances where a student failed to respond within a two-week period, they were replaced by another student from their respective department.

Table 1. Population and sample size in each department.

Department	Sample size (%)	Population (%)
Central Department of Physics	47 (18.7)	114 (18.8)
Central Department of Chemistry	35 (13.9)	84 (13.86)
Central Department of Geology	30 (12.0)	73 (12.05)
Central Department of Mathematics	26 (10.4)	67 (11.05)
Central Department of Zoology	24 (9.6)	58 (9.6)
Central Department of Statistics	21 (8.4)	49 (8.1)
Central Department of Environmental Science	21 (8.4)	48 (7.9)
Central Department of Botany	12 (4.8)	30 (4.95)
Central Department of Microbiology	12 (4.8)	28 (4.6)
Central Department of Computer Science and Information Technology	10 (4.0)	26 (4.3)
Central Department of Bio-Technology	9 (3.6)	21 (3.5)
Central Department of Hydrology and Meteorology	4 (1.6)	8 (1.3)

Table 1 presents the population size and corresponding sample size collected from each department. The sampling process ensured that the sample taken from each department was proportional to its population size, allowing for a considerable representation of students from all departments of IoST. Study habits, academic stress, motivation, and communication skills were the only variables measured using multiple items. Each item is a 5-point Likert scale so, their internal consistency was measured using Cronbach's alpha. Table 2 shows that the items under the variable motivation and communication are internally consistent (> 0.7), while the items under study habits and academic stress are not found to be internally consistent (< 0.7). Although these have a value of less than 0.7, still these two are considered for analysis as per Nunnally's recommendations (Nunnally, 1967).

Table 2. Cronbach's alpha of items within factors.

Variables	Cronbach's alpha
Study habits	0.537
Academic stress	0.603
Motivation	0.774
Communication skills	0.759

Statistical model

Semester Grade Point Average (SGPA) is the response variable used. Twelve independent variables that influence SGPA were studied. The variables were students' gender, romantic status in 1st semester, both parents' education, family income, personal expenditure, age, study habits, motivation, academic stress, communication skills and percentage obtained in undergraduate study. Study habits, motivation, academic stress and communication skills were measured with 8 items, 6 items, 6 items and 7 items by using a five-point Likert scale respectively. To detect differences in SGPA among different groups, statistical tests such as the F-test and t-test were performed. Only those factors that had a significant association with SGPA (p-value < 0.05) were used in the final model. Additionally, a selection process was employed for the final model, where each ratio scale independent variable underwent simple linear regression analysis, and only those variables showing statistical significance were chosen for inclusion in the final model. Bivariate analyses of factors found to be significant are presented in tables in the results section. The model for multiple linear regression is:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_k X_k + \epsilon$$

where,

Y = Response variable (SGPA)

β_i = unknown parameters

X_i = Explanatory variables

ϵ = Random error or Disturbance term

Model's performance checking

After fitting the model, the accuracy of the fitted model was determined using the coefficient of determination, adjusted coefficient of multiple determination, multicollinearity test, one-sample Kolmogorov-Smirnov test. Since the assumption of normality is very essential in the fitted model this was further assessed using probability plots.

RESULTS AND DISCUSSION

Table 3 provides descriptive statistics for the dependent variable, SGPA, as well as various continuous independent variables. These statistics are based on primary data collected from a sample of 251 students. The average age of students was 26 years which is approximately half their

parent's age as shown in Table 3. Students' mothers were on an average younger compared to their fathers. The highest percentage obtained in bachelors was 82% and the minimum percentage was 44%. The study habits score ranges from 1.88 to 3.67 with a standard deviation of 0.56. Similarly, Table 3 summarizes all the ratio scale variables used in the study.

Table 3. Descriptive statistics.

Variable	Number	Min.	Max.	Mean	Std. deviation
SGPA (out of 4)	251	2.60	4.00	3.51	0.24
Student's age (in years)	251	23	36	25.58	1.43
Mother's age (in years)	251	38	69	50.01	5.61
Father's age (in years)	251	40	80	54.85	6.26
Bachelor's percentage	251	44.00	82.00	63.11	6.67
Study habits	251	1.88	5.0	3.67	0.56
Motivation	251	1.67	5.0	3.75	0.69
Academic stress	251	1.0	5.0	2.99	0.71
Communication	251	1.0	5.0	2.99	0.798

Table 4 shows that 39(15.5%) respondents had a monthly family income of less than NPR 20,000. 53(21.1%) had a family income between NPR 20,001 to NPR 30,000. Furthermore, most respondents responded 58(23.1%) with a family income above NPR 50,000. Similarly, Table 4 shows that 86(34.3%) of all the respondents had an expenditure of NPR 10,001 to NPR 15,000 during their first semester. This category forms the bulk of the respondents in this survey.

Table 4. Distribution of Socio-economic variable.

Monthly family income	Number (%)	Total monthly personal expenditure	Number (%)
Less or equal to NPR 20, 000	39 (15.5)	Less or equal to NPR 5,000	30 (12.0)
NPR 20,001 – NPR 30,000	53 (21.1)	NPR 5,001 – NPR 10,000	53 (21.1)
NPR 30,001 – NPR 40,000	56 (22.3)	NPR 10,001 – NPR 15,000	86 (34.3)
NPR 40,001 – NPR 50,000	45 (17.9)	NPR 15,001 – NPR 20,000	46 (18.3)
Above NPR 50,000	58 (23.1)	Above NPR 20,000	36 (14.3)

Here Table 5 shows that among 251 respondents, 103(41.0%) of them were females, the remaining 148(59.0%) were males. Among them, 93(37.1%) responded as living with others in rent by sharing with others, 84(33.5%) said they were living in a single rent, 62(24.7%) were living with their parents, and only 12(4.8%) were living in their relative's house. Among them, 198(78.9%) of

them said they were single during their first semester, 22(8.8%) said they were in a romantic relationship, 16(6.4%) of them said they were married, and 15(6.0%) preferred not to disclose their relationship status.

Table 5. Distribution of gender, living status, and relationship status.

Demographic variable	Categories	Number (%)
Gender	Female	103 (41.0)
	Male	148 (59.0)
Living status	In rent with other	93 (37.1)
	Single rent	84 (33.5)
	Parents	62 (24.7)
	Relatives house	12 (4.8)
Relationship status	In a relationship	22 (8.8)
	Married	16 (6.4)
	Prefer not to say	15 (6.0)
	Single	198 (78.9)

There are considerable number of parents (mothers and fathers of respondents) who did not attend the school for their studies (Figure1). It was reported in the study that 20 students' fathers and 5 students' mothers each completed their master's level education.

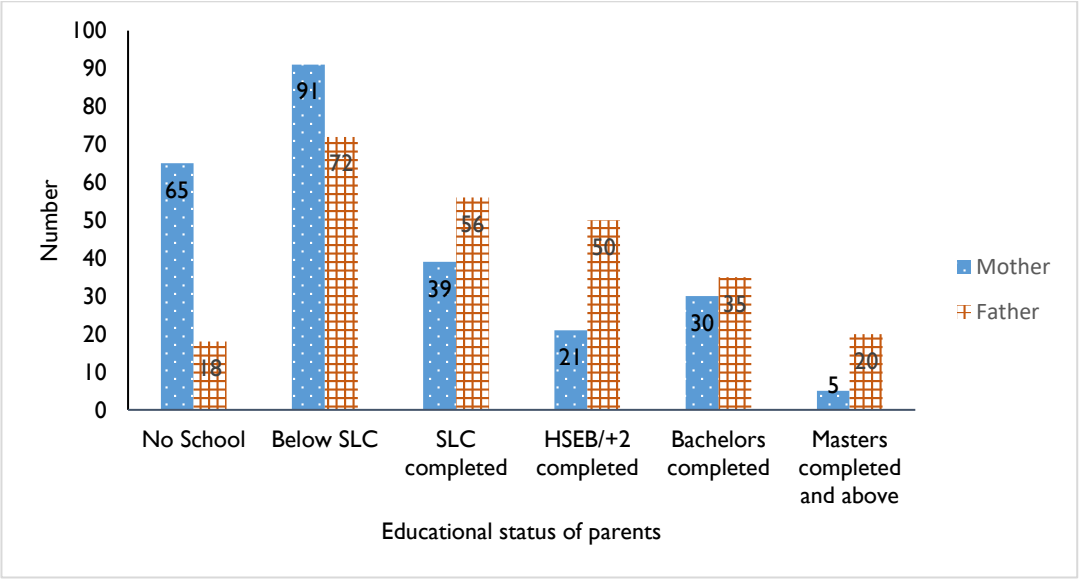

Fig. 1. Level of education of parents.

Table 6 shows a statistically significant difference in students' academic performance with differing expenditure habits. At a 5% level of significance, we reject the null hypothesis and conclude that academic performance as measured by SGPA varies depending on the personal expenditure of the students at MSc. Level in Tribhuvan University central departments. However, the coefficient was not statistically significant when this variable was included in the final model. Hence, this variable was not included in the final model. After the bi-variate analysis, only continuous independent variables study habits, motivation and communication skills were found to have a significant effect on SGPA at 5% level of significance. So, for the construction of the final MLR, only these variables were chosen. Age, gender, relationship status, parent's education, monthly family income, total monthly personal expenditure, academic stress and percentage obtained in undergraduate are not found to have statistically significant influence on academic performance. Thus, these factors were not included in the final model.

Table 6. Comparison of academic performance by personal expenditure.

Personal Expenditure	Frequency	Mean	Std. Deviation	F-value	p-value
Less or equal to NPR 5,000	57	3.51	0.23	3.813	0.005
NPR 5,001 – NPR 10,000	65	3.61	0.22		
NPR 10,001 – NPR 15,000	42	3.49	0.20		
NPR 15,001 – NPR 20,000	51	3.43	0.28		
Above NPR 20,000	36	3.49	0.28		

Final model

Table 7 summarizes the fitted final MLR where academic performance as measured by SGPA is explained by the study habits of students, motivation, and communication skills. MLR was used to estimate the effect of explanatory variables which the study is interested in on students' academic performance. Only three variables turned out to be significant (Table 7). Let Y_i, represents the academic performance of students as measured by SGPA, SH_i, represents the study habits of students, M_i, represents the motivation of students and C_i, represents the communication skills of the students, and then the multiple linear regression model can be written as:

$$Y_i = 2.103 + 0.118 * SH_i + 0.190 * M_i + 0.086 * C_i$$

Looking at the mathematical model, we can conclude that study habits, motivation, and communication positively affect students' academic performance. Since the coefficient of all the variables study habits, motivation, and communication are positive, we can conclude that these variables positively affect the SGPA. Also, study habit has the highest coefficient in magnitude, so we can conclude that study habits have a much more significant influence on SGPA. Although positive, communication has the least coefficient, so we conclude that communication has a smaller

effect on the SGPA. According to Table 7, when assessing the overall significance of the model at a 5% level of significance, we observe that the p-value is < 0.001. This indicates that the overall model is statistically significant. Hence, we can conclude that the model provides a meaningful fit to the data and exhibits a significant relationship between the independent variables and the students' SGPA.

Table 7. Regression of academic performance on all the significant variables (n=251).

Variable	Unstandardized Coefficients		95% CI for β		t	p-value
	β	Std. Error	Lower	Upper		
Constant	2.103	0.082	1.941	2.265	25.541	< 0.001
Study Habit	0.118	0.020	0.078	0.158	5.837	< 0.001
Motivation	0.190	0.016	0.158	0.222	11.544	< 0.001
Communication	0.086	0.013	0.061	0.111	6.827	< 0.001
The value of F with (3,247) degrees of freedom = 112.277, p < 0.001 Adjusted R^2 = 0.577, and standard error of estimate: 0.158						

Diagnostics of the fitted regression model

Table 8. Test of presence of multicollinearity.

Variables	Collinearity Statistics	
	Tolerance	VIF
Study Habits	0.772	1.295
Motivation	0.776	1.289
Communication	0.995	1.005

Table 8 clearly shows that the fitted model is free of the multicollinearity problem as the value of VIF for all variables is less than 2. So, the final fitted model can be trusted as there are no variables with high correlation within themselves.

Table 9. Test of normality of residuals.

N	Mean	Std. deviation	Kolmogorov-Smirnov Z	p-value
251	0.000	0.0099	0.051	0.2

According to Table 9, the p-value is 0.2, which exceeds the significance level of 0.05. Therefore, at a 5% level of significance, we fail to reject the null hypothesis of there is no difference between the distribution of residuals and the normal distribution. This suggests that the assumption of normality for the model's residuals is satisfied, which is a crucial assumption for the validity of the model. Figure 2 provides evidence that there is no violation of the assumption of the normality

of the residuals since the data points are observed along the straight line reasonably. This finding strengthens our confidence in the fitted model, as it indicates that the residuals adhere to a normal distribution as assumed. This assurance in the normality of the residuals supports the validity of the model's predictions and results, lending credibility to its overall performance. Figure 3 shows that the variance of the residuals of the model is reasonably constant. So, we can assume that the variance of the error term is homoscedastic. There are a few values that are not within 3 standard deviations which can be considered outliers. However, the exclusion of these values did not significantly affect the final model so these values are kept as is.

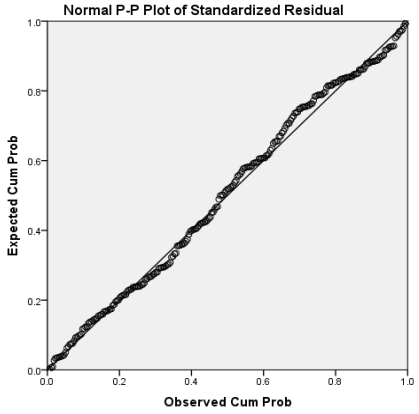

Fig 2. Normal P-P plot of standardized residuals

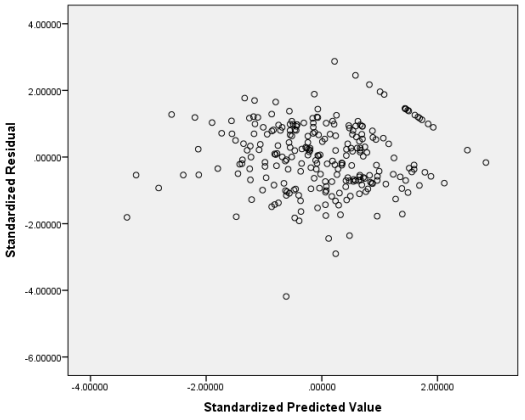

Fig. 3. Test of homoscedasticity of residuals.

Our research done in IoST, TU showed that the factors such as students' study habits, motivation and communication skills have a positive impact on their academic performance. This agrees with previous research done on academic performance (Fuente & Cardelle-Elawar, 2009; Indreica et al., 2011; Montes, 2012; Amrai et al., 2011; Sh, 2004; Ali et al., 2009; Su & Wo, 2004; Aina et al., 2013). At the master's level, students themselves are more responsible for their academic success than anything else. Some studies (Haist et al., 2000; Ballard &Johnson, 2005) found that women outperformed in academics. However, our research did not find any significant difference in academic performance among different gender. Studies (Idris et al., 2020; Khan et al., 2015) have seen a positive association between parent's education level and their children's academic performance, but we found no association between parents' education level and students' academic performance. These findings can assist the University Admission Board in refining their student admission methods to promote academic success. Additionally, the research report will serve as a valuable reference for future researchers interested in studying the academic performance of TU. They can build upon the limitations of this study. Importantly, individual students can directly benefit by addressing the factors identified as positively influencing academic performance, students can actively work towards improving their chances of achieving success in their academic endeavors.

Limitations

It is conducted only at the Central Departments of the IoST, TU using non-probability sampling, a convenient sampling. So, the results of this research cannot be generalized for and beyond IoST, TU. At most, the results from this study can act as a hypothesis for studies in other Universities, other departments, and IoST. Moreover, this research looked into academic performance only from the perspective of marks obtained by the students, i.e., SGPA. There are multiple ways to measure academic performance, and research has also been conducted using different measures. Since this study collects first-semester academic data of students currently studying in the 4th semester, there may be some recall bias.

CONCLUSION

The study highlights that students' intrinsic characteristics, including motivation, study habits, and communication skills, are the primary influencers of their SGPA. Bivariate analysis reveals that there are no significant differences in SGPA among different income groups, suggesting that family income does not play a role in academic performance at the M.Sc. level. Similarly, gender does not have a discernible impact on SGPA, indicating that male and female students in the central department of IoST perform similarly. Based on these findings, the study concludes that students bear greater responsibility for their academic performance at the M.Sc. level.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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