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A Study on Academic Attainment of Agriculture Students and its Correlates: A Dummy Regression Approach

Herojit Singh[1] · Abhijnan Das[1] · Soumik Dey[1] · Lakshmi Narsimhaiah[1] · Pramit Pandit[1] · Kanchan Sinha[2] · P. K. Sahu[1] · P. Mishra[3]

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Abstract

Education is a Nation's strength. Association analysis of academic performance and its influential factors has remained research interest for all education researchers all over the world. India being an agriculture dominated country, for its development in agricultural front it requires ahuge numberof efficient technocrats having strong academic background. In this study an attempt has been made to examine the associationship of academic performance of the agriculture graduates, as measured through overall grade point average (OGPA) with the factors supposed to influence the academic performance. Special emphasis has been given to visualize the performance in presence of the influences of nominal factors. Students at masters level were surveyed for their social, economic, demographic and family and educational background through a designed questionnaire and tested accordingly. Statistical tools, starting from frequency, percentage, Chi-square test, test for normality, Cramer's V test, multiple regression analysis with the inclusion of dummy variables were employed. Dependency of OGPA with gender, caste and expenditure on education is recorded. The dependency of educational expenditure on OGPA is quite obvious. But the dependency of OGPA with those of gender and caste is most probably not a good sign for a healthy higher education system. This study will help the education planners to take group oriented action plan for improving the education standard in higher education institutions.

Keywords Accademic attainment · Agricuture · Correlates · OGPA · Student

✉ P. Mishra
pradeepjnkvv@gmail.com

[1] Department of Agricultural Statistics, Bidhan Chandra KrishiViswavidyalaya, Mohanpur, Nadia, India

[2] ICAR- Indian Agricultural Statistics Research Institute (IASRI), New Delhi, India

[3] College of Agriculture, JNKVV, Powarkheda, Madhya Pradesh, India

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1 Introduction

Philosopher Jean Jacques Rousseau once wrote: "Plants are shaped by cultivation and humans by education". Education is defined as the process of learning, knowledge building, developing skills, values, beliefs, and habits. In this direction,education especially higher education systemnot only enrichesthe lives of individuals, but also helps in overall development of the nation. The prime vision of higher education in India is to utilize the country's human resource potential to its highest possible extent and channelising it to number of development-linked strategies to enhance human capital of the nation. India is primarily an agriculture based country and its economy largely depends upon agriculture. Agriculture and allied sectors contribute about 17% to the total GDP and more than 50% of the workforce depends on it for their livelihood. Therefore, India's overall development largely depends upon the prosperity of agriculture sector. For the development of agriculture, efficient man power is needed which can be obtained through strengthening the agriculture education and organizing the agri-students for the betterment of farming community. These technocrats are mostly coming out of agriculture universities. The need for efficient man power with natural resources was felt time and again. Good students with strong academic background in majority of the cases, are the basis for obtaining efficient manpower for this purpose. Academic performances is mostly measured through overall grade point average (OGPA). While discussing the analysis of socio-economic correlates, different authors have discussed about the problems and prospects in such data analysis [9–12]. This study is an attempt to picturize the effect of the factors in deciding OGPA, especially the qualitative factors that cannot be directly included in the analysis unless these are made quantitative or coded in certain manner. One of the techniques in using qualitative variables in analysis is to assign suitable values against this factors.

A Dummy variable or Indicator variable is an artificial variable created to represent an attribute with two or more distinct categories/levels. For example,

$$\mathrm{D} = \begin{cases} 1, & \text{if the person is male} \\ 0, & \textit{otherwise} \end{cases},$$

$$\mathrm{D} = \begin{cases} 1, & \text{if Urban} \\ 0, & \text{otherwise} \end{cases}$$

"Dummy variables" approach allows us to represent nominal-level variables in statistical analysis. Dummy variables are used in agriculture in many ways viz. design of experiments, investigating structural stability in input-yield response models, time series analysis, seasonal analysis and qualitative data applications, agri-economic forecasting, response modeling, etc. Application of dummy variables is also found in research concerning on factors influencing the overall academic performance of agriculture graduates.

Abdullahi et al. [1] worked on analysis of determinants of students' academic achievement in agricultural sciences in Nigeria. The study revealed parent's

education, parent's occupation, family feeding, provision of resource materials, visits to schools, provision of pocket money, and residential type are the variables having positive impact on academic achievement. The study also also revealed gap associated with differences in the students' attributes, and the desire for parents to provide better educational opportunities to their children. Ogweno et al. [8] worked on influence of students' characteristics on academic performance in secondary agriculture education in Rachuonyo North Sub County, Kenya. The study observed that students' age, career choice, gender, study times and class attendance positively influenced students' performance. Choudhury et al. [4] studied the relationship between personality traits, academic achievement and salary in a reputed B-School in Bangalore. Study revealed that only confidence has a correlation with salary and CGPA is correlated with self-motivation and confidence. Bulala et al. [2] worked on location as a factor in the prediction of performance in Botswana Junior School Certificate Agriculture Examinations by continuous assessment scores. The study revealed no significant difference between students' academic performance in rural, peri-urban and urban secondary schools in agriculture junior school certificate examinations. Ndirika and Njoku [7] worked on home influences on the academic performance of agricultural science students in Ikwuano Local Government Area of Abia State, Nigeria. The study reported that different factors intelligence, health, motivation, anxiety, etc. and their environment i.e. availability of suitable learning environment, adequacy of educational infrastructure such as textbooks and well equipped laboratories and library are the important factors. The students' socioeconomic standings tend to have a lasting effect on their academic performances. Studies have focused on assessing the learning styles of students in colleges of agriculture. Learning styles have been found to have a positive relationship with academic performance, as measured by grade point average [5] performance in agriculture courses [6], and overall success in higher education [3] ; (Cano 1999). With this backdrop, the present study is an attempt to find out the relatively important factors associated with the academic performances of agriculture students with the inclusions of the number of dummy variables in the associationship model with specific objective to examine the relationship of the academic performances with the factors and demonstrate the impact of the use of dummy variables in identifying the performances of different categories of students.

2 Materials and Methods

Bidhan Chandra Krishi Viswavidyalaya (BCKV) is one of the pioneer agriculture university in India, imparting teaching, research, extension for the betterment of agriculture in West Bengal since its inception in 1974. As such, students of this university is purposefully selected to study the factors that determine their level of performance in Undergraduate level (in terms of OGPA). Data were collected through a given questionnaire from the Masters students admitted during 2014–2015 session across all faculties. Out of 310 students who took admission, 150 students (106 were males and 44 females) were selected at random for the study.

Different characters are examined using different descriptive statistics along with their frequency distribution. The point of interest in this study is the academic performance of the M.Sc.(Ag.) students at the graduation level as measured through overall grade point average. Thus the associationship of OGPA along with social, economical and other related variables are analyzed through χ^2 test for independence of attributes, followed by Cramer's V test (in the event of rejection of independency) and dummy regression approach. Most of the students are found to have got their Secondary and Higher Secondary degrees in percentage of marks basis, whereas their graduation marks have been awarded in 10 point scale OGPA. To keep parity and for the sake of clarity of understanding the OGPA is transformed into percentage using conversion method. In the following sections statistical tools used are discussed.

3 Anderson–Darling Test for Normality

It is one of the most powerful statistical tools for detecting most departures from normality. For testing of normality Anderson–Darling test is usedto test:

H_0: The data follow Normal distribution, against

H_1: The data do not follow Normal distribution

Anderson–Darling test statistic (A^2) is defined as

$$A^2 = -N - S$$

where $S = \sum_{i=1}^{n} \frac{(2i-1)}{N} \left[\ln F(Y_i) - \ln(1 - F(Y_{N+1-i}))\right]$. F is the cumulative distribution function of normal distribution, Y_i are the ordered data and N is the sample size. In this case the critical values for the Anderson–Darling test are dependent on normal distribution that is being tested. The test is a one-sided test and the hypothesis that the distribution is of a specific form is rejected if the test statistic, A^2 is greater than the critical value.

4 χ^2 Test for Independent of Attributes

It is used to test the independence of two characters in a (r×s) contingency table. A test of independence assesses whether paired observations on two variables(mostly categorical), expressed in a contingency table, are independent of each other. To test:

H_0: Two attributes are independent of each other against

H_1: Two attributes are not independent of each other,the test statistic is defined as

$$\chi^2_{(r-1,s-1)} = \sum_{i=1}^{r}\sum_{j=1}^{s} \frac{(o_{ij} - e_{ij})^2}{e_{ij}}$$

$$= \sum_{i=1}^{r}\sum_{j=1}^{s} \frac{o_{ij}^2}{e_{ij}} - n$$

where o_{ij} = observed frequency for (i, j)th cell, e_{ij} = expected frequency for (i, j)th cell

$$n = \sum o_{ij} = \sum e_{ij}$$

If the table value of χ^2 at specified level of significance at corresponding degrees of freedom be greater than the calculated value of χ^2 then the test is non-significant and the hypothesis of independence of attributes can not be rejected.

5 Cramér's V

In statistics, Cramér's V (sometimes referred to as Cramér's phi and denoted (φ_c) is a measure of association between two nominal variables, giving a value between 0 and +1. φ_c is the inter-correlation of two discretevariables and may be used for variables having two or more levels. φ_c is a symmetrical measure, it does not matter which variable we place in the columns and which in the rows. Also, the order of rows/columns doesn't matter, so φ_c may be used with nominal data types or higher (ordered, numerical, etc.). Cramer's V is computed by taking the square root of the Chi-squared statistic divided by the sample size and the minimum dimension minus 1. The probability value correcponding to Cramer's V score helps in deciding the significance of the test where p value less than 0.05 denotes significant association between two variables. In general a value of V statistic around 0.20 to 0.30 shows significant association between two varibles. In general this test is employed once χ^2 square test for independence of attributes is rejected. The test statistic V is defined as

$$V = \sqrt{\frac{\varphi^2}{\min(r-1, s-1)}} = \sqrt{\frac{\chi^2/n}{\min(r-1, s-1)}}$$

where φ^2 = phi coefficient χ^2 = derived from Pearson's Chi-squared test, n = grand total of observations, r = no. of rows, s = no. of columns.

6 Regression Analysis

The most powerful and widely used statistical tool in describing the relation between the dependent variable and the independent variable(s) is the regression analysis. In a regression model, the dependent variable is presemted as the function of one or more independent variable(s) and the error term, $Y = f(X_i, u)$, where i stands for ith independent variable and u is the random component i.e. error term $u_i \sim$ i.i.d. $N(0, \sigma^2)$. But with the introduction of categorical variables (dummy variables) the dummy regression approach is used and the functional form becomes $Y = f(X_i, D_j, u)$, where, Y is dependent variable, X_i's are

quantitative variables and D_j's are dummy variables used in representing the categorical variables in the regression model with the order varies according to their levels.Use of dummy variables in relational analysis provides many benefits in explaining and segmenting the relationship under given situation.

7 Results and Discussion

Altogether eighteen quantitaive and four qualitative variables are considered, to study their effects in deciding academic achievements of the students at under-graduate level. The quantitative variables can be categorized under the following heads:

(a) Marks obatained by the student at different stages (viz. marks at secondary, higher secondary level and marks of eight semesters during their under graduate programme) as these marks are one of the major factors influencing the academic performance (OGPA) on completion of under graduate studies.
(b) Several sources of income for example, agricultural income, non-agriculture income along with total income are taken for the study. Along with these several other qualitative and psychological factors, familiy income is also considered as a factor in deciding the student's performance.
(c) Besides several sources of income, family expenditure also plays a great role in student's academic performance.

Dpending upon the nature of the four qualitative characters viz. gender (male/female), father's profession (business/farming/self-employed/service/teacher), category (general/SC/ST), place of residence(urban/rural) dummy variables are assigned accordingly.

Table 1 provides an insight into the distribution of sampled students in different attributes viz. gender, profession,category and residence. So it would be pertinent to analyse the information group wise.

7.1 Test for Normality

OGPA is the principle dependent character in our study. So we are interested to test the normality for OGPA of all the 150 respondents using Anderson–Darling Test.

7.2 Test Interpretation

H_0: The variable from which the sample was extracted follows a Normal distribution against

H_1: The variable from which the sample was extracted does not follow a Normal distribution.

As the computed p-value is greater than the significance level $\alpha = 0.05$, one cannot reject the null hypothesis H_0. Hence the sample follows normal distribution at $p = 0.05$ (Table 2)

Table 1 Characteristic features of the students. classification of students based on qualitative characters

Particulars	Classes	Frequency	Percentage
Gender	Male	106	70.67
	Female	44	29.33
Father's profession	Business	36	24.00
	Farmer	19	12.67
	Self employed	6	4.00
	Service holder	68	45.33
	Teacher	21	14.00
Category	General	106	70.67
	SC	28	18.67
	ST	16	10.67
Residence	Urban	72	48
	Rural	78	52

Table 2 Normality test of OGPA of students

A^2	0.544
p-value	0.159
alpha	0.056

7.3 Test for Associationship

7.3.1 Test for Independence of Performance with Gender of Students

7.3.1.1 To Test H_0: Performance is independent of gender of students, against

H_1: Performance is not independent of gender of students

To identify whether the performance of the students vary genderwise or not χ^2 test for independence of attribute was attempted and the results are tabulated in Table 3.

Table 3 shows that the *p*-value of χ^2 is less than 0.05; hence the test is significant and H_0 is rejected. Thus there is dependency between gender of students with their academic performance. From this we conclude that the performance is gender biased. This is again established by the Cramer's V test. Under ideal situation the boys and girls student should have performed equally well (Table 4).

7.3.2 Test for Independence of Performance with Father's Profession

7.3.2.1 To Test H_0: Performance of students are independent of their father's profession, against

H_1: Performance of students are not independent of their father's profession

From the Table 4 it is quite obvious that father's profession has no role to play in deciding the academic performance of the students as the calculated value of χ^2 is much lesser than the corresponding table value hence the test is non-significant

Table 3 Gender dependence of academic performance

Gender	OGPA (%)		
	< 75	75–80	> 80
Male	3	23	18
Female	28	48	30
χ^2 Cal.	7.64		
$\chi^2_{2,0.05}$	5.99		
Cramer's V score	0.23 ($p=0.02$)		

Table 4 Dependence of academic performance on father's profession

Profession	OGPA (%)		
	< 75	75–80	> 80
Business	12	16	8
Farmer	7	8	4
Self-employed	3	3	0
Service holder	18	33	17
Teacher	8	11	2
χ^2 Cal.	5.14		
$\chi^2_{8,0.05}$	15.51		
Cramer's V score	0.13 ($p=0.78$)		

and we cannot reject H_0.Thus, one can conclude that this finding contradicts the results obtained from the study of Abdullhai et al. [1] where parents occupation had impact on academic performance of the students.

7.3.3 Test for Independence of Performance with Category of Students

7.3.3.1 To Test H_0: Performance is independent of category of students against
H_1: Performance is not independent of category of students

From Table 5 it is clear that the p-value of χ^2 is 0.05 hence test is significant and H_0 is rejected. There is dependency between category of students with their academic performance. The performance of the students are category biased. This is again established by the Cramer's V test. Under ideal situation General, Schedule Caste and Schedule Tribe student should have performed equally well but this is not happening.

7.3.4 Test for Independence of Performancewith Domicile Background of Students

7.3.4.1 To Test H_0: Performance is independent of domicile background of students, against
H_1: Performance is not independent of domicile background of students

Table 5 Category dependence of academic performance

Category	OGPA (%)		
	< 75	75–80	> 80
General	20	47	39
SC	4	18	6
ST	7	6	3
$\chi^2_{\text{Cal.}}$	9.69		
$\chi^2_{4,0.05}$	9.49		
Cramer's V score	0.19 ($p=0.05$)		

Table 6 Domicile dependence of academic performance

Background	OGPA (%)		
	< 75	75–80	> 80
Rural	18	37	23
Urban	13	34	25
$\chi^2_{\text{Cal.}}$	0.77		
$\chi^2_{2,0.05}$	5.99		
Cramer's V score	0.07 ($p=0.72$)		

In Table 6 it is found that calculated value of χ^2 falls below the corresponding table value hence the test is non-significant and we cannot reject H_0.Hence there is independency between residence(urban/rural) of students with their academic performance. Therefore, their academic performancedonot depend on their background from where they have come.This result again confirms the findings of Bulalaet al. [2].

Thus from the study of different attributes like gender, father's profession, category of students (caste) and domicile of students reveals some interesting points. It says that though domicile background and father's profession has nothing to do with the subsequent academic performance of the students but academic performancesare influenced by the category and gender of the students. This is most probably not at all desirable for all round development of education system and requires immediate policy attention.

8 Relationship of Academic Performance (OGPA) with Related Variables for Different Categories of Students

Once after revelation of dependence of academic performance on social attributes it is now required to work out the relation of academic performance with those associated attributes. In this section the functional relationship between the academic performance with the associated eighteen quantitative and eight dummy variables for different categories of students has been worked out.

9 General Functional form of OGPA with Other Variables

$$
\begin{aligned}
OGPA = {} & \mathbf{47.75}(< 0.01) + \mathbf{0.14}(< 0.01)X_1 - 0.04(0.37)X_2 - 2.23(0.24)D_1 - 2.95D_2 - 2.77(0.11)D_3 \\
& - 3.43(0.18)D_4 - \mathbf{0.68}(0.04)d_1 + 0.85(0.23)Z_1 + \mathbf{2.67}(0.01)M_1 + 1.79(0.16)M_2 - 0.00002(0.43)X_3 \\
& - 0.00008(0.49)X_4 + 0.00002(0.45)X_5 + \mathbf{0.000028}(0.02)X_6 + 0.00003(0.96)X_7 + \mathbf{0.00017}(0.04)X_8 \\
& - \mathbf{0.000049}(0.01)X_9 - 0.00015(0.51)X_{10} + 0.032(0.74)X_{11} + 0.077(0.32)X_{12} + 0.0102(0.75)X_{13} \\
& + 0.13(0.13)X_{14} - 0.03(0.82)X_{15} + \mathbf{0.17}(0.03)X_{16} - 0.01(0.26)X_{17} + \mathbf{0.09}(0.07)X_{18}
\end{aligned}
$$

[Values in parentheses are the probability level of significance of respective coefficient]

$R^2 = 0.539$, $\bar{R}^2 = 0.442$; $p = < 0.001$

The functional form of OGPA after discarding the non-significant variables from equation through stepdown regression becomes: $OGPA = \mathbf{42.201}(< 0.001) + \mathbf{0.141}(< 0.001)X_1 + \mathbf{1.205}(0.074)Z_1 + \mathbf{1.543}(0.015)M_2 + \mathbf{0.00023}(0.013)X_6 - \mathbf{0.00047}(0.003)X_9 + \mathbf{0.193}(0.001)X_{14} + \mathbf{0.207}(0.002)X_{16} - \mathbf{0.110}(0.001)X_{18}$ $R^2 = 0.489$, $\bar{R}^2 = 0.460$; $p = < 0.001$

[Values in parentheses are the probability level of significance of respective coefficient]

Quantitaive variables X_1 = marks in 10th level examination (Madhyamik)(%); X_2 = marks in H.S (%); X_3 = total income (Rs.); X_4 = other income (Rs.); X_5 = agriculture income (Rs.); X_6 = expenditure on fooding (Rs.); X_7 = expenditure on clothing (Rs.); X_8 = expenditure on education (Rs.); X_9 = expenditure on medical (Rs.); X_{10} = other expenditures (Rs.); X_{11} = marks in B.Sc. 1st sem. (%); X_{12} = marks in B.Sc. 2nd sem. (%); X_{13} = marks in B.Sc. 3rd sem. (%); X_{14} = marks in 4th sem. (%): X_{15} = marks in B.Sc. 5th sem. (%); X_{16} = marks in B.Sc. 6th sem. (%); X_{17} = marks in B.Sc. 7th sem. (%); X_{18} = marks in B.Sc. 8th sem. (%).

Dummy variables $D_1 = 1$ if teacher, otherwise = 0; $D_2 = 1$ if businessman, otherwise = 0; $D_3 = 1$ if farmer, otherwise = 0; $D_4 = 1$ if service holder, otherwise = 0. $d_1 = 1$ if the student is male, otherwise = 0; $Z_1 = 1$ if rural, otherwise = 0; $M_1 = 1$ if the student belongs to general category, otherwise = 0; $M_2 = 1$ if the student belongs to SC category, otherwise = 0.

From the above relationship it is found that the coefficients of percentage marks obtained in Madhyamik examination (10th standard) (X_1), gender of the student (d_1), general category student (M_1) i.e. the category of the student, expenditure on fooding (X_6), expenditure on education (X_8), expenditure on medical (X_9), percentage marks obtained in B.Sc. 6th semester (X_{16}) and percentage marks obtained in B.Sc. 8th semester (X_{18}) are significant at 5% level of singnificance.

Thus, among eighteen quantitative correlates a lot of variables are found to be non-significant; as such the study opted for stepdown regression analysis and the results are provided above. From the stepdown regression, it is found that out of 18 quantitative variables and 8 dummy variables, 8 variables altogether are significantly contributing to OGPA to the extent of 46% ($\bar{R}^2 = 0.460$); as against 44% ($\bar{R}^2 = 0.442$); in full model, thereby resulting a gain of around 4% in explaining power of the model.

The findings of independence of attributes with academic performance in previous section is again established in relational study. In this study among eighteen attributes only the coefficient corresponding to marks at 10th standard (Madhyamik) examination, expenditures on fooding and medical, rural, SC category and marks of the students in 4th, 6th and 8th semesters found to have significant effect on academic performance of the students, though these results are not in exact conformity with the findings of [7], results in identifying significant contributors in OGPA under the given situation.

The beauty of regression analysis with quantitative as well as dummy independent variables is that from a single multiple regression equation, one can extract multiple number of relationships as per the dummy independent variables in the model. In the following section this study attempted to find out the relationship of OGPA with correlates for different category (qualitative characters) of student in an exhaustive way and is presented in Table 7.

From Table 7 it is clear that from a single regression equation one can frame as many as sixty relationships depending upon the nature of dummy variables to represent sixty different categories of students. It is also revealed that among eighteen quantitative correlates, not all are equally efficient or significant in explaining the variations in academic attainment of the students. In most of the cases only a few correlates are significant like marks in 10th standard examination,expenditures on fooding, education and health along with percentages of marks secured in 6th and 8th semesters. Expenditures made by the students are mainly met by the respective family, as such family support plays important role. Along with family support, the effort made by the students are also playing important role in academic attainment, which is quite obvious. Studying the above table, one can easily point out the significant impact of gender and caste of the students in deciding the academic performance (OGPA). As for example the highest average performance (OGPA) can be found for rural, female, general category students whose fathers are self employed. The second one gives the average OGPA of rural, male general category students whose fathers are self-employed. The third most average OGPA is found for urban female general students whose fathers are self-employed. In this way there are 60 combinations and their respective OGPA's are studied. If one considers the best three and the last three group of students it will be clear that general category students are performing better than other groups while ST category students need to find some way to boost themselves for achieving academic excellence.

10 Conclusion

In a country like India, agriculture contributes substantially to the GDP and as such the agriculture education vis-à-vis its correlates play significant role in the agriculture development of the country. To identify the significant correlates among different categories of students from different socio-economic and geographic location, regression analysis with the incorporation of dummy variables are suitable and used in this study. With this background the salient finding of the present study are very important; some of which are (i) students' performance is independent of their

Table 7 Relationship of academic achievements (OGPA) with correlates for different group of students

Group of students (Father's profession, Characteristics of students)	Relationship	Average marks (%)
Self-employed, Female, Urban, ST	$OGPA = 47.75 + 0.14X_1 - 0.042X_2 - 0.00002X_3 - 0.000077X_4 + 0.000021X_5 + 0.000028X_6 + 0.00003X_7 + 0.0002X_8 - 0.000049X_9 - 0.00015X_{10} + 0.032X_{11} + 0.077X_{12} + 0.0102X_{13} + 0.134X_{14} - 0.0279X_{15} + 0.17X_{16} - 0.01X_{17} + 0.09X_{18}$	78.66
Teacher, Female, Urban, ST	$OGPA = 47.75 + 0.14X_1 - 0.042X_2 - 0.00002X_3 - 0.000077X_4 - 2.23D_1 + 0.000021X_5 + 0.000028X_6 + 0.00003X_7 + 0.00017X_8 - 0.000049X_9 - 0.00015X_{10} + 0.0316X_{11} + 0.077X_{12} + 0.0102X_{13} + 0.134X_{14} - 0.0279X_{15} + 0.17X_{16} - 0.01X_{17} + 0.09X_{18}$	76.43
Teacher, Male, Urban, ST	$OGPA = 47.75 + 0.14X_1 - 0.042X_2 - 0.00002X_3 - 0.000077X_4 - 2.23D_1 - 0.68d_1 + 0.000021X_5 + 0.000028X_6 + 0.00003X_7 + 0.00017X_8 - 0.000049X_9 - 0.00015X_{10} + 0.0316X_{11} + 0.077X_{12} + 0.0102X_{13} + 0.134X_{14} - 0.0279X_{15} + 0.17X_{16} - 0.01X_{17} + 0.09X_{18}$	75.76
Teacher, Male, Urban, SC	$OGPA = 47.75 + 0.14X_1 - 0.042X_2 - 0.00002X_3 - 0.000077X_4 - 2.23D_1 - 0.68d_1 + 1.79M_2 + 0.000021X_5 + 0.000028X_6 + 0.00003X_7 + 0.00017X_8 - 0.000049X_9 - 0.00015X_{10} + 0.0316X_{11} + 0.077X_{12} + 0.0102X_{13} + 0.134X_{14} - 0.0279X_{15} + 0.17X_{16} - 0.01X_{17} + 0.09X_{18}$	77.55
Teacher, Male, Rural, ST	$OGPA = 47.75 + 0.14X_1 - 0.042X_2 - 0.00002X_3 - 0.000077X_4 - 2.23D_1 - 0.68d_1 + 0.85Z_1 + 0.000021X_5 + 0.000028X_6 + 0.00003X_7 + 0.00017X_8 - 0.000049X_9 - 0.00015X_{10} + 0.0316X_{11} + 0.077X_{12} + 0.0102X_{13} + 0.134X_{14} - 0.0279X_{15} + 0.17X_{16} - 0.01X_{17} + 0.09X_{18}$	76.61
Teacher, Male, Rural, General	$OGPA = 47.75 + 0.14X_1 - 0.042X_2 - 0.00002X_3 - 0.000077X_4 - 2.23D_1 - 0.68d_1 + 0.85Z_1 + 2.67M_1 + 0.000021X_5 + 0.000028X_6 + 0.00003X_7 + 0.00017X_8 - 0.000049X_9 - 0.00015X_{10} + 0.0316X_{11} + 0.077X_{12} + 0.0102X_{13} + 0.134X_{14} - 0.0279X_{15} + 0.17X_{16} - 0.01X_{17} + 0.09X_{18}$	79.28

Table 7 (continued)

Group of students (Father's profession, Characteristics of students)	Relationship	Average marks (%)
Teacher, Male, Urban, General	$OGPA = 47.75 + 0.14X_1 - 0.042X_2 - 0.00002X_3 - 0.000077X_4 - 2.23D_1 - 0.68d_1 + 2.67M_1 + 0.000021X_5 + 0.000028X_6 + 0.00003X_7 + 0.00017X_8 - 0.000049X_9 - 0.00015X_{10} + 0.0316X_{11} + 0.077X_{12} + 0.0102X_{13} + 0.134X_{14} - 0.0279X_{15} + 0.17X_{16} - 0.01X_{17} + 0.09X_{18}$	78.43
Teacher, Male, Rural, SC	$OGPA = 47.75 + 0.14X_1 - 0.042X_2 - 0.00002X_3 - 0.000077X_4 - 2.23D_1 - 0.68d_1 + 0.85Z_1 + 1.79M_2 + 0.000021X_5 + 0.000028X_6 + 0.00003X_7 + 0.00017X_8 - 0.000049X_9 - 0.00015X_{10} + 0.0316X_{11} + 0.077X_{12} + 0.0102X_{13} + 0.134X_{14} - 0.0279X_{15} + 0.17X_{16} - 0.01X_{17} + 0.09X_{18}$	78.39
Teacher, Female, Rural, ST	$OGPA = 47.75 + 0.14X_1 - 0.042X_2 - 0.00002X_3 - 0.000077X_4 - 2.23D_1 + 0.85Z_1 + 0.000021X_5 + 0.000028X_6 + 0.00003X_7 + 0.00017X_8 - 0.000049X_9 - 0.00015X_{10} + 0.0316X_{11} + 0.077X_{12} + 0.0102X_{13} + 0.134X_{14} - 0.0279X_{15} + 0.17X_{16} - 0.01X_{17} + 0.09X_{18}$	77.28
Teacher, Female, Rural, General	$OGPA = 47.75 + 0.14X_1 - 0.042X_2 - 0.00002X_3 - 0.000077X_4 - 2.23D_1 + 0.85Z_1 + 2.67M_1 + 0.000021X_5 + 0.000028X_6 + 0.00003X_7 + 0.00017X_8 - 0.000049X_9 - 0.00015X_{10} + 0.0316X_{11} + 0.077X_{12} + 0.0102X_{13} + 0.134X_{14} - 0.0279X_{15} + 0.17X_{16} - 0.01X_{17} + 0.09X_{18}$	79.95
Teacher, Female, Rural, SC	$OGPA = 47.75 + 0.14X_1 - 0.042X_2 - 0.00002X_3 - 0.000077X_4 - 2.23D_1 + 0.85Z_1 + 1.79M_2 + 0.000021X_5 + 0.000028X_6 + 0.00003X_7 + 0.00017X_8 - 0.000049X_9 - 0.00015X_{10} + 0.0316X_{11} + 0.077X_{12} + 0.0102X_{13} + 0.134X_{14} - 0.0279X_{15} + 0.17X_{16} - 0.01X_{17} + 0.09X_{18}$	79.07

Table 7 (continued)

Group of students (Father's profession, Characteristics of students)	Relationship	Average marks (%)
Teacher, Female, Urban, SC	$OGPA = 47.75 + 0.14X_1 - 0.042X_2 - 0.00002X_3 - 0.000077X_4 - 2.23D_1 + 1.79M_2 + 0.000021X_5 + 0.000028X_6 + 0.00003X_7 + 0.00017X_8 - 0.000049X_9 - 0.00015X_{10} + 0.0316X_{11} + 0.077X_{12} + 0.0102X_{13} + 0.134X_{14} - 0.0279X_{15} + 0.17X_{16} - 0.01X_{17} + 0.09X_{18}$	78.22
Teacher, Female, Urban, General	$OGPA = 47.75 + 0.14X_1 - 0.042X_2 - 0.00002X_3 - 0.000077X_4 - 2.23D_1 + 2.67M_1 + 0.000021X_5 + 0.000028X_6 + 0.00003X_7 + 0.00017X_8 - 0.000049X_9 - 0.00015X_{10} + 0.0316X_{11} + 0.077X_{12} + 0.0102X_{13} + 0.134X_{14} - 0.0279X_{15} + 0.17X_{16} - 0.01X_{17} + 0.09X_{18}$	79.10
Businessman, Female, Urban, ST	$OGPA = 47.75 + 0.14X_1 - 0.042X_2 - 0.00002X_3 - 0.000077X_4 - 2.95D_2 + 0.000021X_5 + 0.000028X_6 + 0.00003X_7 + 0.00017X_8 - 0.000049X_9 - 0.00015X_{10} + 0.0316X_{11} + 0.077X_{12} + 0.0102X_{13} + 0.134X_{14} - 0.0279X_{15} + 0.17X_{16} - 0.01X_{17} + 0.09X_{18}$	75.71
Businessman, Male, Urban, ST	$OGPA = 47.75 + 0.14X_1 - 0.042X_2 - 0.00002X_3 - 0.000077X_4 - 2.95D_2 - 0.68d_1 + 0.000021X_5 + 0.000028X_6 + 0.00003X_7 + 0.00017X_8 - 0.000049X_9 - 0.00015X_{10} + 0.0316X_{11} + 0.077X_{12} + 0.0102X_{13} + 0.134X_{14} - 0.0279X_{15} + 0.17X_{16} - 0.01X_{17} + 0.09X_{18}$	75.04
Businessman, Male, Rural, ST	$OGPA = 47.75 + 0.14X_1 - 0.042X_2 - 0.00002X_3 - 0.000077X_4 - 2.95D_2 - 0.68d_1 + 0.85Z_1 + 0.000021X_5 + 0.000028X_6 + 0.00003X_7 + 0.00017X_8 - 0.000049X_9 - 0.00015X_{10} + 0.0316X_{11} + 0.077X_{12} + 0.0102X_{13} + 0.134X_{14} - 0.0279X_{15} + 0.17X_{16} - 0.01X_{17} + 0.09X_{18}$	75.89

Table 7 (continued)

Group of students (Father's profession, Characteristics of students)	Relationship	Average marks (%)
Businessman, Male, Rural, General	$OGPA = 47.75 + 0.14X_1 - 0.042X_2 - 0.00002X_3 - 0.000077X_4 - 2.95D_2 - 0.68d_1 + 0.85Z_1 + 2.67M_1 + 0.000021X_5 + 0.000028X_6 + 0.00003X_7 + 0.00017X_8 - 0.000049X_9 - 0.00015X_{10} + 0.0316X_{11} + 0.077X_{12} + 0.0102X_{13} + 0.134X_{14} - 0.0279X_{15} + 0.17X_{16} - 0.01X_{17} + 0.09X_{18}$	78.56
Businessman, Male, Urban, General	$OGPA = 47.75 + 0.14X_1 - 0.042X_2 - 0.00002X_3 - 0.000077X_4 - 2.95D_2 - 0.68d_1 + 2.67M_1 + 0.000021X_5 + 0.000028X_6 + 0.00003X_7 + 0.00017X_8 - 0.000049X_9 - 0.00015X_{10} + 0.0316X_{11} + 0.077X_{12} + 0.0102X_{13} + 0.134X_{14} - 0.0279X_{15} + 0.17X_{16} - 0.01X_{17} + 0.09X_{18}$	77.71
Businessman, Male, Urban, SC	$OGPA = 47.75 + 0.14X_1 - 0.042X_2 - 0.00002X_3 - 0.000077X_4 - 2.95D_2 - 0.68d_1 + 1.79M_2 + 0.000021X_5 + 0.000028X_6 + 0.00003X_7 + 0.00017X_8 - 0.000049X_9 - 0.00015X_{10} + 0.0316X_{11} + 0.077X_{12} + 0.0102X_{13} + 0.134X_{14} - 0.0279X_{15} + 0.17X_{16} - 0.01X_{17} + 0.09X_{18}$	76.83
Businessman, Male, Rural, SC	$OGPA = 47.75 + 0.14X_1 - 0.042X_2 - 0.00002X_3 - 0.000077X_4 - 2.95D_2 - 0.68d_1 + 0.85Z_1 + 1.79M_2 + 0.000021X_5 + 0.000028X_6 + 0.00003X_7 + 0.00017X_8 - 0.000049X_9 - 0.00015X_{10} + 0.0316X_{11} + 0.077X_{12} + 0.0102X_{13} + 0.134X_{14} - 0.0279X_{15} + 0.17X_{16} - 0.01X_{17} + 0.09X_{18}$	77.68
Businessman, Female, Rural, ST	$OGPA = 47.75 + 0.14X_1 - 0.042X_2 - 0.00002X_3 - 0.000077X_4 - 2.95D_2 + 0.85Z_1 + 0.000021X_5 + 0.000028X_6 + 0.00003X_7 + 0.00017X_8 - 0.000049X_9 - 0.00015X_{10} + 0.0316X_{11} + 0.077X_{12} + 0.0102X_{13} + 0.134X_{14} - 0.0279X_{15} + 0.17X_{16} - 0.01X_{17} + 0.09X_{18}$	76.57

Table 7 (continued)

Group of students (Father's profession, Characteristics of students)	Relationship	Average marks (%)
Businessman, Female, Rural, General	$OGPA = 47.75 + 0.14X_1 - 0.042X_2 - 0.00002X_3 - 0.000077X_4 - 2.95D_2 + 0.85Z_1 + 2.67M_1 + 0.000021X_5 + 0.000028X_6 + 0.00003X_7 + 0.00017X_8 - 0.000049X_9 - 0.00015X_{10} + 0.0316X_{11} + 0.077X_{12} + 0.0102X_{13} + 0.134X_{14} - 0.0279X_{15} + 0.17X_{16} - 0.01X_{17} + 0.09X_{18}$	79.24
Businessman, Female, Rural, SC	$OGPA = 47.75 + 0.14X_1 - 0.042X_2 - 0.00002X_3 - 0.000077X_4 - 2.95D_2 + 0.85Z_1 + 1.79M_2 + 0.000021X_5 + 0.000028X_6 + 0.00003X_7 + 0.00017X_8 - 0.000049X_9 - 0.00015X_{10} + 0.0316X_{11} + 0.077X_{12} + 0.0102X_{13} + 0.134X_{14} - 0.0279X_{15} + 0.17X_{16} - 0.01X_{17} + 0.09X_{18}$	78.35
Businessman, Female, Urban, SC	$OGPA = 47.75 + 0.14X_1 - 0.042X_2 - 0.00002X_3 - 0.000077X_4 - 2.95D_2 + 1.79M_2 + 0.000021X_5 + 0.000028X_6 + 0.00003X_7 + 0.00017X_8 - 0.000049X_9 - 0.00015X_{10} + 0.0316X_{11} + 0.077X_{12} + 0.0102X_{13} + 0.134X_{14} - 0.0279X_{15} + 0.17X_{16} - 0.01X_{17} + 0.09X_{18}$	77.50
Businessman, Female, Urban, General	$OGPA = 47.75 + 0.14X_1 - 0.042X_2 - 0.00002X_3 - 0.000077X_4 - 2.95D_2 + 2.67M_1 + 0.000021X_5 + 0.000028X_6 + 0.00003X_7 + 0.00017X_8 - 0.000049X_9 - 0.00015X_{10} + 0.0316X_{11} + 0.077X_{12} + 0.0102X_{13} + 0.134X_{14} - 0.0279X_{15} + 0.17X_{16} - 0.01X_{17} + 0.09X_{18}$	78.38
Farmer, Female, Urban, ST	$OGPA = 47.75 + 0.14X_1 - 0.042X_2 - 0.00002X_3 - 0.000077X_4 - 2.77D_3 + 0.000021X_5 + 0.000028X_6 + 0.00003X_7 + 0.00017X_8 - 0.000049X_9 - 0.00015X_{10} + 0.0316X_{11} + 0.077X_{12} + 0.0102X_{13} + 0.134X_{14} - 0.0279X_{15} + 0.17X_{16} - 0.01X_{17} + 0.09X_{18}$	75.89

Table 7 (continued)

Group of students (Father's profession, Characteristics of students)	Relationship	Average marks (%)
Farmer, Male, Urban, ST	$OGPA = 47.75 + 0.14X_1 - 0.042X_2 - 0.00002X_3 - 0.000077X_4 - 2.77D_3 - 0.68d_1 + 0.000021X_5 + 0.000028X_6 + 0.00003X_7 + 0.00017X_8 - 0.000049X_9 - 0.00015X_{10} + 0.0316X_{11} + 0.077X_{12} + 0.0102X_{13} + 0.134X_{14} - 0.0279X_{15} + 0.17X_{16} - 0.01X_{17} + 0.09X_{18}$	75.22
Farmer, Male, Urban, SC	$OGPA = 47.75 + 0.14X_1 - 0.042X_2 - 0.00002X_3 - 0.000077X_4 - 2.77D_3 - 0.68d_1 + 1.79M_2 + 0.000021X_5 + 0.000028X_6 + 0.00003X_7 + 0.00017X_8 - 0.000049X_9 - 0.00015X_{10} + 0.0316X_{11} + 0.077X_{12} + 0.0102X_{13} + 0.134X_{14} - 0.0279X_{15} + 0.17X_{16} - 0.01X_{17} + 0.09X_{18}$	77.01
Farmer, Male, Rural, ST	$OGPA = 47.75 + 0.14X_1 - 0.042X_2 - 0.00002X_3 - 0.000077X_4 - 2.77D_3 - 0.68d_1 + 0.85Z_1 + 0.000021X_5 + 0.000028X_6 + 0.00003X_7 + 0.00017X_8 - 0.000049X_9 - 0.00015X_{10} + 0.0316X_{11} + 0.077X_{12} + 0.0102X_{13} + 0.134X_{14} - 0.0279X_{15} + 0.17X_{16} - 0.01X_{17} + 0.09X_{18}$	76.07
Farmer, Male, Rural, General	$OGPA = 47.75 + 0.14X_1 - 0.042X_2 - 0.00002X_3 - 0.000077X_4 - 2.77D_3 - 0.68d_1 + 0.85Z_1 + 2.67M_1 + 0.000021X_5 + 0.000028X_6 + 0.00003X_7 + 0.00017X_8 - 0.000049X_9 - 0.00015X_{10} + 0.0316X_{11} + 0.077X_{12} + 0.0102X_{13} + 0.134X_{14} - 0.0279X_{15} + 0.17X_{16} - 0.01X_{17} + 0.09X_{18}$	78.74
Farmer, Male, Rural, SC	$OGPA = 47.75 + 0.14X_1 - 0.042X_2 - 0.00002X_3 - 0.000077X_4 - 2.77D_3 - 0.68d_1 + 0.85Z_1 + 1.79M_2 + 0.000021X_5 + 0.000028X_6 + 0.00003X_7 + 0.00017X_8 - 0.000049X_9 - 0.00015X_{10} + 0.0316X_{11} + 0.077X_{12} + 0.0102X_{13} + 0.134X_{14} - 0.0279X_{15} + 0.17X_{16} - 0.01X_{17} + 0.09X_{18}$	77.85

Table 7 (continued)

Group of students (Father's profession, Characteristics of students)	Relationship	Average marks (%)
Farmer, Female, Rural, ST	$OGPA = 47.75 + 0.14X_1 - 0.042X_2 - 0.00002X_3 - 0.000077X_4 - 2.77D_3 + 0.85Z_1 + 0.000021X_5 + 0.000028X_6 + 0.00003X_7 + 0.00017X_8 - 0.000049X_9 - 0.00015X_{10} + 0.0316X_{11} + 0.077X_{12} + 0.0102X_{13} + 0.134X_{14} - 0.0279X_{15} + 0.17X_{16} - 0.01X_{17} + 0.09X_{18}$	76.74
Farmer, Female, Rural, General	$OGPA = 47.75 + 0.14X_1 - 0.042X_2 - 0.00002X_3 - 0.000077X_4 - 2.77D_3 + 0.85Z_1 + 2.67M_1 + 0.000021X_5 + 0.000028X_6 + 0.00003X_7 + 0.00017X_8 - 0.000049X_9 - 0.00015X_{10} + 0.0316X_{11} + 0.077X_{12} + 0.0102X_{13} + 0.134X_{14} - 0.0279X_{15} + 0.17X_{16} - 0.01X_{17} + 0.09X_{18}$	79.41
Farmer, Female, Rural, SC	$OGPA = 47.75 + 0.14X_1 - 0.042X_2 - 0.00002X_3 - 0.000077X_4 - 2.77D_3 + 0.85Z_1 + 1.79M_2 + 0.000021X_5 + 0.000028X_6 + 0.00003X_7 + 0.00017X_8 - 0.000049X_9 - 0.00015X_{10} + 0.0316X_{11} + 0.077X_{12} + 0.0102X_{13} + 0.134X_{14} - 0.0279X_{15} + 0.17X_{16} - 0.01X_{17} + 0.09X_{18}$	78.53
Farmer, Female, Urban, SC	$OGPA = 47.75 + 0.14X_1 - 0.042X_2 - 0.00002X_3 - 0.000077X_4 - 2.77D_3 + 1.79M_2 + 0.000021X_5 + 0.000028X_6 + 0.00003X_7 + 0.00017X_8 - 0.000049X_9 - 0.00015X_{10} + 0.0316X_{11} + 0.077X_{12} + 0.0102X_{13} + 0.134X_{14} - 0.0279X_{15} + 0.17X_{16} - 0.01X_{17} + 0.09X_{18}$	77.68
Farmer, Female, Urban, General	$OGPA = 47.75 + 0.14X_1 - 0.042X_2 - 0.00002X_3 - 0.000077X_4 - 2.77D_3 + 2.67M_1 + 0.000021X_5 + 0.000028X_6 + 0.00003X_7 + 0.00017X_8 - 0.000049X_9 - 0.00015X_{10} + 0.0316X_{11} + 0.077X_{12} + 0.0102X_{13} + 0.134X_{14} - 0.0279X_{15} + 0.17X_{16} - 0.01X_{17} + 0.09X_{18}$	78.56

Table 7 (continued)

Group of students (Father's profession, Characteristics of students)	Relationship	Average marks (%)
Farmer, Male, Urban, General	$OGPA = 47.75 + 0.14X_1 - 0.042X_2 - 0.00002X_3 - 0.000077X_4 - 2.77D_3 - 0.68d_1 + 2.67M_1 + 0.000021X_5 + 0.000028X_6 + 0.00003X_7 + 0.00017X_8 - 0.000049X_9 - 0.00015X_{10} + 0.0316X_{11} + 0.077X_{12} + 0.0102X_{13} + 0.134X_{14} - 0.0279X_{15} + 0.17X_{16} - 0.01X_{17} + 0.09X_{18}$	77.88
Service holder, Female, Urban, ST	$OGPA = 47.75 + 0.14X_1 - 0.042X_2 - 0.00002X_3 - 0.000077X_4 - 3.43D_4 + 0.000021X_5 + 0.000028X_6 + 0.00003X_7 + 0.00017X_8 - 0.000049X_9 - 0.00015X_{10} + 0.0316X_{11} + 0.077X_{12} + 0.0102X_{13} + 0.134X_{14} - 0.0279X_{15} + 0.17X_{16} - 0.01X_{17} + 0.09X_{18}$	75.23
Service holder, Male, Urban, ST	$OGPA = 47.75 + 0.14X_1 - 0.042X_2 - 0.00002X_3 - 0.000077X_4 - 0.68d_1 - 3.43D_4 + 0.000021X_5 + 0.000028X_6 + 0.00003X_7 + 0.00017X_8 - 0.000049X_9 - 0.00015X_{10} + 0.0316X_{11} + 0.077X_{12} + 0.0102X_{13} + 0.134X_{14} - 0.0279X_{15} + 0.17X_{16} - 0.01X_{17} + 0.09X_{18}$	74.56
Service holder, Male, Rural, ST	$OGPA = 47.75 + 0.14X_1 - 0.042X_2 - 0.00002X_3 - 0.000077X_4 - 0.68d_1 - 3.43D_4 + 0.85Z_1 + 0.000021X_5 + 0.000028X_6 + 0.00003X_7 + 0.00017X_8 - 0.000049X_9 - 0.00015X_{10} + 0.0316X_{11} + 0.077X_{12} + 0.0102X_{13} + 0.134X_{14} - 0.0279X_{15} + 0.17X_{16} - 0.01X_{17} + 0.09X_{18}$	75.41
Service holder, Male, Rural, General	$OGPA = 47.75 + 0.14X_1 - 0.042X_2 - 0.00002X_3 - 0.000077X_4 - 0.68d_1 - 3.43D_4 + 0.85Z_1 + 2.67M_1 + 0.000021X_5 + 0.000028X_6 + 0.00003X_7 + 0.00017X_8 - 0.000049X_9 - 0.00015X_{10} + 0.0316X_{11} + 0.077X_{12} + 0.0102X_{13} + 0.134X_{14} - 0.0279X_{15} + 0.17X_{16} - 0.01X_{17} + 0.09X_{18}$	78.08

Table 7 (continued)

Group of students (Father's profession, Characteristics of students)	Relationship	Average marks (%)
Service holder, Male, Urban, General	$OGPA = 47.75 + 0.14X_1 - 0.042X_2 - 0.00002X_3 - 0.000077X_4 - 0.68d_1 - 3.43D_4 + 2.67M_1 + 0.000021X_5 + 0.000028X_6 + 0.00003X_7 + 0.00017X_8 - 0.000049X_9 - 0.00015X_{10} + 0.0316X_{11} + 0.077X_{12} + 0.0102X_{13} + 0.134X_{14} - 0.0279X_{15} + 0.17X_{16} - 0.01X_{17} + 0.09X_{18}$	77.23
Service holder, Male, Rural, SC	$OGPA = 47.75 + 0.14X_1 - 0.042X_2 - 0.00002X_3 - 0.000077X_4 - 0.68d_1 - 3.43D_4 + 0.85Z_1 + 1.79M_2 + 0.000021X_5 + 0.000028X_6 + 0.00003X_7 + 0.00017X_8 - 0.000049X_9 - 0.00015X_{10} + 0.0316X_{11} + 0.077X_{12} + 0.0102X_{13} + 0.134X_{14} - 0.0279X_{15} + 0.17X_{16} - 0.01X_{17} + 0.09X_{18}$	77.19
Service holder, Male, Urban, SC	$OGPA = 47.75 + 0.14X_1 - 0.042X_2 - 0.00002X_3 - 0.000077X_4 - 0.68d_1 - 3.43D_4 + 1.79M_2 + 0.000021X_5 + 0.000028X_6 + 0.00003X_7 + 0.00017X_8 - 0.000049X_9 - 0.00015X_{10} + 0.0316X_{11} + 0.077X_{12} + 0.0102X_{13} + 0.134X_{14} - 0.0279X_{15} + 0.17X_{16} - 0.01X_{17} + 0.09X_{18}$	76.34
Service holder, Female, Rural, ST	$OGPA = 47.75 + 0.14X_1 - 0.042X_2 - 0.00002X_3 - 0.000077X_4 - 3.43D_4 + 0.85Z_1 + 0.000021X_5 + 0.000028X_6 + 0.00003X_7 + 0.00017X_8 - 0.000049X_9 - 0.00015X_{10} + 0.0316X_{11} + 0.077X_{12} + 0.0102X_{13} + 0.134X_{14} - 0.0279X_{15} + 0.17X_{16} - 0.01X_{17} + 0.09X_{18}$	76.08
Service holder, Female, Rural, General	$OGPA = 47.75 + 0.14X_1 - 0.042X_2 - 0.00002X_3 - 0.000077X_4 - 3.43D_4 + 0.85Z_1 + 2.67M_1 + 0.000021X_5 + 0.000028X_6 + 0.00003X_7 + 0.00017X_8 - 0.000049X_9 - 0.00015X_{10} + 0.0316X_{11} + 0.077X_{12} + 0.0102X_{13} + 0.134X_{14} - 0.0279X_{15} + 0.17X_{16} - 0.01X_{17} + 0.09X_{18}$	78.75

Table 7 (continued)

Group of students (Father's profession, Characteristics of students)	Relationship	Average marks (%)
Service holder, Female, Rural, SC	$OGPA = 47.75 + 0.14X_1 - 0.042X_2 - 0.00002X_3 - 0.000077X_4 - 3.43D_4 + 0.85Z_1 + 1.79M_2 + 0.000021X_5 + 0.000028X_6 + 0.00003X_7 + 0.00017X_8 - 0.000049X_9 - 0.00015X_{10} + 0.0316X_{11} + 0.077X_{12} + 0.0102X_{13} + 0.134X_{14} - 0.0279X_{15} + 0.17X_{16} - 0.01X_{17} + 0.09X_{18}$	77.87
Service holder, Female, Urban, SC	$OGPA = 47.75 + 0.14X_1 - 0.042X_2 - 0.00002X_3 - 0.000077X_4 - 3.43D_4 + 1.79M_2 + 0.000021X_5 + 0.000028X_6 + 0.00003X_7 + 0.00017X_8 - 0.000049X_9 - 0.00015X_{10} + 0.0316X_{11} + 0.077X_{12} + 0.0102X_{13} + 0.134X_{14} - 0.0279X_{15} + 0.17X_{16} - 0.01X_{17} + 0.09X_{18}$	77.02
Service holder, Female, Urban, General	$OGPA = 47.75 + 0.14X_1 - 0.042X_2 - 0.00002X_3 - 0.000077X_4 - 3.43D_4 + 2.67M_1 + 0.000021X_5 + 0.000028X_6 + 0.00003X_7 + 0.00017X_8 - 0.000049X_9 - 0.00015X_{10} + 0.0316X_{11} + 0.077X_{12} + 0.0102X_{13} + 0.134X_{14} - 0.0279X_{15} + 0.17X_{16} - 0.01X_{17} + 0.09X_{18}$	77.90
Self-employed, Male, Urban, ST	$OGPA = 47.75 + 0.14X_1 - 0.042X_2 - 0.00002X_3 - 0.000077X_4 - 0.68d_1 + 0.000021X_5 + 0.000028X_6 + 0.00003X_7 + 0.00017X_8 - 0.000049X_9 - 0.00015X_{10} + 0.0316X_{11} + 0.077X_{12} + 0.0102X_{13} + 0.134X_{14} - 0.0279X_{15} + 0.17X_{16} - 0.01X_{17} + 0.09X_{18}$	77.98
Self-employed, Male, Rural, ST	$OGPA = 47.75 + 0.14X_1 - 0.042X_2 - 0.00002X_3 - 0.000077X_4 - 0.68d_1 + 0.85Z_1 + 0.000021X_5 + 0.000028X_6 + 0.00003X_7 + 0.00017X_8 - 0.000049X_9 - 0.00015X_{10} + 0.0316X_{11} + 0.077X_{12} + 0.0102X_{13} + 0.134X_{14} - 0.0279X_{15} + 0.17X_{16} - 0.01X_{17} + 0.09X_{18}$	78.83

Table 7 (continued)

Group of students (Father's profession, Characteristics of students)	Relationship	Average marks (%)
Self-employed, Male, Rural, General	$OGPA = 47.75 + 0.14X_1 - 0.042X_2 - 0.00002X_3 - 0.000077X_4 - 0.68d_1 + 0.85Z_1 + 2.67M_1 + 0.000021X_5 + 0.000028X_6 + 0.00003X_7 + 0.00017X_8 - 0.000049X_9 - 0.00015X_{10} + 0.0316X_{11} + 0.077X_{12} + 0.0102X_{13} + 0.134X_{14} - 0.0279X_{15} + 0.17X_{16} - 0.01X_{17} + 0.09X_{18}$	81.50
Self-employed, Male, Rural, SC	$OGPA = 47.75 + 0.14X_1 - 0.042X_2 - 0.00002X_3 - 0.000077X_4 - 0.68d_1 + 0.85Z_1 + 1.79M_2 + 0.000021X_5 + 0.000028X_6 + 0.00003X_7 + 0.00017X_8 - 0.000049X_9 - 0.00015X_{10} + 0.0316X_{11} + 0.077X_{12} + 0.0102X_{13} + 0.134X_{14} - 0.0279X_{15} + 0.17X_{16} - 0.01X_{17} + 0.09X_{18}$	80.62
Self-employed, Female, Rural, ST	$OGPA = 47.75 + 0.14X_1 - 0.042X_2 - 0.00002X_3 - 0.000077X_4 + 0.85Z_1 + 0.000021X_5 + 0.000028X_6 + 0.00003X_7 + 0.00017X_8 - 0.000049X_9 - 0.00015X_{10} + 0.0316X_{11} + 0.077X_{12} + 0.0102X_{13} + 0.134X_{14} - 0.0279X_{15} + 0.17X_{16} - 0.01X_{17} + 0.09X_{18}$	79.51
Self-employed, Female, Rural, General	$OGPA = 47.75 + 0.14X_1 - 0.042X_2 - 0.00002X_3 - 0.000077X_4 + 0.85Z_1 + 2.67M_1 + 0.000021X_5 + 0.000028X_6 + 0.00003X_7 + 0.00017X_8 - 0.000049X_9 - 0.00015X_{10} + 0.0316X_{11} + 0.077X_{12} + 0.0102X_{13} + 0.134X_{14} - 0.0279X_{15} + 0.17X_{16} - 0.01X_{17} + 0.09X_{18}$	82.18
Self-employed, Female, Rural, SC	$OGPA = 47.75 + 0.14X_1 - 0.042X_2 - 0.00002X_3 - 0.000077X_4 + 0.85Z_1 + 1.79M_2 + 0.000021X_5 + 0.000028X_6 + 0.00003X_7 + 0.00017X_8 - 0.000049X_9 - 0.00015X_{10} + 0.0316X_{11} + 0.077X_{12} + 0.0102X_{13} + 0.134X_{14} - 0.0279X_{15} + 0.17X_{16} - 0.01X_{17} + 0.09X_{18}$	81.30

Table 7 (continued)

Group of students (Father's profession, Characteristics of students)	Relationship	Average marks (%)
Self-employed, Male, Urban, SC	$OGPA = 47.75 + 0.14X_1 - 0.042X_2 - 0.00002X_3 - 0.000077X_4 - 0.68d_1 + 1.79M_2 + 0.000021X_5 + 0.000028X_6 + 0.00003X_7 + 0.00017X_8 - 0.000049X_9 - 0.00015X_{10} + 0.0316X_{11} + 0.077X_{12} + 0.0102X_{13} + 0.134X_{14} - 0.0279X_{15} + 0.17X_{16} - 0.01X_{17} + 0.09X_{18}$	79.77
Self-employed, Male, Urban, General	$OGPA = 47.75 + 0.14X_1 - 0.042X_2 - 0.00002X_3 - 0.000077X_4 - 0.68d_1 + 2.67M_1 + 0.000021X_5 + 0.000028X_6 + 0.00003X_7 + 0.00017X_8 - 0.000049X_9 - 0.00015X_{10} + 0.0316X_{11} + 0.077X_{12} + 0.0102X_{13} + 0.134X_{14} - 0.0279X_{15} + 0.17X_{16} - 0.01X_{17} + 0.09X_{18}$	80.65
Self-employed, Female, Urban, General	$OGPA = 47.75 + 0.14X_1 - 0.042X_2 - 0.00002X_3 - 0.000077X_4 + 2.67M_1 + 0.000021X_5 + 0.000028X_6 + 0.00003X_7 + 0.00017X_8 - 0.000049X_9 - 0.00015X_{10} + 0.0316X_{11} + 0.077X_{12} + 0.0102X_{13} + 0.134X_{14} - 0.0279X_{15} + 0.17X_{16} - 0.01X_{17} + 0.09X_{18}$	81.33
Self-employed, Female, Urban, SC	$OGPA = 47.75 + 0.14X_1 - 0.042X_2 - 0.00002X_3 - 0.000077X_4 + 1.79M_2 + 0.000021X_5 + 0.000028X_6 + 0.00003X_7 + 0.00017X_8 - 0.000049X_9 - 0.00015X_{10} + 0.0316X_{11} + 0.077X_{12} + 0.0102X_{13} + 0.134X_{14} - 0.0279X_{15} + 0.17X_{16} - 0.01X_{17} + 0.09X_{18}$	80.45

place of origin or domicile (ii) father's profession also has no role to play in performances of students, (iii) the main point to highlight is that academic performance of the students is gender and category biased, (iv) expenditures on fooding, education and medical needs are major parrental support variables influencing greatly the academic attainments, (v) merit of the students as adjudged by percentage of marks secured in first ever general board Secondary examination is also important correlate for academic attachment; as Secondary examination (Xth standard examination) is most probably the first broad general examination in student's life in which his/her merit is being compared along with others. Under the ideal educational system one would expect to have academic attainment without having any bias of caste, gender, socio-economic situation of the students. Unfortunately still agriculture education, as revealed from this study, is gender and category biased and immediate attention is needed to improve the agriculture education structure in the country.

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