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## **Statistical Modelling in Examining Social Media Usage on Academic Performance of Students: A Case Study of Colleges of Education in Ghana**

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### **Abstract**

This study examines social media usage on academic performance of students in the Colleges of Education in Ghana. To achieve this, ordinal logistic regression and linear models were used on a sample of 400 students chosen at random from the four zonal Colleges of Education. The result uncovered that social network usage for non-educational purposes has an adverse effect on students' academic performance. The findings of the study indicate that a student using social media mainly for educational purposes has a greater chance of obtaining a better grade in Further Algebra (one of the mathematics courses in Colleges of Education in Ghana) than that of a student who uses it for mainly non-educational purposes. The study therefore suggests that the time used on social media for educational purposes should be increased while that for non-educational purposes should be reduced in order to aid academic performance. Parents and teachers should monitor student's usage of social media in order to deter them from using it for non-educational purposes. Since most educational activities can be done through the social media, parents and teachers should engage the students on those media in order to help improve their performances as well as reducing its usage for non-educational purposes.

**Keywords:** social media (social network sites), college, gap, academic performance, education and non-education.

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## INTRODUCTION

Education plays a vital role in the development of human capital and an individual's wellbeing and opportunities for better living in this current globalization and technological era (Farooq, Chaudhry, Shafiq & Berhanu, 2011). However, the top priority for educators is the quality of performance of students since it is the only avenue that can bring all the prospects discussed. Researchers, educators and trainers' main interest is identifying variables or factors that influence the academic performance of students.

These factors have been categorized by Crosnoe, Johnson and Elder (2004) into school factors, student factors, peer factors and family factors. The most researched factors that contribute to determining academic performance of students have been socioeconomic factors and teaching styles.

However, the influence of social network site on academic achievement have been scantily researched. Although some studies (Mansoor et al., 2016) tried to link social media usage to academic performance, their findings were based on perception and opinions of the students and were not scientifically proven. These studies (David et al., 2012) also failed to indicate what students normally use the social media for. Another aspect that they did not cover is the time or frequency of the social media usage (David et al., 2012) .

This study however bridges these gaps by examining social media usage on academic performance of students in the colleges of education in Ghana. The purpose of this research is to explore, portray accurately and test the hypothesis on how social media usage predicts academic performance of students in colleges of education in Ghana.

### Research Objectives

The main objective of this study is to examine the influence of social media usage on academic performance in colleges of education in Ghana. The specific objectives are to:

- i. Examine the effect of social media usage for educational purposes on students' academic performance in colleges of education in Ghana using statistical models.

- ii. Verify the effect of social media usage for non-educational purposes on students' academic performance in colleges of education in Ghana using statistical models.
- iii. Examine the link between the frequency of social media usage and academic performance.

### **Research Questions**

- i. What is the consequence of social media usage for educational purposes on students' academic performance in colleges of education in Ghana using statistical models?
- ii. What is the effect of social media usage for non-educational purposes on students' academic performance in colleges of education in Ghana using statistical models?
- iii. What is the connection between the frequency of social media usage and academic performance?

### **Research Hypothesis**

- i. Social media usage for educational purposes predicts students' academic performance in Colleges of Education in Ghana.
- ii. Social media usage for non-educational purposes predicts students' academic performance in Colleges of Education in Ghana
- iii. There is a link between the frequency of social media usage and academic performance.

### *Delimitation of the Study*

- The current study is delimited to students pursuing further algebra as one of their courses in the Colleges of Education in Ghana.
- This study covers the periods between 2018 and 2020.
- The dependent variable is students' performance in Further Algebra while the independent variable is social media usage.

The findings of this study will add up to the existing literature to aid future research.

This study will also guide College of Education students with respect to management of their time in regard to social media usage in order to fully utilize the benefits of social network sites.

## **LITERATURE REVIEW**

### **Theory**

Technology refers to the methods, systems and devices which are the result of scientific knowledge being used for practical purposes (Stehr, 2017). Information technology is the use of systems such as computers and telecommunications for storing, retrieving and sending information (Adejimola, 2008).

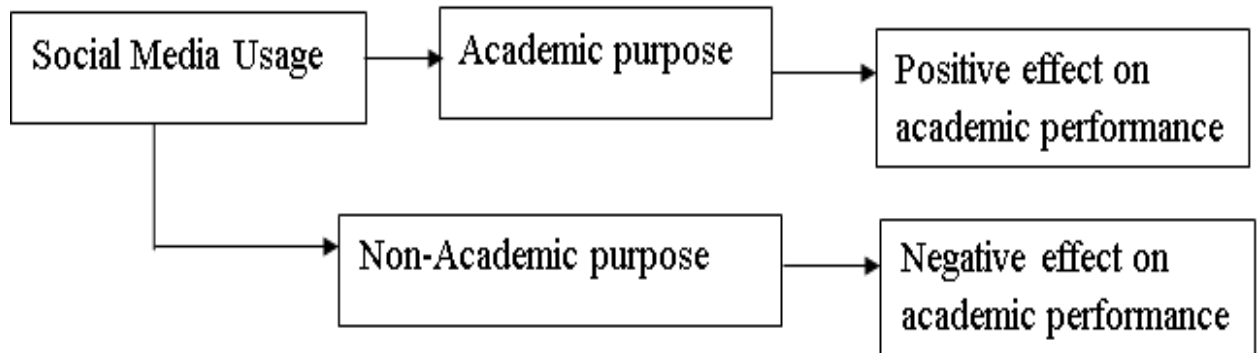
Social media (such as Twitter, Facebook, WhatsApp, LinkedIn, Instagram, google, yahoo, palmchat or skype) are interactive computer-mediated technologies that facilitate the creation and sharing of information, ideas, career interests and other forms of expression via virtual communities and networks (Wellman & Gulia, 2018).

Academic Performance is the apparent demonstration of understanding, concepts, skills, ideas and knowledge of a person and proposed that grades clearly depict the performance of a student (Yeboah & Ewur, 2014).

**LITERATURE REVIEW: EMPIRICAL REVIEW**

<b>AUTHOR</b>	<b>TITLE</b>	<b>METHODOLOGY</b>	<b>FINDINGS</b>	<b>GAPS</b>
Krupalini (2018)	A study on impact of social networking sites on students' academic performance with special reference to Facebook	Employed descriptive research design and used Chi-Square and Fisher's exact test.	The findings revealed an association between lower academic performance and social media usage.	The result cannot be generalized for the entire population since the criteria used to select the sample was not probabilistic in order to apply design effect on the results. Also, there was no model linking the two major variables. The study also failed to indicate what students normally use the social media for.
Ketari & Khanum (2013)	Impact of Facebook usage on the academic grades: A case study	They employed descriptive research design and tested their hypothesis using the various test of associations under Chi-Square analysis.	Found a negative association between social media usage and academic performance.	They also used a non-probability sampling technique in selecting their sample. Facebook was also the only social media network used in the study.

Amin et al., (2016)	Impact of social media of student's academic performance	A probability sampling method was used. They used quantitative research approach in their study.	They found a positive correlation between Facebook (r=0.298, p-value=0.000) or Twitter (r=0.233, p-value=0.000) usage and students' academic performance.	Despite it tried to obtain a model to link social media usage and academic performance, the model was not the best fit for the data since its Adjusted R-Square was 0.083. Normality was not justified for the data.

**Literature Review: Conceptual Framework**

- The conceptual framework indicates that when social media is used for academic purposes, it positively influences academic performance.
- However, when it is used for non-academic purposes, it negatively influences academic performance.

**METHODOLOGY****Research Design**

This study explains how social media usage predicts students' performance in the colleges of education, therefore, the most appropriate designs are both **deductive and quantitative** (de Dieu Basabose, 2019). In addition to the major design for the study, descriptive and explanatory research designs will also be used for this study. Descriptive research design is a survey design that surveys and finds enquiries of different kinds in which the researcher has no control over the variables. Explanatory research design focuses on why questions. In explanatory research design, we explore (WHAT), describe (HOW) and explain (WHY) the status of a range of situation or phenomena instead of focusing on a specific instance of a problem (Baskerville & Pries-Heje, 2010). This study will explore how social media usage predicts students' performance in the colleges of education.

- **Primary and secondary data sources** are used for this study.

- The primary data was collected from the students using a structured questionnaire as the study instrument while the secondary data was collected from the academic affairs department of the institutions.
- The **target population** of this study was students pursuing Further Algebra as one of their courses in colleges of education in Ghana between 2018 and 2020.

### Sample Size

The sample size is 400 students from all the colleges of education in Ghana. Miller and Brewer's (2003) formula was used to calculate this sample size since the target population is known. There are 42 training colleges in Ghana, and each has an average of 180 students pursuing further algebra. Therefore, the average total is 7,560. Using the Miller and Brewer's (2003), we have;

$$n = \frac{N}{1 + N(\alpha)^2}$$

Where 'N' is the sample frame or population, 'n' is the sample size and 'α' is the margin of error which in this case is (5%). The 95% confidence interval was chosen for this study because the study deals with human beings whose accuracy of information is subject to biases unlike the physical sciences with high degree of certainty. By the formula, N=7,560 and α= 0.05.

Therefore;

$$n = \frac{7560}{1 + 7560 (0.05)^2}$$

$$n = 379.9 \cong 400$$

Hence, the sample size was 400. Therefore, 400 respondents as indicated earlier will be selected for the study. The target campuses are dispersed geographically, and it made it difficult to reach all of them.



- The appropriate method of sampling that made it possible was **multistage sampling**.
- Colleges of Education in Ghana have been grouped into **four major zones** namely, Eastern Greater Accra (EGA), Central Western (CENWET), Ashanti Brong Ahafo Northern (ASHBAN) and Volta (VOLTA).
- **Stratified sampling method** was used to select 100 students from each of these zones for the study since the zones are heterogenous within.
- However, in each zone, cluster sampling was used to select one College of Education from each of the zones and within these four Colleges.
- **A systematic random sampling** was then used to select the students for the study in order to increase the accuracy of the result. The sampling frame used was the class register of the students pursuing Further Algebra.
- A **structured questionnaire** was used to collect the data.
- The Cronbach's Alpha Coefficient was used to determine the **validity and reliability** of the questionnaire.
- **Schedule method** was used to collect the data.
- Factor analysis (PCA), multiple linear regression and logistic regression analyses were employed. The level of significance ( $\alpha$ ) is 0.05.
- Respondents privacy was protected in line with the research ethical standards.
- For this study, the simplified model is given by;
- $$P = \beta_0 + \beta_1 SMU_{EDU} + \beta_2 SMU_{NON} + \beta_3 SMU_{BOTH} + \varepsilon$$
- Where  $P$  is Academic Performance in Further Algebra,  $\beta_0$  is the intercept or Academic Performance in Further Algebra when all predictor variables are held constant,  $\beta_1, \beta_2, \beta_3$  are the coefficients of the predictor variables,  $SMU_{EDU}$  is Social Media Usage for Educational Purposes,  $SMU_{NON}$  is Social Media Usage for Non-

Educational Purposes,  $SMU_{BOTH}$  is Social Media Usage especially for Both-Educational and Non-Educational Purposes and  $\varepsilon$  is the error term which is normally distributed. The software used are R, SPSS, Excel and XLSTAT.

## FINDINGS AND DISCUSSIONS

**Table 4.1: Demographic Profile of respondents**

Variables	Frequency	Percent
<b>Age</b>		
19	45	11.3
20	76	19.0
21	97	24.3
22	62	15.5
23	78	19.5
24	42	10.5
Total	400	100.0
Mean (21.445)		
Mode (21)		
Median (21)		
Standard Deviation (1.526)		
<b>Gender</b>		
Female	208	52.0
Male	192	48.0
Total	400	100.0
<b>Zone/Region/District/Community</b>		
EGA/Eastern/Akuapem	100	25.0
North/Akropong		
CentWest/Central/Abura/Cape	100	25.0
Coast		
Volta/Volta/Hohoe/Hohoe	100	25.0
ASHBAN/Ashanti/Kofrom/Kumasi	100	25.0
Total	400	100.0
<b>Year/Level of Education</b>		
One	10	2.5
Two	390	97.5
Total	400	100.0

**Source:** Author's estimation from 2020 survey data.

Also, the average, median and modal ages of the students studied were equivalent and it was 21 years with a standard deviation of 1.5. However, the age of the students ranged between 19 and 24 years. To add to the above, 390 of the students studied, representing 97.5%, were in their second, while those in the first year were 2.5%. This information aided the study since it gave variety of views and opinions for the study.

**Table 4.2: KMO and Bartlett's Test**

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	.547
Bartlett's Test of Sphericity	Approx. Chi-Square
	df
	P-value
	27847.416
	4560
	.000

**Source:** Author's estimation from 2020 survey data.

- The independent variables are 96 in number. However, since they were too many, Principal Component Analysis (PCA) was used to reduce the variables.
- In order to go ahead with the PCA, KMO and Bartlett's test was done to affirm its appropriateness.
- The result in Table 4.2 indicates that the PCA is appropriate since the p-value was less than 0.05 and the Kaiser-Meyer-Olkin's measure of sampling adequacy was above 0.5 with an approximate Chi-Square of 27847.416 and a degree of freedom of 4560 (Solanki & Kothari, 2014 and Jazi et al., 2020).

**Table 4.3: Reliability Statistics**

Cronbach's Alpha	N of Items
0.715	96

**Source:** Author's estimation from 2020 survey data.

- In addition to the discussion above, Cronbach's Alpha of the independent variables in Table 4.3 was 0.715 which is greater than 0.7.
- This also supports the argument by Jazi, Peyrovi and Zareiyan (2020) that a Cronbach Alpha greater than 0.7 is accurate and appropriate.

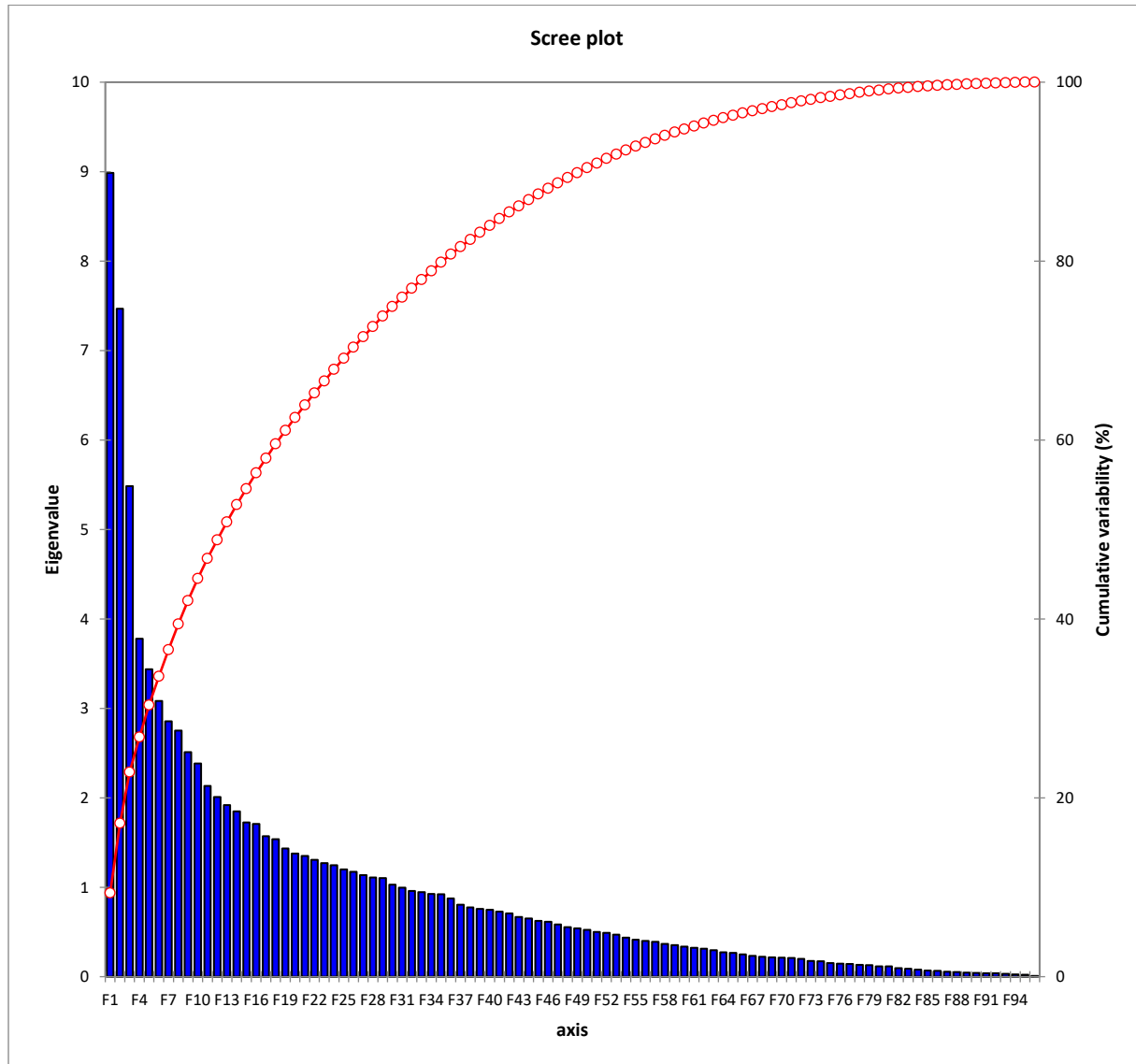
**Table 4.4: Principal Component Analysis (Eigenvalues)**

Factor		Variability	
Loadings	Eigenvalues	(%)	Cumulative %
F1	8.9862	9.3606	9.3606
F2	7.4676	7.7787	17.1394
F3	5.4829	5.7113	22.8507
F4	3.7789	3.9363	26.7871
F5	3.4375	3.5807	30.3678
F6	3.0823	3.2107	33.5785
F7	2.8558	2.9748	36.5533
F8	2.7515	2.8661	39.4194
F9	2.5094	2.6139	42.0333
F10	2.3822	2.4815	44.5148
F11	2.1338	2.2227	46.7375
F12	2.0082	2.0919	48.8294
F13	1.9200	2.0000	50.8294
F14	1.8473	1.9243	52.7537
F15	1.7241	1.7959	54.5496
F16	1.7076	1.7787	56.3284
F17	1.5694	1.6348	57.9631
F18	1.5360	1.6000	59.5631
F19	1.4321	1.4917	61.0548
F20	1.3755	1.4328	62.4877
F21	1.3488	1.4050	63.8926
F22	1.3073	1.3617	65.2544
F23	1.2687	1.3216	66.5760
F24	1.2471	1.2991	67.8751
F25	1.1981	1.2481	69.1231
F26	1.1738	1.2228	70.3459
F27	1.1350	1.1822	71.5281
F28	1.1083	1.1545	72.6826
F29	1.1015	1.1474	73.8300
F30	1.0281	1.0709	74.9009

**Source:** Author's estimation from 2020 survey data.

The Eigenvalues in Table 4.4 shows that factor loadings F1 to F30 were very strong since their eigenvalues were greater than one (1) (Francis et al., 2020; Agrawal et al., 2020). Also,

F1 to F30 cumulatively contribute about 75%. This is encouraging because the study will only lose 25% of the information by excluding the other factor loadings.



**Figure 4.1: Scree Plot of the PCA**

The Scree plot in Figure 4.1 also revealed that after the 30th loading, the rest began to look like a straight line.

**Table 4.5: Factor loading of variables that vary together based on Squared cosines**

- F1) B24edu, B18non, B19non, B23non, B27non, B28non, B29non, B17both, B23both, B24both, B27both, B28both, B29both, B34edu, B44edu (*Mainly for non-educational*)
- F2) B4, B5, B6, B9, B17edu, B18edu, B19edu, B20edu, B25edu, B28edu, B20non, B21non, B25non, B18both, B19both, B38edu, B41edu, B37non, B47non (*Mainly for educational*)
- F3) B8, B12, B13, B21edu, B22non, B45edu, B33non (*Evenly educational*)
- F4) B3, B11, B36edu (*Educational*)
- F5) B14, B15, B29edu, B30both, B31both, B32both (*Both purposes*)
- F6) B23edu, B36non, B40non, B44non, B46non (*Non-educational*)
- F7) B30non, B31non, B32non, B43non (*Purely non-educational*)
- F8) B34non, B35non, B39non (*Fully non-educational*)
- F9) B26edu, B17non, B20both, B21both (*Partly both purposes*)
- F10) B10, B16 (*Aware of LinkedIn*)
- F11) B22both (*Twitter for both purposes*)
- F12) B30edu, B48non (*Badoo educational & others for non-educational*)
- F13) B38non (*Twitter for non-educational*)
- F14) B47edu (*Myspace for educational*)
- F15) B46edu (*Badoo for educational*)
- F16) B26non (*LinkedIn for non-educational*)
- F17) B32edu, B24non, B41non (*Yahoo & Skype for non-educational*)
- F18) B1 (*Aware of Google*)
- F19) B47edu (*Myspace for educational*)
- F20) B40edu (*Yahoo for educational*)
- F21) B33edu (*Google for educational*)
- F22) B26both, B42non (*LinkedIn for both purposes*)

F23) B22edu (*Twitter for educational*)

F24) B37edu (*Zoom for educational*)

F25) B27edu (*YouTube for educational*)

F26) B48edu (*Other social media for educational*)

F27) B31edu (*Myspace for educational*)

F28) B46edu (*Badoo for educational*)

F29) B25both (*Skype for both purposes*)

F30) B2 (*Aware of Facebook*)

The Squared cosines of the variables (weights) used to multiply the original corresponding variable figures before adding to form the new variables as named above. After the generating the new variables, the dependent variable was tested for normality.

Table 4.6: Normality Test

Variable \ Test	Shapiro-	Anderson-		Jarque-Bera
	Wilk	Darling	Lilliefors	
(C1)	< 0.0001	< 0.0001	< 0.0001	< 0.0001

**Source:** Author's estimation from 2020 survey data.

The test result in Table 4.6 disproves the normality of the academic performance data. However, since the dependent variable is not normally distributed, logistic regression was used to analyze the data since it is robust enough to handle that kind of data. Moreover, since students' performance data is ordinal, the ordinal logistic regression was used.

**Table 4.7: Ordinal Logistic Regression**

Source	DF	Chi-square (Wald)	Pr > Wald
F1	1	7.337092	0.0068
F2	1	13.73048	0.0002
F3	1	0.945063	0.3310
F4	1	12.0066	0.0005
F5	1	14.839	0.0001
F6	1	22.58787	< 0.0001
F7	1	1.265034	0.2607
F8	1	18.26521	< 0.0001
F9	1	4.290428	0.0383
F10	1	0.563634	0.4528
F11	1	1.756311	0.1851
F12	1	3.311221	0.0688
F13	1	5.35515	0.0207
F14	1	1.848219	0.1740
F15	1	1.394683	0.2376
F16	1	1.207716	0.2718
F17	1	3.601057	0.0577
F18	1	0.004875	0.9443
F20	1	29.28856	< 0.0001
F21	1	2.947831	0.0860
F22	1	2.424794	0.1194
F23	1	5.992592	0.0144
F24	1	2.448262	0.1177



F25	1	1.650411	0.1989
F26	1	0.024163	0.8765
F27	1	1.233299	0.2668
F29	1	10.22024	0.0014
F30	1	1.138102	0.2861

**Source:** Author's estimation from 2020 survey data.

The performance was ordered as 0 (i.e. E=0-49%), 1 (i.e. D=50-54%), 2 (i.e. D+=55-59%), 3 (i.e. C=60-64%), 4 (i.e. C+=65-69%), 5 (i.e. B=70-74%), 6 (i.e. B+=75-79%) and 7 (i.e. A=80-100%). The results in Table 4.7 revealed that factors F1, F2, F4, F5, F6, F8, F9, F13, F20, F23 and F29 are significant in predicting students' academic performance in further algebra.

These eleven variables were then used for the further analysis.

**Table 4.8: Ordinal Logistic regression with the eleven factors**

Source	DF	Chi-square (Wald)	Pr > Wald
F1	1	30.6701036	< 0.0001
F2	1	16.28771227	< 0.0001
F4	1	16.41000562	< 0.0001
F5	1	5.587330902	0.0181
F6	1	35.8265971	< 0.0001
F8	1	17.71187097	< 0.0001
F9	1	5.654778427	0.0174
F13	1	7.700252971	0.0055
F20	1	40.25375446	< 0.0001
F23	1	6.852192603	0.0089
F29	1	3.012827197	0.0826

**Source:** Author's estimation from 2020 survey data.

The findings in Table 4.8 indicates that F29 has to be dropped since its p-value was greater than 0.05. The ten remaining variables were then used for the final analysis.

Variables	Spearman's rho(r)	C2	F1	F2	F4	F5	F6	F8	F9	F13	F20	F23
Grade(C2)	R	1.000	-.294**	.360**	.110*	0.086	-.243**	-.407**	.109*	.122*	.221**	0.014
	p-value		0.000	0.000	0.028	0.087	0.000	0.000	0.029	0.015	0.000	0.779
F1	R	-.294**	1.000	-.289**	.306**	-.149**	.365**	0.060	-.166**	-0.098	.241**	-0.065
	p-value		0.000	0.000	0.000	0.003	0.000	0.230	0.001	0.051	0.000	0.194
F2	R	.360**	-.289**	1.000	.353**	.358**	0.020	-0.050	0.071	.507**	.119*	.231**
	p-value		0.000	0.000	0.000	0.000	0.694	0.321	0.156	0.000	0.017	0.000
F4	R	.110*	.306**	.353**	1.000	0.043	.242**	.244**	-0.020	.284**	.173**	.122*
	p-value		0.028	0.000	0.000	0.389	0.000	0.000	0.697	0.000	0.001	0.014
F5	R	0.086	-.149**	.358**	0.043	1.000	.182**	-.119*	0.085	0.056	0.058	.239**
	p-value		0.087	0.003	0.000	0.389	0.000	0.018	0.090	0.260	0.247	0.000
F6	R	-.243**	.365**	0.020	.242**	.182**	1.000	0.040	-0.076	-0.091	.207**	0.032
	p-value		0.000	0.000	0.694	0.000	0.000	0.422	0.129	0.069	0.000	0.530
F8	R	-.407**	0.060	-0.050	.244**	-.119*	0.040	1.000	.114*	.232**	-.233**	-0.007
	p-value		0.000	0.230	0.321	0.000	0.018	0.422	0.022	0.000	0.000	0.882
F9	R	.109*	-.166**	0.071	-0.020	0.085	-0.076	.114*	1.000	.162**	-.207**	.118*
	p-value		0.029	0.001	0.156	0.697	0.090	0.129	0.022	0.001	0.000	0.018
F13	R	.122*	-0.098	.507**	.284**	0.056	-0.091	.232**	.162**	1.000	-0.055	-0.033
	p-value		0.015	0.051	0.000	0.000	0.260	0.069	0.000	0.001	0.272	0.512
F20	R	.221**	.241**	.119*	.173**	0.058	.207**	-.233**	-.207**	-0.055	1.000	-0.042
	p-value		0.000	0.000	0.017	0.001	0.247	0.000	0.000	0.000	0.272	0.400
F23	R	0.014	-0.065	.231**	.122*	.239**	0.032	-0.007	.118*	-0.033	-0.042	1.000
	p-value		0.779	0.194	0.000	0.014	0.000	0.530	0.882	0.018	0.512	0.400
N		400	400	400	400	400	400	400	400	400	400	400

\*\* . Correlation is significant at the 0.01 level (2-tailed).

\* . Correlation is significant at the 0.05 level (2-tailed).

**Source:** Author's estimation from 2020 survey data.

The Spearman's correlation analysis in Table 4.9 indicates that there was no multicollinearity among the independent variables since their values were less than 0.7. All the independent variables were positively related to students' performance, except F1, F6 and F8. However, F5 and F23 were not significant since their p-values were greater than 0.05.

The following Table 4.10 presents the ordinary logistic regression with the remaining ten independent variables.

**Table 4.10: Goodness of fit statistics (Variable C2)**

Statistic	Independent	Full
Observations	400	400
Sum of weights	400.0000	400.0000
DF	393	383
-2 Log (Likelihood)	1613.5629	1440.1707
R <sup>2</sup> (McFadden)	0.0000	0.1075
R <sup>2</sup> (Cox and Snell)	0.0000	0.3541
R <sup>2</sup> (Nagelkerke)	0.0000	0.3581
AIC	1627.5629	1474.1707
SBC	1655.5032	1507.0854
Iterations	0	6

**Source:** Author's estimation from 2020 survey data.

About 35.41% of the total variation in students' academic performance can be explained by social media usage for both education and non-educational purposes.

**Table 4.11: Test of the null hypothesis H<sub>0</sub>: Y=0 (Variable C2)**

Statistic	DF	Chi-square	Pr > Chi <sup>2</sup>
-2 Log (Likelihood)	10	173.3922	< 0.0001
Score	10	179.4497	< 0.0001
Wald	10	137.6117	< 0.0001

**Source:** Author's estimation from 2020 survey data.

The results from the study in Table 4.11 indicate that the ordinary logistic regression model is appropriate for the data since the p-values were less than 0.05.

**Table 4.12: Coefficients of the final ordinal logistic regression model**

Source	DF	Standard	Wald Chi-	Pr >	Wald Lower	Wald Upper	
	Value	error	Square	Chi <sup>2</sup>	bound (95%)	bound (95%)	
Intercept	7	-1.9602	0.3958	24.5329	< 0.0001	-2.7358	-1.1845

Intercept6		-0.6086	0.3677	2.7402	0.0979	-1.3292	0.1120
Intercept5		0.0080	0.3652	0.0005	0.9825	-0.7078	0.7238
Intercept4		0.5195	0.3669	2.0047	0.1568	-0.1996	1.2386
Intercept3		1.0254	0.3695	7.6998	0.0055	0.3011	1.7497
Intercept2		1.5482	0.3735	17.1826	< 0.0001	0.8162	2.2802
Intercept1		2.9785	0.3959	56.6021	< 0.0001	2.2026	3.7545
F1	1	-1.0142	0.1741	33.9342	< 0.0001	-1.3555	-0.6730
F2	1	0.6678	0.1694	15.5349	< 0.0001	0.3357	0.9999
F4	1	2.1479	0.5167	17.2789	< 0.0001	1.1352	3.1607
F5	1	-1.9850	0.8799	5.0889	0.0241	-3.7096	-0.2604
F6	1	-0.3351	0.0550	37.1397	< 0.0001	-0.4429	-0.2274
F8	1	-0.2447	0.0567	18.6070	< 0.0001	-0.3560	-0.1335
F9	1	3.3662	1.3375	6.3344	0.0118	0.7448	5.9876
F13	1	-1.7430	0.6352	7.5310	0.0061	-2.9879	-0.4982
F20	1	7.1589	1.1138	41.3156	< 0.0001	4.9760	9.3418
F23	1	-15.6018	6.0344	6.6847	0.0097	-27.4291	-3.7746

**Source:** Author's estimation from 2020 survey data.

The result in Table 4.12 revealed that all the ten variables used (F1, F2, F4, F5, F6, F8, F9, F13, F20 and F23) were significant at 95% confidence level in predicting students' academic performance. The linear combination of the coefficients without the intercepts is given as;

$$Y = -1.0142F1 + 0.6678F2 + 2.1479F4 - 1.9850F5 - 0.3351F6 - 0.2447F8 + 3.3662F9 - 1.7430F13 + 7.1589F20 - 15.6018F23.$$

That is, for a minute usage of social media for mainly non-educational purposes (F1), we expect about 1.0142 decrease in the expected value of students' performance in Further Algebra in the log odds scale, given that all other variables in the model are held constant. However, for a minute usage of social media for mainly educational purposes (F2), we expect about 0.6678 increase in the expected value of students' performance in Further Algebra in the log odds scale, given that all other variables in the model are held constant.

Table 4.13 gives the equations for students obtaining A, B+, B, et-cetera in Further Algebra.

**Table 4.13: Ordinary logistic regression models for each grade or performance**

Grade	P(K=I, ..., XIV)	Equation
P(A)	P(I)	$\left(\frac{1}{1 + e^{-(-1.9602+Y)}}\right)$
P(A or B+)	P(II)	$\left(\frac{1}{1 + e^{-(-0.6086+Y)}}\right)$
P(B+)	P(III)=P(II)-P(I)	$\left(\frac{1}{1 + e^{-(-0.6086+Y)}}\right) - \left(\frac{1}{1 + e^{-(-1.9602+Y)}}\right)$
P(A or B+ or B)	P(IV)	$\left(\frac{1}{1 + e^{-(0.0080+Y)}}\right)$
P(B)	P(V)=P(IV)-P(II)	$\left(\frac{1}{1 + e^{-(0.0080+Y)}}\right) - \left(\frac{1}{1 + e^{-(-0.6086+Y)}}\right)$
P(A or B+ or B or C+)	P(VI)	$\left(\frac{1}{1 + e^{-(0.5195+Y)}}\right)$
P(C+)	P(VII)=P(VI)-P(IV)	$\left(\frac{1}{1 + e^{-(0.5195+Y)}}\right) - \left(\frac{1}{1 + e^{-(0.0080+Y)}}\right)$
P(A or B+ or B or C+ or C)	P(VIII)	$\left(\frac{1}{1 + e^{-(1.0254+Y)}}\right)$
P(C)	P(IX)=P(VIII)-P(VI)	$\left(\frac{1}{1 + e^{-(1.0254+Y)}}\right) - \left(\frac{1}{1 + e^{-(0.5195+Y)}}\right)$
P(A or B+ or B or C+ or C or D+)	P(X)	$\left(\frac{1}{1 + e^{-(1.5482+Y)}}\right)$
P(D+)	P(XI)=P(X)-P(VIII)	$\left(\frac{1}{1 + e^{-(1.5482+Y)}}\right) - \left(\frac{1}{1 + e^{-(1.0254+Y)}}\right)$
P(A or B+ or B or C+ or C or D+ or D)	P(XII)	$\left(\frac{1}{1 + e^{-(2.9785+Y)}}\right)$
P(D)	P(XIII)=P(XII)-P(X)	$\left(\frac{1}{1 + e^{-(2.9785+Y)}}\right) - \left(\frac{1}{1 + e^{-(1.5482+Y)}}\right)$
P(E)	P(XIV)=1-P(XII)	$1 - \left(\frac{1}{1 + e^{-(2.9785+Y)}}\right)$

**Source:** Author's estimation from 2020 survey data.

The result in Table 4.13 revealed that, the probability of a student obtaining an “A” [P(A)]

in Further Algebra if he/she uses the social media mainly for non-educational purposes

(F1) is 0.049. That is  $\left(\frac{1}{1+e^{-(-1.9602-1.0142)}}\right) = \left(\frac{1}{1+e^{(2.9744)}}\right) = 0.049$ .

Similarly, the probability of a student obtaining an “A” [P(A)] in Further Algebra if he/she

uses the social media mainly for educational purposes (F2) is 0.215. That is

$\left(\frac{1}{1+e^{-(-1.9602+0.6678)}}\right) = \left(\frac{1}{1+e^{(1.2924)}}\right) = 0.215$ .

Therefore, comparing the two probabilities in both cases, it is obvious that a student using

social media mainly for educational purposes has a greater chance of obtaining an “A” in

Further Algebra than that of a student who uses it for mainly non-educational purposes.

This finding conforms to the findings of Lambić (2016) who found a positive correlation

between Facebook use for educational purposes and academic performance. Table 4.14

presents the prediction of the first 20 observations.

**Table 4.14: Predictions for the first 20 observations**

Observation	Pred(E)	Pred(D)	Pred(D+)	Pred(C)	Pred(C+)	Pred(B)	Pred(B+)	Pred(A)
Obs1=D	0.3212	0.4780	0.2008	0.1350	0.0956	0.0574	0.0403	0.0149
Obs2=D	0.4965	0.3836	0.1199	0.0753	0.0505	0.0293	0.0201	0.0072
Obs3=E	0.4012	0.4392	0.1596	0.1035	0.0712	0.0420	0.0291	0.0106
Obs4=C	0.1965	0.5171	0.2863	0.2081	0.1589	0.1001	0.0732	0.0285
Obs5=B+	0.0853	0.5174	0.3973	0.3222	0.2811	0.1972	0.1575	0.0713
Obs6=A	0.0797	0.5162	0.4041	0.3302	0.2908	0.2062	0.1659	0.0764
Obs7=C	0.0553	0.5105	0.4343	0.3692	0.3387	0.2550	0.2120	0.1091
Obs8=B+	0.0725	0.5146	0.4129	0.3409	0.3039	0.2186	0.1776	0.0840
Obs9=B	0.0673	0.5134	0.4193	0.3489	0.3139	0.2285	0.1869	0.0903
Obs10=C+	0.1122	0.5213	0.3665	0.2879	0.2410	0.1626	0.1260	0.0536
Obs11=D+	0.2115	0.5142	0.2743	0.1971	0.1488	0.0930	0.0675	0.0260
Obs12=E	0.1038	0.5204	0.3758	0.2980	0.2525	0.1722	0.1346	0.0582
Obs13=D	0.1798	0.5197	0.3005	0.2213	0.1715	0.1091	0.0804	0.0316
Obs14=B+	0.0633	0.5124	0.4243	0.3555	0.3219	0.2368	0.1947	0.0959
Obs15=A	0.0368	0.5084	0.4549	0.4075	0.3804	0.3109	0.2623	0.1580

Obs16=B+	0.1894	0.5183	0.2923	0.2136	0.1641	0.1038	0.0762	0.0297
Obs17=C	0.0583	0.5112	0.4305	0.3639	0.3322	0.2478	0.2052	0.1037
Obs18=C+	0.1290	0.5224	0.3486	0.2690	0.2202	0.1459	0.1113	0.0461
Obs19=E	0.0604	0.5117	0.4279	0.3602	0.3278	0.2430	0.2007	0.1002
Obs20=D+	0.2155	0.5133	0.2712	0.1943	0.1462	0.0912	0.0661	0.0254

**Source:** Author's estimation from 2020 survey data.

The result in Table 4.14 revealed that, all things being equal, if a student is capable of scoring grade D in Further Algebra, then the estimated probability that this same student will score grade E, D, D+, C, C+, B, B+ and A are 0.3212, 0.4780, 0.2008, 0.1350, 0.0956, 0.0574, 0.0403 and 0.0149 respectively according to this model. Similarly, all things being equal, if a student is capable of scoring grade A in Further Algebra, then the estimated probability that this same student will score grade E, D, D+, C, C+, B, B+ and A are 0.0368, 0.5084, 0.4549, 0.4075, 0.3804, 0.3109, 0.2623 and 0.1580 respectively based on this model. This therefore implies that social media usage mainly for non-educational purposes may downgrade a student who is capable of scoring grade A since the probability for this student scoring grade D based on this model is 0.5084 or 50.84%. This finding is empirically proven by Cao and Tian (2020) who found an adverse effect of social media use for non-educational purposes on academic performance.

## CONCLUSIONS

Based on the findings of the study, the study can conclude that following hypothesis were true.

- i. Social network usage for educational purposes predicts students' academic performance positively in colleges of education in Ghana.
- ii. Social network usage for non-educational purposes predicts students' scholastic achievement negatively in colleges of education in Ghana.
- iii. There is a positive link between social media usage for both educational and non-educational purposes simultaneously and academic performance.

- iv. There is a positive link between the frequency of social media usage for educational purposes and academic achievement.
- v. There is an adverse link between the frequency of social media usage for non-educational purposes and academic performance.

## RECOMMENDATIONS

- ❑ The findings of the study indicate that in order to enhance students' academic performance, social media should be mostly used for academic purposes. The study therefore suggests that the time used on social media for educational purposes should be increased while that for non-educational purposes should be reduced in order to aid academic performance.
- ❑ Parents and teachers should monitor student's usage of social media in order to deter them from using it for non-educational purposes.
- ❑ Since most educational activities can be done through the social media, parents and teachers should engage the students on those media in order to help improve their performances as well as reducing its usage for non-educational purposes.

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