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## The Effect of Instructional Methods on Students' Academic Performance in Ghana

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### ABSTRACT

This paper aims to establish the effect of instructional methods on students' academic performance at the Catholic University of Ghana. A quantitative (generalized linear model-full factorial analysis) and a case study approach were employed. A total of 1,809 students' data observations were analyzed. The findings postulate that blended instruction and the interaction between face-to-face and regular students significantly positively affect students' academic performance. However, the interaction between face-to-face \* regular students\* science programs and the interaction between regular students\* Science programs \* Male students adversely affects students' academic performance.

### INTRODUCTION

The method of delivering instructions to learners must be crafted in a manner that yields improvements in students' academic performance. To achieve this, diverse instructional methods have metamorphosed with time. This paper construes instructional methods to be teaching and learning activities carried out using face-to-face, online, and blended instructions. The foremost method of teaching and learning used by educational institutions across the world before the proliferation of technology and ICT was traditional face-to-face instruction. This method requires the physical presence of both the instructor and the learner (Bandara & Wijekularathna, 2017); personal interaction leading to the creation of interpersonal relationships and bonding (McDonald, 2019); ease of managing, supervising, controlling, and observing learning outcomes and active participation of the learner (Alabdulaziz & Tayfour, 2023); and been a teacher-centered approach (El *et al.*, 2021).

Technological advancements over time such as the use of the internet, mobile phones, laptops, learning management systems, Zoom, and Google Classroom among others have helped address the shortcomings of face-to-face instruction such as rigidity, in-person teaching, and learning, over-reliance on instructor, and cost ineffectiveness. This has led to a paradigm shift from the over-reliance on face-to-face instruction to more flexible instructional methods such as online and blended instruction by educational institutions. The use of online instruction as a mode of instruction is heightened in the wake of the COVID-19 pandemic. Educational institutions had no option but to go fully online due to various governments' proposed lockdown

measures. Sameera *et al.* (2023) observed that online instructions make good use of the internet through the use of computer electronic devices. Aldholay, Abdullah, and Ramayah (2019) identify online instruction as a cost-effective, flexible, personalized learning, accurate and updated learning information, minimizes time constraints, and enhances learning outcomes. Calix (2022) and Pulham and Graham (2018) construe that teaching skills required for online instruction are distinct from face-to-face instruction. They postulate that the instructor must be abreast of technology integration, crafting of e-learning lessons and activities, and identify, examine, and understand individual learners learning capabilities using technology. Post-COVID and loss of interpersonal interactions and bonding have intensified the need for hybrid teaching (blended instruction) that ensures that both benefits in online and face-to-face instruction are achieved and shortcomings in each are offsets. Ali, Khan, and Alouraini (2023) view blended instruction as a creative educational environment that incorporates traditional teaching methods by applying advanced media technology. Nguyen (2017) establishes that blended instruction offers students the opportunity to access online instructional materials, tutorials, and online lecturing in addition to traditional face-to-face instruction. Zhang and Wu (2022) observed that the increase in the use of online and blended instruction is necessitated by improvement in access and speed of the internet and investment in educational technologies.

The performance of students forms an integral part of every teaching and learning goal. Putra, Agusti, Hastuti, and Zainal (2023) observe that the success of every given learning process is determined by the academic

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performance of the students. Hayat *et al.* (2020) establish that a student's academic performance is judged by good grades and knowledge of the content of an instructional material being delivered. This study describes academic performance as the semester grade point average of students under a period of consideration.

There has been extensive literature on how instructional methods impact students' academic performance (Cavanaugh, Jacquemin, and Junker, 2023; Ghosh, Khatun, and Khanam, 2023; Alfina *et al.* 2022; Ayham and Araci, 2023; Li, Liu, Yang and Yu, 2023; Khalid, 2023; Aqdas, Ahmed and Soomro, 2023; Li, Yu and Yang, 2022; Sobaih, Hasanein and Elshaer, 2022; Li and Wang). However, there are contradictory findings from this vast literature. Cavanaugh, Jacquemin, and Junker (2023), Ghosh, Khatun, and Khanam (2023), Sobaih, Hasanein, and Elshaer (2022), and Khalid (2023) establish a positive effect of instructional methods on students' academic performance. Contrary, Aqdas, Ahmed, and Soomro (2023) and Ayham and Araci (2023) identify a negative effect of online instruction on students' academic performance. Li, Yu and Yang (2022), Li and Wang (2022), and Cole (2020) establish a positive effect of blended instruction on students' academic performance. However, Alfina *et al.* (2022) argued that blended instruction hurts students' academic performance. Ayham and Araci (2023) also establish a positive effect of face-to-face instruction on students' academic performance. In addition to these conflicting outcomes, prior literature failed to examine how the interaction between instructional method and program stream/mode, instructional method and nature of program and instructional method, and gender can influence students' academic performance. Hence, this study seeks to address these identified research gaps.

## LITERATURE REVIEW

### The Effect of Instruction Method on Students' Academic Performance

Cavanaugh, Jacquemin, and Junker (2023) assessed students' performance based on online instructions during the abrupt change from face-to-face to online instructions during the COVID-19 pandemic period. Their study was based on 831 students from 191 higher public educational institutions in the US. Their results revealed that the effect of the change from face-to-face instructions to online instructions caused a 0.10 increase in students' performance (grade point average). Thus, the abrupt shift from face-to-face instruction to online instruction did not hurt students' performance but rather impacted it positively. They further stressed that educational institutions should be well prepared to diversify their mode of instructional delivery.

Ghosh, Khatun, and Khanam (2023) examined the association of electronic media-based teaching on students' performance. This study used structural equation modeling to examine 302 university-going learners in Bangladesh. The study found a significant positive relationship between online instructions through

the use of electronic media on students' performance during the era of the pandemic. The implications of these findings suggest that enhanced students' academic performance can be achieved through collaboration and attentiveness in online-related activities.

Alfina, Alya, Sintiya, and Vika (2022) assessed the use of hybrid learning in high schools in Indonesia. The study was conducted using a survey through data collated using questionnaires from students in high schools using direct observation. The finding shows that the use of blended learning became less effective due to technical and personal challenges posed to the learners such as communication challenges between teachers and learners and a lack of understanding of the content of instructional materials provided online.

Li, Yu, and Yang (2022) examined the impact of blended learning on students' performance. A quantitative study was used through the conduct of an evidence-based meta-analysis. A sample size of 142 studies conducted from 2000 – 2021 was considered. The results that emanated from the suggested that blended instruction has an above-moderate positive impact on the performance of students.

Sobaih, Hasanein, and Elshaer (2022) assessed the performance of higher education students before and after COVID-19 using the electronic learning approach in Egypt. The electronic learning approach covered in this study includes Zoom, Facebook, and WhatsApp. Primary data were gathered using a questionnaire. A sample size of 600 students was covered. Structural equation modeling was used for data analysis. The results observed a significant positive effect of electronic learning (Zoom, Facebook, and WhatsApp) on students' academic performance.

Li and Wang (2022) examined the literature on the effect of blended learning on students' performance using meta-analysis. Their study covered 84 kinds of literature undertaken from 2000 – 2020 and was based on 30,377 students. It was revealed that blended instructions have a significant positive effect on students' performance. They further stressed that blended instruction has a significant positive effect on the enhancement of the cognitive and affective domains of the student's learning process. The study concluded that one of the most effective ways of improving the academic performance of students is through the usage of blended instructions.

Aqdas, Ahmed, and Soomro (2023) explore the effect of online teaching and learning on students' performance during the COVID-19 pandemic era. The study was carried out in Pakistan. An exploratory research design was used. The data gathered for the study covered 60 students in level 300 of bachelor studies. The results indicated the swift change in teaching and learning methodology to online negatively impacted the performance of the students.

Ayham and Araci (2023) analyzed the effect of blended and online instructions on students' academic performance. The philosophical foundation of the study

was based on the positivist approach. A deductive and quantitative research design was used. The sample size covered by this study was 20 respondents. Correlational analysis, ANOVA, and regression analysis were used to establish the relationship that exists between instructional approach and students' academic performance. The result depicted that participating in face-to-face learning coupled with the provision of recorded teaching lessons offers a significant positive effect on students' performance. Thus, the recorded video lessons of courses offer the opportunity for learners to recall and understand concepts that they found difficult to understand or could not take note of in ordinary face-to-face lessons. Accessing teaching and lesson materials only online was identified as having an insignificant effect on the academic performance of students.

Li, Liu, Yang, and Yu (2023) assessed how computer-assisted instructions impact students' academic performance in China. The study employed the difference in difference regression analysis. The results showed that computer-assisted instructions have a positive significant impact on students' academic performance. Thus, their academic performance increased by 0.978 standard deviations.

Khalid (2023) examines the impact of remote learning on accounting students' academic performance during the period of the pandemic in Kuwait. The study was based on 100 students who were admitted into the university during the COVID-19 pandemic period. A stepwise regression model was purposefully used in analyzing the data collected. The findings suggest that the academic performance measured as grade point average (GPA) witnessed an increase during the COVID-19 pandemic period when remote learning was employed. This is an indication that remote/online learning has a significant positive impact on the grade point average (academic performance) of accounting students.

## METHODOLOGY

The study employed a Generalized linear model (full

factorial), as a quantitative approach to establishing the effect of instructional methods on student's academic performance. The choice of full factorial analysis was to take into consideration the interaction between instructional methods, program stream/mode, nature of program, and gender. The purposive sampling technique was used to select 603 students and 1,809 students' data observations. However, to make the findings The study choice for purposive sampling emanates from the fact that students to be sampled must be pursuing a program that spans for at least two (2) years, and courses are assessed on 40 marks continuous assessment and 60 marks exams and having a maximum CGPA of 4.0 points. The study is a case study with a focus on students at the Catholic University of Ghana. The paper considered the academic performance of students under three (3) distinct instructional methods (face-to-face, online, and blended) in the 2019/2020 and 2020/2021 academic year. The instructional method used for the first semester of the 2019/2020 academic year was classified as face-to-face, the instructional method used for the second semester of 2019/2020 was also termed as blended instructions while that of the first semester of 2020/2021 academic year was classified as online instructions. The data gathered were secondary data covering students' semester grade point average (SGPA) in a particular semester under a particular instructional method.

The generalized linear model (full factorial) employed in this study is outlined as follows:

$$SAP \text{ (SGPA)} = \beta_0 + \beta_1 \text{ InstructionalMethod} + \beta_2 \text{ ModeofStudy} + \beta_3 \text{ NatureofProgram} + \beta_4 \text{ Gender} + \beta_5 \text{ InstructionalMethod} * \text{ ModeofStudy} + \beta_6 \text{ InstructionalMethod} * \text{ Natureofprogram} + \beta_7 \text{ InstructionalMethod} * \text{ Gender} + \beta_8 \text{ InstructionalMethod} * \text{ ModeofStudy} * \text{ NatureofProgram} + \beta_9 \text{ InstructionalMethod} * \text{ ModeofStudy} * \text{ Gender} + \text{ NatureofProgram} * \text{ Gender} + \text{ ModeofStudy} * \text{ NatureofProgram} * \text{ Gender} + \epsilon$$

## RESULTS

### Normality Test

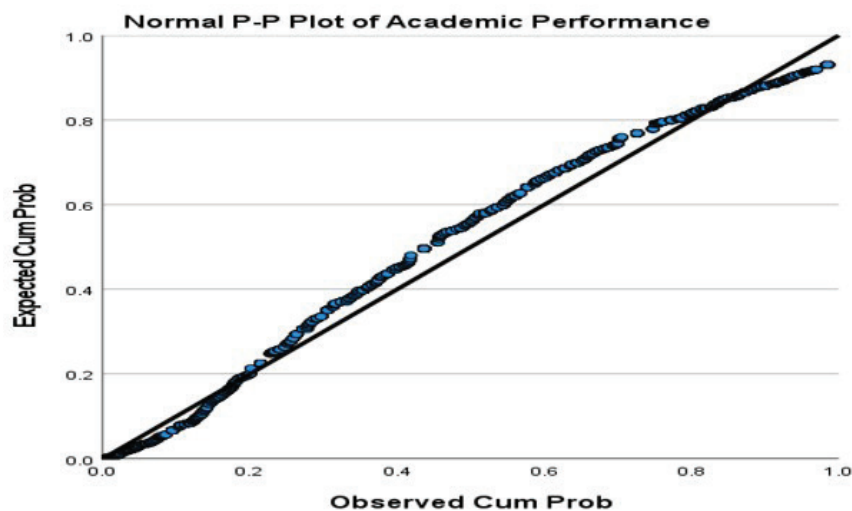


Figure 1: Normal P-P Plot to Test for Normal Distribution of Dependent Variable (Students' Academic Performance).

Figure 1 shows the P-P Plot of students' academic performance to test for the normality of the dependent variable (students' academic performance). The normality assumption for the dependent variable is tested using the normal P-P plot of regression standardized residuals. It was observed that students' academic performance

measured by their semester grade point average distribution is closer to the straight line. Hence, the study, therefore, concludes that the data is normally distributed.

### Homoscedasticity Test

The homoscedasticity test assumption is conducted

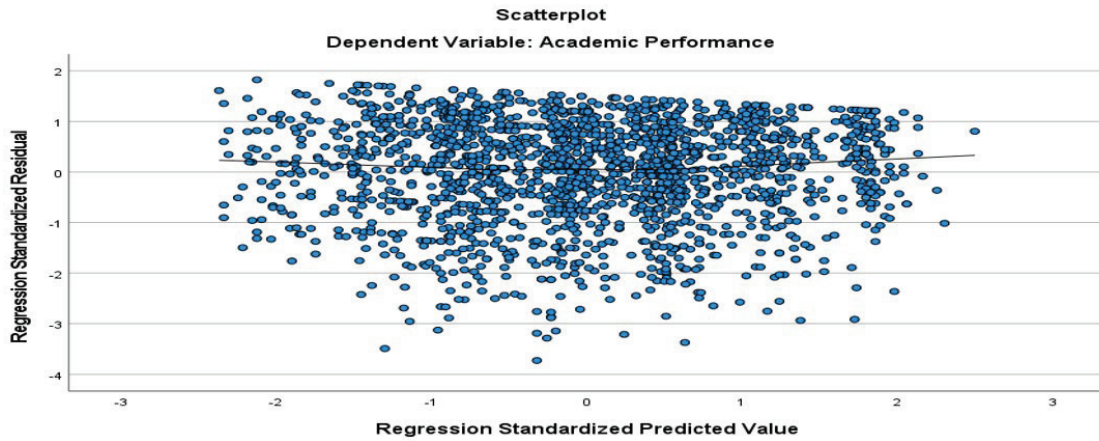


Figure 2: Scatter Plot for the residuals (Homoscedasticity test).

through the use of the scatter plot for the residuals as shown in Figure 2. Findings as per Figure 2 suggest that the homoscedasticity assumption is not breached because the line looks somehow horizontal and it is parallel to the x-axis. Also, the residual (dots) are somehow similarly dispersed on both the left and right of zero on the horizontal axis and below and above zero on the vertical axis. Thus, the residual values are equally distributed. Hence, the study, therefore, concludes that the residuals are homogenous.

### Omnibus Test for Model Fitness

Table 1: Omnibus Test<sup>a</sup>

Likelihood Ratio Chi-Square	df	Sig.
101.665	23	0.000

Table 1 presents the model fitness based on the Omnibus test. This was to ensure that the model had a predictive capability. The result shows that a likelihood ratio chi-square of 101.665 was recorded with a sig. value of 0.000. Because the sig. value is less than 0.05 (5%) significance level,

the factorial regression model (generalized linear model) used has the predictive ability to establish the effect of instructional methods on students' academic performance.

### Test of Model Effects

Table 2 outlines the test of model effect which determines which of the independent variables and their interactions have a significant effect on students' academic performance. The outcome from Table 2 suggests that instructional methods (sig. value = 0.001), the nature of the program (sig. value = 0.007), the interaction between mode of study and nature of the program (sig. value = 0.028), the interaction between mode of study and gender (0.000), and interaction between nature of program and gender (sig. value = 0.005) have a significant effect on students' academic performance at 5% significant level. Also, at a 10% significant level, the mode of study (sig. value = 0.054), the interaction between instructional method and nature of the program (sig. value = .057), and the interaction between mode of study, nature of program and gender (sig. value = 0.081) have a significant effect on students' academic performance.

Table 2: Tests of Model Effects

Source	Type III		
	Wald Chi-Square	df	Sig.
(Intercept)	28976.377	1	.000
Instructional Methods	14.149	2	.001**
Mode of study	3.701	1	.054*
Nature of the program	7.187	1	.007**
Gender	2.677	1	.102
Instructional Methods * Mode of study	2.107	2	.349
Instructional Methods * Nature of the program	5.736	2	.057*

Instructional Methods * Gender	2.263	2	.323
Mode of study * Nature of program	4.824	1	.028**
Mode of study * Gender	14.012	1	.000**
Nature of the program * Gender	7.915	1	.005**
Instructional Methods * Mode of study * Nature of program	2.818	2	.244
Instructional Methods * Program stream * Gender	.537	2	.765
Instructional Methods * Nature of program * Gender	.051	2	.975
Mode of study * Nature of the program * Gender	3.038	1	.081*
Instructional Methods * Program stream * Nature of program * Gender	2.535	2	.281

Contrary, gender (sig. value = 0.102), the interaction between instructional methods and mode of study (sig. value = 0.349), the interaction between instructional methods and gender (sig. value = 0.323), the interaction between instructional methods, mode of study and nature of the program (sig. value = 0.244), the interaction between instructional methods, mode of study and gender (sig. value = 0.765), the interaction between instructional

methods, nature of programs and gender (sig. value = 0.975), and the interaction between instructional methods, mode of study, Nature of program and gender (sig. value = 0.281) have no statistical significance on students' academic performance at 5% or 10% significance level.

**Parameter Estimates**

Table 3 specifies the category of the independent

**Table 3:** Parameter Estimates

Parameter	B	Std. Error	95% Wald Confidence Interval		Hypothesis Test		
			Lower	Upper	Wald Chi-Square	df	Sig.
(Intercept)	3.031	.0913	2.852	3.210	1101.470	1	.000
Face-to-face	-.422	.1291	-.675	-.169	10.668	1	.001*
Online	-.189	.1291	-.442	.064	2.144	1	.143
Regular	.029	.1190	-.204	.263	.061	1	.805
Science	.122	.1500	-.173	.416	.656	1	.418
Male	-.012	.1150	-.237	.213	.011	1	.917
Face-to-face * Regular	.334	.1683	.004	.664	3.945	1	.047*
Online * Regular	.225	.1683	-.105	.555	1.793	1	.181
Face-to-face * science	.350	.2122	-.065	.766	2.728	1	.099
Online * Science	-.086	.2122	-.501	.330	.163	1	.687
Face-to-face * Male	.268	.1626	-.051	.587	2.721	1	.099
Online * Male	.104	.1626	-.215	.423	.410	1	.522
Regular * Science	.163	.1783	-.186	.513	.839	1	.360
Regular * Male	.039	.1551	-.265	.343	.063	1	.802
Science * Male	.030	.2051	-.372	.432	.021	1	.885
Face-to-face * regular* science	-.511	.2522	-1.005	-.016	4.100	1	.043*
Online * Regular * Science	-.075	.2522	-.570	.419	.089	1	.765
Face-to-face * Regular * Male	-.317	.2193	-.746	.113	2.083	1	.149
Online * Regular * Male	-.224	.2193	-.654	.206	1.040	1	.308
Online * Regular * Male	-.060	.2901	-.628	.509	.043	1	.836
Regular * Science * Male	-.493	.2444	-.972	-.014	4.068	1	.044*
(Scale)	.425b	.0141	.398	.454			

variables and their interactions that have a significant effect on students' academic performance. Referring to Table 3 the following reference categories were used, blended instruction was used for instructional methods,

the weekend stream was also used for the mode of study, non-science was used as a reference category for the nature of the program, and female for gender. The outcome shows that face-to-face instruction has a

statistically significant (sig. value = 0.001) lower academic performance ( $\beta = -0.422$ ) than blended instruction at a 5% significance level. This is an indication that blended instruction has a significant positive effect on students' academic performance whereas an inverse relationship was established between face-to-face and students' academic performance.

The interaction between face-to-face instruction and regular students has a statistically significant (sig. value = 0.047) higher academic performance ( $\beta = -0.334$ ) than the interaction between face-to-face instruction and weekend students at a 5% significance level. This suggests that interaction between face-to-face and regular students has a significant positive effect on students' academic performance.

The interaction between face-to-face instruction, regular students and science program has a statistically significant (sig. value = 0.043) lowest academic performance ( $\beta = -0.511$ ) than the interaction between face-to-face instruction, regular students, and non-science program, the interaction between face-to-face, weekend and science, and interaction between face-to-face, weekend and non-science program. This suggests that the interaction between face-to-face instruction, regular and science has a significant negative effect on students' academic performance.

The interaction between regular students, science program, and male students has a statistically significant (sig. value = 0.044) lowest academic performance ( $\beta = -0.511$ ) than the interaction between regular, science and female, interaction between regular, non-science and male, interaction between regular, non-science and female, interaction between weekend, science and male, interaction between weekend, science and female, interaction between weekend, non-science and male, and interaction between weekend, non-science and female. This suggests that interaction between regular, science, and males has a significant negative effect on students' academic performance.

## DISCUSSION

Face-to-face instruction was established as having a significant negative effect on students' academic performance. This is because face-to-face instruction has a significantly lower academic performance than blended instruction. The implication of this is that blended instruction has a significant positive effect on students' academic performance. Hence, higher progression in academic performance can be achieved through blended instruction. This finding is in line with Ayham and Araci (2023), Cole (2020), Li and Wang (2022), and Li *et al.* (2022) whose studies postulate a significant positive effect of blended instruction on students' academic performance. However, the finding is in contrast with Alfina *et al.* (2022) who identified that blended instruction was less effective in enhancing students' academic performance. In contrast, no significant relationship was established between online instruction and students'

academic performance. This result contradicts Khalid (2023), Li *et al.*, (2023), Sobaih *et al.* (2023), Khatun and Khanam (2023), and Cavanaugh *et al.* (2023) whose respective studies identified a significant positive effect of online instruction on students' academic performance. However, it supports Ayham and Araci's (2023) study which suggested an insignificant impact of online instruction on students' academic performance.

Also, the interaction between face-to-face and regular school has a significant positive effect on students' academic performance. This is an indication the use of face-to-face instruction for regular students can lead to improved academic performance. However, the interaction between face-to-face, regular, and science programs has a significant negative effect on students' academic performance. Thus, the interaction between face-to-face instruction, regular students, and non-science programs, the interaction between face-to-face, weekend, and science, and interaction between face-to-face, weekend, and non-science programs produce significantly higher academic performance than the interaction between face-to-face, regular, and science programs. Likewise, the interaction between regular, science and male students has a significant negative effect on students' academic performance. The implication of this is that the interaction between regular, science, and female, the interaction between regular, non-science, and male, the interaction between regular, non-science, and female, the interaction between weekend, science, and male, the interaction between weekend, science and female, the interaction between weekend, non-science and male, and interaction between weekend, non-science and female produce significant higher academic performance than face-to-face, regular and science program.

## CONCLUSION

Blended instruction can achieve a more significant positive impact on student's academic performance compared to online and face-to-face instruction. Also, face-to-face instruction maintains higher academic performance among regular students compared to weekend students. This finding can be attributed to the low-class attendance of weekend students due to the rigidity of attending all lectures physically rather than being remote.

The use of face-to-face instruction leads to significantly higher academic performance for regular students studying non-science programs and weekend students studying science and non-science programs. These findings imply that to achieve almost the best academic performance among students, face-to-face instruction should be used for regular students studying non-science programs, and weekend students studying both science and non-science programs. Again, the academic performance of regular female students pursuing science programs performance was comparatively higher than that of male regular students pursuing science programs. This paper therefore concludes that even though blended instruction in general produces the highest students'

academic performance, if face-to-face instruction is used for regular non-science programs and weekend science and non-science programs same academic performance can be achieved. Hence, university management and educational policymakers must take into consideration the most appropriate instructional method suitable for a program stream/mode and the nature of the program, to attain the best academic outcome.

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