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On the effect of daily average reading and sleeping hours on student's Cumulative Grade Point Average (CGPA)

O.M. Olayiwola[1], A.A. Adewara[2], G.N.Amahia[3] ,A.A.Okunlade[4]

[1]Department of Physical Sciences, Ajayi Crowther University, Oyo, Oyo State, Nigeria

[2]Department of Statistics, University of Ilorin, Nigeria.

[3]Department of Statistics, University of Ibadan, Nigeria.

[4]Nigerian Institute of Science Laboratory Technology, Samonda, Ibadan, Nigeria.

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ABSTRACT

Cumulative Grade point average (CGPA) is a commonly used indicator for academic performance among students in the Universities. Many factors could act as barriers to students in attaining and maintaining a high CGPA that reflects their overall academic performance during their stay in the University. Such factors include test anxiety, time management, test competence, academic competence, study techniques, Lecturer teaching method, peer group, health, learning environment, parental background etc. In this study, a sequential procedure is used to model a combination of daily average reading hour and daily average sleeping hour to maximize students' CGPA. The design for this study is stratified sampling scheme with department as the ultimate sampling unit. A Sample of 200 students was randomly selected. The questionnaire for the research contained information on students' CGPA, daily average reading hour and daily average sleeping hour. SPSS software package was used to produce summary statistics. A second order response surface model (SORSM) was constructed from the data to determine various combinations of daily average reading hour and daily average sleeping hour that will make students to be in either good academic standing or not in good academic standing. The above SORSM was subjected to a canonical analysis to characterize the nature of stationary point of the model as well as to determine the daily average reading hour (x_1) and daily average sleeping hour (x_2) that maximize students' CGPA. The model gives daily average reading hour (x_1) to be 4 and daily average sleeping hour (x_2) to be 5. Hence, the student's maximum CGPA would be achieved if daily average reading hour (x_1) is four and daily average sleeping hour (x_2) is five after normal daily lectures.

Introduction

All researches reviewed support the hypothesis that student performance depends on different socio-economic, psychological and environmental factors. The findings of research studies focused that student performance is affected by different factors such as learning abilities because new paradigm about learning assumes that all students can and should learn at higher levels but it should not be considered as constraint because there are other factors like race, gender, sex that can affect student's performance. Hansen Joe (2000). Some of the researchers even tried to explain the link between students achievements, economics circumstances and the risk of becoming a drop-out that proven to be positive Goldman et al (1988), Pallas et al (2001), explained the effects of age, educational qualification, distance from learning place etc. on student performance. The performance of students on the module is not affected by such factors as age, sex and place of residence but is associated with qualification in quantitative subjects. It is also found that those who live around the university environment perform better than far away students.

Yvonne et al (1998) further elaborated that student performance is very much dependent on SEB (socio economic back ground) as statistically significant differences, linked to their gender, grade level, school location, school type, student type and socio-economic background.

Research on improving the rather weak performance of students in University has been extensive in recent years. In a paper advocating reform, Becker (1997) noted that grades in economics classes are often lower than grades in other college departments. Further, women have consistently performed worse than men. Thus, a focal point for much of the research has been an attempt to explain the relatively low performance of woman in the principles of Economics courses, even after adjusting for mathematics background, ACT, and GPA, Anderson et al (1994); Ballard and Johnson (2005); Becker (1997), Dynan and Rouse (1997), Greene (1997), Ziegerty)2000).

Borg and Shapiro (1996) first noted that gender was not a significant factor in determining students' performance once student personality type was introduced. Using the Myers-Briggs Type Indicator to determine student and personal personality type and the courses grade to determine the student's mastery of the material, they found student gender to be insignificant. They also noted that matching student and personal personality types enhanced student performance. Borg

Tele:

E-mail addresses: laniyimathew@yahoo.com

and Shapiro (1996) and Ziegert and Sullivan (1999) concluded that certain broad personality types, introverts and thinkers, tend to perform better. However, Ziegert and Sullivan (1999) disagreed that student's personality match improved performance. Although, three of the four broad personality categories are distributed evenly between men and women, one is not; most women are 'feelers' sensitive, empathetic, and in search of harmony, while most men are 'thinkers' cool, analytical and logical, Tieger and Tieger (1998), Ziegert (2000).Given the gender-specific personality type, some argued that if matching personality types enhances learning, then women students would learn better. Ballard and Johnson (2005), Dynan and Rouse (1997), Jensen and Owen (2001).

However, the reality is that economics remains a field dominated by men. In 2000, less than one-third of undergraduate degrees and doctorates in economics were awarded to women Ballard and Johnson (2005), while in 1994 only 11 percent of female economics professors were tenured associates Dynan and Rouse (1997). Ballard and Johnson (2005) found that women tend to have low expectations about their ability to succeed in principles of economics courses, with a major factor being women's relatively low level of competency in mathmatics. In several studies (Ballard and Johnson (2005), Anderson et al. (1994), Jensen and Owen (2001)) noted the importance of mathmatics skills in determining students' performance in economics.

Another area of concern in the economic education has been whether the traditionally large lecture classes for principles of economics provide a beneficial learning environment for the students. Research by Arias and Walker (2004) found a significant negative relationship between class size and student performance. They did not find gender to be significant.

Kirby Winston et al. (2002) focused on student's impatience (his time-discount behavior) that influences his own academic performance.

Goethe (1976) discovered that weak students do better when grouped with other weak students. As implied by Zajonc's analysis of older siblings it shows that students' performance improves if they are with the students of their own educational calibre.

Materials and methods

The data used in this research work are primary data. The students' CGPA were collected from the Department and the information related to the students' reading and sleeping hours per day were collected from the students at the point of registration by using interview method. The design for this study is a two-stage stratified sampling scheme with department as the ultimate sampling unit. A Sample of 200 students was randomly selected. SPSS software package was used to produce summary statistics. A second order response surface model (SORSM) was constructed from the data to determine various combinations of daily average reading hour and daily average sleeping hour that will make students to be in either good academic standing or not in good academic standing. The above SORSM was subjected to a canonical analysis to characterize the nature of stationary point of the model as well as to determine the daily average reading hour (x_1) and daily average sleeping hour (x_2) that maximize predicted students' CGPA

Simple correlation coefficient was used to determine the nature of linear relationship between CGPA and reading hour and sleeping hour while second order of response surface model was used to determine the appropriate range of both reading and sleeping hour per day that can make students to be in good academic standing and the combination that can make the students not to be in a good academic standing. The product moment correlation coefficient (r) is found from the formula

$$r = \frac{n\sum xy - \sum x \sum y}{\sqrt{[n\sum y^2 - (\sum y)^2]\quad [n\sum x^2 - (\sum x)^2]}} \qquad \text{.....(1)}$$

Spearman's rank order correlation is given by the formula:

$$r = 1 - \frac{6\sum d^2}{n(n^2-1)} \qquad \text{.....(2)}$$

Where d = rank of x –rank of y

The second order response surface model fitted to the data is given as

$$Y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_{11} x_1^{\ 2} + \beta_{22} x_2^{\ 2} + \beta_1 \beta_2 x_1 x_2 \ldots\ldots \qquad (3)$$

Various Combinations of reading and sleeping hour that determine academic standing of the students were obtained from the canonical analysis of the SORSM using equation

$$P = \Phi B^{-1} b \qquad \text{.....(4)}$$

Where φ is set of values, B is a 2x2 matrix obtained from the second order model and b is also a column matrix from the model. Optimum point of the model was achieved when φ = 0.5. This optimum point was at maximum, the eigen values of B were both negative.

Results and discussion

The results of correlation analysis show that there is positive linear relationship between both reading and sleeping hours and student CGPA. The degree of the relationship is not strong between reading hour and CGPA (r = 0.087) and also is weak between sleeping hour and CGPA (r = 0.097) as shown in table1.

The second order response surface model that was derived from the data gave

$$Y=3.085+0.470x_1+0.329x_2-0.058x_1^{\ 2}-0.033x_2^{\ 2}-0.007x1x2 \qquad \text{..... (5)}$$

as shown in table 2.

From the Analysis of Variance result, the probability value for the fitted SORSM and lack of fit result were 0.032 and 0.424 respectively at 1% which means that the fitted model is significant as in tables 3 and 4 respectively.

From the fitted model

$$b = \begin{Bmatrix} 0.470 \\ 0.329 \end{Bmatrix}$$

$$B = \begin{Bmatrix} -0.05 & 0.0035 \\ 0.0035 & -.033 \end{Bmatrix}$$

$$B^{-1} = \begin{Bmatrix} -17.35 & -1.84 \\ -1.84 & -30.50 \end{Bmatrix}$$

$$\varphi B^{-1} b = \varphi \begin{Bmatrix} -0.05 & 0.0035 \\ 0.0035 & -.033 \end{Bmatrix} \begin{Bmatrix} 0.470 \\ 0.329 \end{Bmatrix}$$

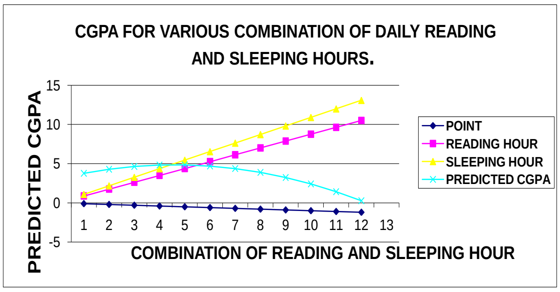
$$\varphi \begin{Bmatrix} -8.76 \\ -10.90 \end{Bmatrix}$$

The eigen values of matrix B are -0.0325 and -0.0585. This means that the turning point of the model is at maximum and the canonical form of the fitted model is

$$Y = 4.843772 - 0.0325w_1^{\,2} - 0.0585w_2^{\,2} \qquad (6)$$

Where w_1 and w_2 are the transformed (x_1 and x_2) independent variables respectively. Based on this study, the above model can only have positive values if and only if $-0.1 \leq \varphi \leq -1.2$, since daily average reading hour (x_1), daily average sleeping hour (x_2) and students' CGPA can never be negative. As a result, the predicted CGPA were estimated and it was observed that student would be in a good academic standing if his average daily reading hour ranges from 1 hour to 9 hours and with average daily sleeping hour ranges from 1 hour to 11 hours after normal class lectures. The optimum CGPA would be achieved if the students could read for 4 hours daily and rest for 5 hours after the normal class lectures. This is illustrated in table 4 and figure 1

Figure 1



Conclusion

It was observed that there is positive linear relationship between both daily average reading hour and CGPA and daily average sleeping hour and CGPA. From the fitted SORSM, it was observed that student would be in a good academic standing if his average daily reading hour ranges from 1 hour to 9 hours and with average daily sleeping hour ranges from 1 hour to 11 hours after the normal daily lectures and canonical analysis of the model shows that maximum CGPA would be achieved when daily average reading hour (x_1) is 4 and daily average sleeping hour (x_2) is 5.

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Table 1: Correlation results among reading hour, sleeping hour and CGPA

		CGPA	AVERAGEREADINGHOUR	AVERAGESLEEPINGHOUR
CGPA	Pearson Correlation	1	.087	.097
	Sig. (2-tailed)		.219	.172
	N	200	200	200
AVERAGEREADINGHOUR	Pearson Correlation	.087	1	.021
	Sig. (2-tailed)	.219		.767
	N	200	200	200
AVERAGESLEEPINGHOUR	Pearson Correlation	.097	.021	1
	Sig. (2-tailed)	.172	.767	
	N	200	200	200

Table 2: Estimates of the second order response surface model

Model		Unstandardized Coefficients		Sig.
		B	Std. Error	P-value
1	(Constant)	3.085	1.271	0.0394
	AVERAGEREADINGHOUR (X_1)	0.470	0.372	0.0208
	AVERAGESLEEPINGHOUR (X_2)	0.329	0.435	0.0450
	X_1^2	-0.058	0.044	0.0184
	X_2^2	-0.033	0.046	0.0482
	X_1X_2	0.007	0.057	0.0409

Table 3: Analysis of variance result for second-order response surface model

Source	Type I Sum of Squares	Df	Mean Square	F	P-value
Corrected Model	18.127(a)	22	0.824	3.536	0.032
Intercept	1614.427	1	1614.427	6928.872	0.000
AVERAGEREADINGHOUR (X_1)	4.534	5	0.907	3.893	0.029
AVERAGESLEEPINGHOUR (X_2)	6.277	5	1.255	5.3863	0.013
X_1^2	.000	0	.	.	.
X_2^2	.000	0	.	.	.
X_1X_2	7.316	12	0.610	2.618	0.061
Error	41.241	177	0.233		
Total	1673.795	200			

Table 4: Lack of fit test result the model

Source	Sum of Squares	df	Mean Square	F	Sig.
Lack of Fit	2.064	3	0.688	0.938	0.424
Pure Error	127.617	174	0.733		

Table 4: Predicted CGPA from fitted second-order model

φ	x_1	x_2	PREDICTED CGPA
-0.1	0.876	1.09	3.771615
-0.2	1.752	2.18	4.2908
-0.3	2.628	3.27	4.642554
-0.4	3.504	4.36	4.826878
-0.5	4.38	5.45	4.843772
-0.6	5.256	6.54	4.693236
-0.7	6.132	7.63	4.37527
-0.8	7.008	8.72	3.889873
-0.9	7.884	9.81	3.237046
-1	8.76	10.9	2.416789
-1.1	9.636	11.99	1.429102
-1.2	10.512	13.08	0.273984