

Article

Sustainable Teacher Training via Distance Education: The Effect of Study Centers, Gender and Economic Demographics on Academic Performance

Hong Zhang ¹, Wilson Osafo Apeanti ², Paul Georgescu ^{3,*}, Prince Harvim ⁴, Dianchen Lu ⁴, Tan Li ⁵ and Bing Zhang ⁶

- ¹ School of Economics and Management, Changzhou Institute of Technology, Changzhou 213032, China; zhanghong2018@czu.cn
- ² Faculty of Science, University of Education, P.O. Box 25 Winneba, Ghana; woapeanti@uew.edu.gh
- ³ Department of Mathematics, Technical University of Iași, Bd. Copou 11A, 700506 Iași, Romania
- ⁴ Faculty of Science, Jiangsu University, Zhenjiang 212013, China; princeharvim@yahoo.com (P.H.); dclu@ujs.edu.cn (D.L.)
- ⁵ School of Innovation and Entrepreneurship, Changzhou Institute of Technology, Changzhou 213032, China; lit@czu.cn
- ⁶ School of Electrical and Information Engineering, Changzhou Institute of Technology, Changzhou 213032, China; zhangb@czu.cn
- * Correspondence: vpgeo@tuiasi.ro

Abstract: We examine the effectiveness and sustainability of the distance teacher education program established by the University of Education, Winneba, Ghana, by investigating the differences in the academic performance of students who are trained in the teacher education program via traditional and distance education modes, respectively, from 2011 to 2015. Close attention is paid to the factors that affect the academic performance of students in the distance mode. Our findings confirm that traditional mode students perform better than their distance mode counterparts in terms of cumulative GPAs. Gender and economic demographics of distance study centers are found to affect the academic performance of distance education students significantly. The policy implications of these findings are discussed and directions of further action are outlined.

Keywords: teacher education; distance education; economic demographics; academic performance



Citation: Zhang, H.; Apeanti, W.O.; Georgescu, P.; Harvim, P.; Lu, D.; Li, T.; Zhang, B. Sustainable Teacher Training via Distance Education: The Effect of Study Centers, Gender and Economic Demographics on Academic Performance. *Sustainability* **2021**, *13*, 7965. <https://doi.org/10.3390/su13147965>

Academic Editor: Naomi T. Krogman

Received: 18 May 2021
Accepted: 8 July 2021
Published: 16 July 2021

Publisher's Note: MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.



Copyright: © 2021 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

1. Introduction

Education plays a vital role in meeting the developmental needs of any country. Quality education requires trained teachers, with communication skills, knowledge of the content and pedagogical proficiency [1–3]. However, meeting the increasing demand for trained teachers is a challenging task. Ghana, like many developing countries, has fewer trained teachers than necessary [4], this shortage being actually commonplace in all sub-Saharan countries [5]. Although in Ghana the pupil to trained teacher ratio (PTTR) norm is 35 students per teacher at the basic level, as of the 2015/16 academic year the PTTR was 56 at the national level and 103 in some deprived districts [6]. Even though the PTTR has improved over the years, more trained teachers are still needed, the acute shortage of trained teachers in Ghana being created by increases in pre-tertiary school enrolments due to rapid population growth and by the inability of teacher education institutions to train the required number of teachers because of inadequate infrastructure [7]. To address this shortage, teacher education institutions in Ghana have adopted distance education as a supplementary mode to increase the number of trainees. In particular, the suitability and sustainability of distance education in order to achieve teacher education and training is a topic of interest in many countries [8].

Since the introduction of distance teacher education programs in Ghana, there has been a considerable increase in the number of trained teachers in basic schools. For instance,

the Education Sector Performance Report of the Ministry of Education in Ghana showed that as of the 2010/11 academic year only 63% of teachers in primary schools were trained, but in 2015/16 academic year this percentage has increased to 78% [6]. Also, there has been a considerable increase in the number of trained teachers in kindergartens (KG) and junior high schools (JHS) (see Figure 1).

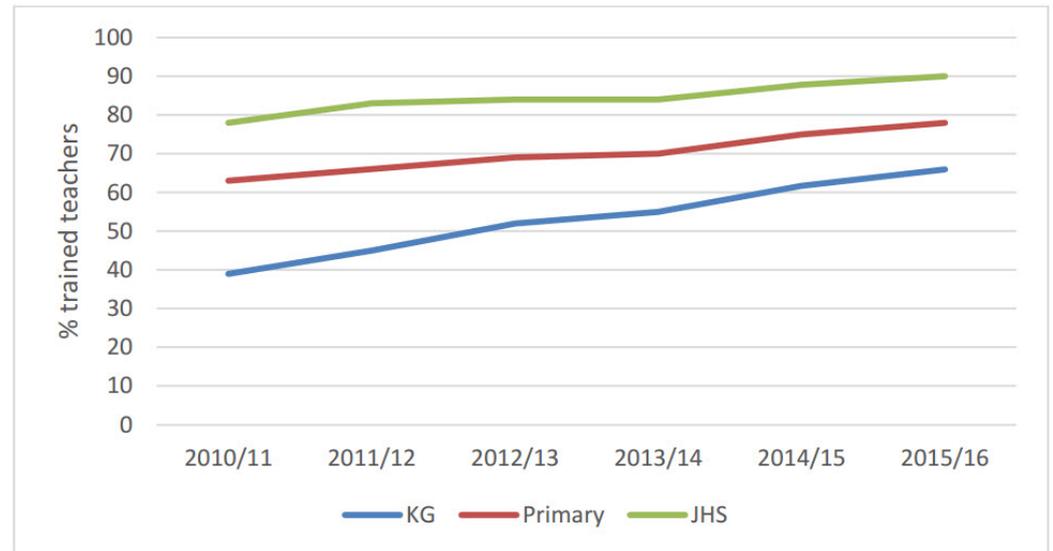


Figure 1. Trends in the percentage of trained teachers in public basic schools [6].

Distance education is an approach that is designed to deliver education to students who are not physically present in a traditional on-campus classroom [9]. This approach focuses on opening the access to education by freeing learners from the constraints of time and place [10]. Instead of assembling students from dispersed locations in a classroom setting, as it is the case with traditional education, distance education tries to reach out to students wherever they live or wish to study [11]. In teacher education, distance education is used as a complementary, sustainable mode of delivery to overcome the challenges of access, equity, cost-effectiveness and quality for teacher training [12,13].

1.1. Background on Distance Education in Ghana

In Ghana, distance education is used to train prospective and in-service active teachers who are seeking for professional advancement. Its purpose is to upgrade the academic and professional competence of a large number of teachers in Ghana by raising their performance levels and equipping them with skills for lifelong learning [7]. The introduction of distance education programs for teacher training is not only mitigating the shortage of teachers, but also the high attrition rates often associated with study leave, when teachers move from their duty stations to seek further education [14]. Teachers can then remain at their posts and learn by integrating college work with teaching load [1].

Due to the concentration of higher education institutions in large cities, people from rural areas often find these institutions difficult to access. Consequently, universities in Ghana have created study centers for distance education at locations and sites that are away from their main campuses. This form of distance education is different from on-line education or e-learning, for which students and instructors meet in a virtual classroom using on-line technologies such as learning management systems (LMS) and video conferencing. The distance study centers are used as satellite campuses where students and instructors interact occasionally. Such an educational environment gives students a unique opportunity to acquire knowledge both independently and under the guidance of lecturers from the main campus. In this way, higher education is brought to the door step of students, thereby increasing their access to education.

The University of Education, Winneba (UEW) has been established as an University College in 1992, being at the forefront of higher education in Ghana ever since. Its main aims are to train teachers for all levels of education within the Ghanaian education system and to foster a systematic advancement of teacher education in Ghana by means of conducting research, disseminating knowledge and contributing towards the development of educational policies. In this quality, UEW now has an enrolment of over 85,000 students, its status being upgraded to that of a non-profit, public University in 2004.

The institute for educational development and extension (IEDE) has been running the distance education programs through its center for distance education (CDE) using the hybrid mode of print and on-line methods of delivery. CDE has the mandate to provide opportunities for new and in-service teachers to experience quality education for continuing professional development [15]. A Bachelor's degree in basic education for trainees who wish to teach in basic schools is offered both in traditional face-to-face mode and in distance education mode [16]. Students can access the distance education program through study centers that are created across the ten regions of Ghana. As of the year 2015, UEW had twenty-three distance education study centers away from its main campus in Winneba (see Figure 2).



Figure 2. Distance education study centers of UEW across Ghana.

1.2. Admission Procedure

UEW offers a degree in basic education program for in-service and prospective teachers wishing to teach in basic schools, via traditional on-campus mode and distance education mode at the various study centers, as a four-year program. However, depending on the entry qualifications of the candidates, the program can be completed in either three or four years. Candidates who are teachers with at least one year of teaching experience and possess a diploma in education are allowed to start directly in the second year and to complete the program in 3 years. Most of these teachers are graduates from colleges of education who want to better themselves professionally. Other candidates with no teaching experience coming directly from high school and possessing West African Secondary School Certificate Examination (WASSCE), Senior Secondary School Certificate

Examination (SSSCE), General Certificate of Education (GCE) advanced level certificate, and mature applicants may complete the program in four years. Mature applicants must be at least twenty-five years of age with certificates of professional training from a recognized institution. SSSCE/WASSCE candidates are expected to have credit passes in six subject comprising three core subjects, namely English Language, Mathematics and Science, and three relevant elective subjects. All GCE candidates are expected to have credit passes with Grade D or better in three relevant subjects.

The target group for the traditional on-campus full-time degree in basic education program are high school students with WASSCE or SSSCE certificates and GCE advanced level. General Business Certificate Examination (GBCE) candidates and mature candidates also qualify for this program. Even though the outcome of traditional face-to-face and distance programs is the same Bachelor's degree certificate, the target group for the face-to-face program consists of candidates with no teaching experience (see Table 1).

Table 1. Characteristics of distance and traditional teacher education program for Bachelor's degree in basic education.

	Distance	Traditional Face-to-Face
Target group	In-service teachers Non-teachers	Non-teachers
Duration	Four years for non-teachers Three years for teachers	Four years
Entry requirement	Diploma in Education WASSCE/SSSCE GCE A level Mature applicants	WASSCE/SSSCE GCE A level GBCE Mature applicants
Mode of delivery	Bi-weekly weekend face-to-face tutorials Course books Use of LMS (MOODLE)	Weekly face-to-face tutorials Course manuals Handouts
Location of delivery	Study centres	Campus lecture halls
Academic calendar	Two semesters per academic year	Two semesters per academic year
Assessment	Quizzes and Examination	Quizzes and Examination
Grading	Four-Scale GPA	Four-Scale GPA

1.3. Delivery Mode Specifics

The distance education mode includes bi-weekly weekend tutorials at the study centers, interactive teaching and learning using the Learning Management System [15]. Lecturers from the main campus meet students in tutorial sessions to discuss issues concerning the program, clarify difficult areas of the course and give students the opportunity to ask questions about matters that hold them back as they pursue their independent studies. The bi-weekly weekend tutorial meetings are also used to counsel students and give them course materials, seminars, feedback on completed assignments and individual support through workplace visits. Distance education students are all provided with tablets. The tablets contain course materials in e-book form and provide opportunities for students to interact virtually with their coordinators, colleagues and lecturers [15]. However, traditional students have access to study materials on the main campus library and are also provided with course manuals and handouts from lecturers which they use to aid them in their studies (see Table 1).

1.4. Academic Calendar

Both distance and traditional face-to-face programs run a flexible two-semester academic calendar. Each semester has 14 weeks. There are eight courses per semester, the students being expected to pass all of them. Students who fail more than two courses per semester are withdrawn from the program. However, students who fail two courses or

less are given the opportunity to resit the courses. For both delivery modes, the first semester starts in August and ends in December. The time table for tutorials, quizzes and examination is communicated to the distance education students at their study centers.

1.5. Assessment and Examination

Distance education students take two quizzes each semester before the end of semester examination, all conducted at the study centers. Traditional face-to-face students also take quizzes each semester before the end of semester examination. However, the number of quizzes is determined by the lecturers who teach the courses. The students in both groups have the same course curriculum and take similar end of semester examinations. The assessment and grading of examinations are done, in both modes, by university lecturers.

1.6. Grading Procedure

The academic performance of a student in the distance or traditional face-to-face mode is measured by using a cumulative Grade Point Average (GPA) score. The GPA score is calculated as a weighted average of the number of credit hours in each course, the scale associated with the grade of students at the end of each semester ranging from 0.00 to 4.00. Depending on the GPA score, the student is ranked in terms of First class (3.50–4.00), Second class upper (3.00–3.49), Second class lower (2.50–2.99), Third class (2.00–2.49), Pass (1.00–1.99) and Fail (0.00–0.99) (see Table 2). At the end of the degree program, a cumulative GPA which is an average of all semestrial GPAs is calculated for each student.

Table 2. Four-point GPA scale.

Letter Grade	Percent Grade	4.0 Scale	Remark
A	80–100	4.00	Excellent
B+	75–79	3.50	Very Good
B	70–74	3.00	Good
C+	65–69	2.50	Very Fair
C	60–64	2.00	Fair
D+	55–59	1.50	Satisfactory
D	50–54	1.00	Barely Satisfactory
E	0–49	0.00	Fail

Example			
Course	Grade	4.0 Scale (x)	Credit Hours (y)
Course I	A	4	3
Course II	C+	2.5	2
Course III	B+	3.5	3

$$\begin{aligned}
 GPA &= \frac{\sum xy}{\sum y} \\
 &= \frac{(4 \times 3) + (2.5 \times 2) + (3.5 \times 3)}{(3 + 2 + 3)} \\
 &= 3.45.
 \end{aligned}$$

1.7. Research Euestions

As a result of distance education programs being introduced by teacher education institutions in Ghana, more teachers are being trained via distance education mode than via the traditional face-to-face mode. Therefore, it is important to examine whether the distance education is as effective as the traditional face-to-face mode in regard to teacher training as provided by UEW, particularly in connection with teacher quality. This is our first research question. Our second research question is then how do gender, economic demographics and locality of study centers affect performance of distance education students.

Our comparison seeks to provide an objective measurement of the quality of distance education in relation to conventional classroom-based education for teacher training.

Inasmuch as the number of teachers in schools is critical, it is also vital to have qualified teachers since quality education relies on quality teachers [3]. Consequently, it has become necessary for educational administrators and managers to document the effectiveness of distance teacher education programs in relation to student learning outcomes, particularly as compared to traditional face-to-face programs [17]. To the best of our knowledge, little is known about the comparison between the academic performances of distance learners and on-campus students in teacher training programs for basic school teachers in Ghana.

Researchers have found evidence of correlations between various aspects of the school environment and the performance of students, varying in strength depending upon the specifics of the aspect. These aspects include the geographical location, type of locality, resources and facilities available to the school [18,19]. The particularities of the school environment have broadened influence on student learning and on the social, emotional and ethical development of students [20]. A supportive school environment promotes students' sense of connectedness, belongingness or community. Thus, within the scope of distance education, various aspect of distance study centers such as their locality (Urban, Semi-Urban and Rural) influence the academic success of students. For instance, it was found that, although there is an uneven distribution of resources between urban and rural schools, urban students often live a stressful daily life which may affect their academic performances [18]. Gender is also an important factor that affects the performance of distance education students. This is because female distance education students face the challenges of lack of financial resources, cultural restrictions, household commitments and responsibilities, all factors which affect their academic performances [21].

1.8. Literature Review

The academic performance of a student is a multidimensional concept which includes successful completion of a course, added knowledge, skill building and grades. Among these aspects, a student's grade, which is usually expressed using a cumulative GPA score, is often used to measure individual success in academic programs, particularly in relation to other students in the same program [17]. GPA is a familiar measure of a student's performance that is commonly used in universities, colleges and high schools worldwide. However, certain studies have criticized the use of GPA as a measure of academic performance because it does not only reflect academic achievement, but also course taking strategies and instructor grading practices [22]. The source of much of the variation between students' GPAs may be the courses they took and the instructors they had, and not necessary the performances of students in those courses alone [23]. However, in order to minimize this shortcoming and make GPAs more comparable, it has been recommended that there should be a strict adherence of all instructors to a common grading standard and the group of students who are being compared should have taken the same courses [23]. The participants in this study took the same course modules and it was assumed that the quality assurance unit of the university enforced the use of the university grading standards. Under similar circumstances, GPA is still by far the most common aggregate measure used for comparing the academic performances of different students [17,23,24].

There is a large corpus of studies that compare the performances of students in distance and tradition face-to-face programs using GPA scores. A meta-analysis of 232 comparative studies of distance and traditional face-to-face education by [25] revealed that in some of the studies, distance education worked well for students, while in other studies it did not. Their meta-study showed that distance education students had slightly higher overall academic achievements than traditional on campus students. Another, meta-analysis study by [26] that used twenty years (1990–2009) comparative studies focused on the differences between the academic performances of students enrolled in traditional and distance education courses. They found that in 70% of the cases, students taking distance education courses outperformed their counterparts in the traditionally instructed

courses. However, ref. [27] found no significant differences in the final GPA scores and total certification scores for traditional and distance health informatics students.

Other studies have investigated factors that influence the performance of distance education students, such as gender and economic demographics [21,28,29]. A study by [30] revealed that among other factors, gender significantly affected the performances of distance education students. In general, females performed poorly and were less represented in distance education programs because of the lack of financial resources, cultural restrictions, household commitments and responsibilities [21,29]. To deal with this problem, gender awareness and promotion of gender consciousness at all levels of distance education programs, which require exploring alternatives of making distance education more women friendly, have been recommended [31]. Evidence from developing countries on the effect of economic demographics of school locality on the performance of students is still sparse. However, a few studies have found no significant differences in the academic performance of students from rural environments compared to that of students from urban environments [32,33]. It could be concluded from these studies that, all else being equal, rural students do not suffer disadvantage in their academic performance simply as a result of their residence in rural areas.

2. Methodology

This study uses a causal-comparative research design to compare the performances of traditional face-to-face and distance education students who graduated with a Bachelor's degree in basic education. A causal comparative research design attempts to determine the reason for existing differences in the status of groups of individuals [34]. This type of research design is different from experimental research because there is no manipulation of the variables and the groups that are compared are already formed [34].

2.1. Population and Sample

The population for this study consists in graduates with a Bachelor's degree in basic education in both traditional and distance modes of delivery from UEW, Ghana. Purposive sampling was used to select data from five cohorts of students who graduated from the program through traditional face-to-face and distance education modes from 2011 to 2015. These cohorts were purposely selected because the curriculum and the structure of the program were the same for all these academic years. Permission was sought from the management information systems (MIS) department of the university to use five years (2011–2015) data on GPA, gender, study centers and year of completion for students who graduated with a Bachelor's degree of education. Table 3 shows the distribution of students who graduated with a degree in basic education by distance and traditional face-to-face modes within this period. In all, there were 32,683 students, of which 31,734 were distance students and 949 were traditional face to face students. In the distance education program, there were more female (55.3%, N = 17,549) than male (44.7%, N = 14,185) graduates. By contrast, there were more male (62.8%, N = 596) than female (37.2%, N = 353) graduates in the traditional face to face mode.

Table 3. Gender and year distribution of distance and traditional students.

		Year					Total Number N (%)
		2011 Number N (%)	2012 Number N (%)	2013 Number N (%)	2014 Number N (%)	2015 Number N (%)	
Distance	Male	2401 (16.9)	3893 (27.4)	3184 (22.4)	2123 (15.1)	2584 (18.2)	14,185 (44.7)
	Female	2660 (15.2)	4737 (27.0)	4003 (22.8)	3033 (17.3)	3116 (17.7)	17,549 (55.3)
	Total	5061	8630	7187	5156	5700	31734
Traditional	Male	127 (52.0)	162 (58.7)	117 (71.8)	125 (69.8)	65 (74.7)	596 (62.8)
	Female	117 (48.0)	114 (41.3)	46 (20.2)	54 (30.2)	22 (12.3)	353 (37.2)
	Total	244	276	163	179	87	949

2.2. Statistical Analysis

The data was entered in the SPSS version 20 software for statistical analysis. Various statistical tools were used for data analysis. For the statistical analysis, the level of significance was set at p -value < 0.05 level. The comparison between the performances of the traditional face-to-face and distance education students was conducted using a two-tailed independent sample t -test. Factorial analysis of variance (ANOVA) design was used to find out the influence of gender and study center economic demography (SCED) on the performance of distance students.

Binary logistic regression was also carried out to examine how academic performances of distance education students were predicted by student gender and study centers. For the binary logistic regression, the performances of students were categorized into high and low. Students with GPA scores of 2.5 (Second class lower) and above were classified as high performance, while those with scores below 2.5 were classified as low performance. Binary logistic regression was used to predict which of the two categories a student is likely to belong to based on the gender and study center. In this logistic regression, instead of predicting the value of the dependent variable (performance), one predicts the probability that a student performance will be high or low based on the independent variables (gender and study center). Logistic regression assumptions were checked for the data being used. Data screening was done to ensure that there was no missing data on the dependent variable. The linearity assumption of the logistic regression, which assumes that there is a linear relationship between any continuous predictors and the logit (natural logarithm on the odds ratio) of the outcome variable, was not violated because both predictors (gender and study center) were categorical variables [35].

3. Results

3.1. Comparing Academic Performances of Distance and Traditional Students

The overall performances (cumulative GPA) of distance and traditional students were compared using two-tailed independent sample t -test. The results of the t -test are shown in Table 4. The mean cumulative GPA score for distance education students is 2.622 (SD = 0.392), while that of the traditional students is 2.801 (SD = 0.458). This shows that, on average, traditional face-to-face students performed better than distance education students. The difference between the means is found to be statistically significant ($t = -13.797$, $df = 32,681$, $p < 0.05$).

Table 4. Independent t -test to compare the GPA scores of distance and traditional students

Mode of Delivery	Mean (M)	Standard Deviation (SD)	t -Statistic	Degree of Freedom (df)	p -Value
Distance	2.622	0.392	-13.797	32681	0.000
Traditional	2.801	0.458			

3.2. Gender Differences in Academic Performances of Distance and Traditional Students

The performances of male and female students were also compared in both modes of delivery using an independent sample t -test as in Table 5. The analysis reveals that male graduates performed better ($M = 2.652$, $SD = 0.398$) than the females ($M = 2.597$, $SD = 0.380$) in the distance program. However, the female graduates performed better ($M = 2.886$, $SD = 0.423$) than the males ($M = 2.750$, $SD = 0.470$) in the traditional face-to-face program (See Figure 3). The differences in the GPA scores according to gender were found to be statistically significant in both the distance mode ($t = 12.448$, $df = 31,732$, $p < 0.05$) and the traditional mode ($t = -4.469$, $df = 947$, $p < 0.05$) as shown in Table 5.

Table 5. Independent *t*-test to compare GPAs of male and female students.

Mode of Delivery	Gender	Mean (M)	Standard Deviation (SD)	<i>t</i> -Statistic	Degree of Freedom (<i>df</i>)	<i>p</i> -Value
Distance	Male	2.652	0.398	12.448	31,732	0.000
	Female	2.597	0.380			
Traditional	Male	2.750	0.470	−4.469	947	0.000
	Female	2.886	0.423			

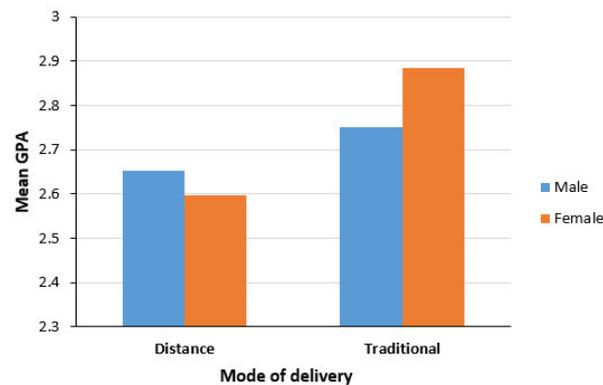
**Figure 3.** The mean GPA scores of male and female students of the distance and traditional modes, respectively.

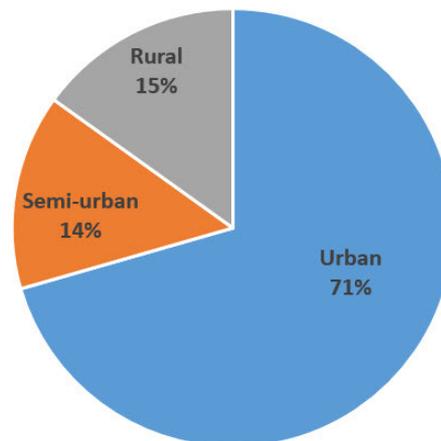
Table 6 shows a comparison between the performances of the same gender groups in the two modes of delivery. A significant difference ($t = 5.823, df = 14,779, p < 0.05$) is found between the performances of males in the traditional mode as compared to males in the distance mode. Likewise, a significant difference ($t = 13.814, df = 17,194, p < 0.05$) is found between the performances of females in the traditional mode as compared to females in the distance mode. This shows that males in the traditional mode performed better than males in the distance mode and females in the traditional mode also performed better than females in the distance mode.

Table 6. Independent *t*-test to compare students of the same gender in different modes.

Group	Mean (M)	Standard Deviation (SD)	<i>t</i> -Statistic	Degree of Freedom (<i>df</i>)	<i>p</i> -Value
Male Traditional	2.750	0.470	5.823	14,779	0.000
Male Distance	2.652	0.398			
Female Traditional	2.886	0.423	13.814	17,194	0.000
Female Distance	2.597	0.380			

3.3. Effect of Study Center Economic Demography and Gender on the Performances of Distance Education Students

Factorial ANOVA with post hoc analysis was used to investigate the extent to which gender and study center economic demography (SCED) affect the academic performance of distance education students. The SCED was adapted and modified from the Ghana statistical service population and housing census [36]. The study centers are grouped under Urban, Semi-Urban and Rural. Study centers located in regional capitals are classified as Urban, study centers in localities with 50,000 or more persons which are not Urban are classified as Semi-Urban, while study centers in localities with less than 50,000 persons are classified as Rural. In all, ten study centers are classified as Urban, nine are classified as Semi-Urban and five are classified as Rural. From this classification, 22,410 (71.0%) of the distance education students are from Urban study centers, 4581 (14.0%) are from Semi-Urban study centers and 4743 (15.0%) are from Rural study centers (see Figure 4).



SCED	Study center	Number of students	Percentage
Urban	1, 2, 7, 11, 12, 13, 17, 18, 20, 23	22410	71%
Semi-Urban	3, 4, 5, 10, 14, 16, 21, 22	4581	14%
Rural	6, 8, 9, 15, 19	4783	15%

Figure 4. All study centers are divided into three groups: Urban, Semi-Urban and Rural.

Table 7 shows the factorial ANOVA design test for between-subject effects with the cumulative GPA scores of distance education students as the dependent variable. From the factorial ANOVA test, it is observed that gender and SCED combined significantly ($F = 27.783, df = 2, p < 0.05$) affect cumulative GPA scores of distance education students. Independently, gender ($F = 18.447, df = 1, p < 0.05$) and SCED ($F = 122.230, df = 2, p < 0.05$) also affect the GPA scores significantly.

Table 7. Factorial ANOVA design test between-subjects effects.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	69.010 ^a	5	13.802	91.283	0.000
Intercept	132,886.684	1	132,886.684	878,886.940	0.000
Gender	2.789	1	2.789	18.447	0.000
SCED	36.962	2	18.481	122.230	0.000
Gender*SCED	8.402	2	4.201	27.783	0.000
Error	4797.237	31,728	0.151		
Total	223,040.517	31,734			
Corrected Total	4866.246	31,733			

^a Dependent Variable: GPA.

Although the Factorial ANOVA test indicates that gender and SCED combined significantly affect the performance of distance education students, it does not indicate specific differences between the gender groups and SCED. To test for differences between specific gender groups and SCED, a post hoc comparison technique using the Scheffe test is conducted. The difference between the specified *I* and *J* group mean GPA in Table 8 can be found in the column labelled Mean Difference ($I - J$). The mean difference values accompanied by asterisks indicate which group differ significantly from each other at the 0.05 level of significance.

Table 8. Descriptive statistics of GPA score per gender and study centre economic demography.

Gender*SCED	Number of Students (N)	Mean (M)	Standard Deviation (SD)	Standard Error	95% Confidence Interval for Mean (Lower Bound)	95% Confidence Interval for Mean (Upper Bound)
Male*Urban	9229	2.638	0.392	0.004	2.630	2.646
Male*Semi-Urban	2436	2.661	0.433	0.007	2.649	2.677
Male*Rural	2520	2.680	0.394	0.008	2.664	2.695
Female*Urban	13,181	2.572	0.380	0.003	2.565	2.578
Female*Semi-Urban	2145	2.652	0.436	0.007	2.642	2.670
Female*Rural	2223	2.646	0.374	0.008	2.631	2.662
Total	31,734	2.620	0.395	0.002	2.616	2.625

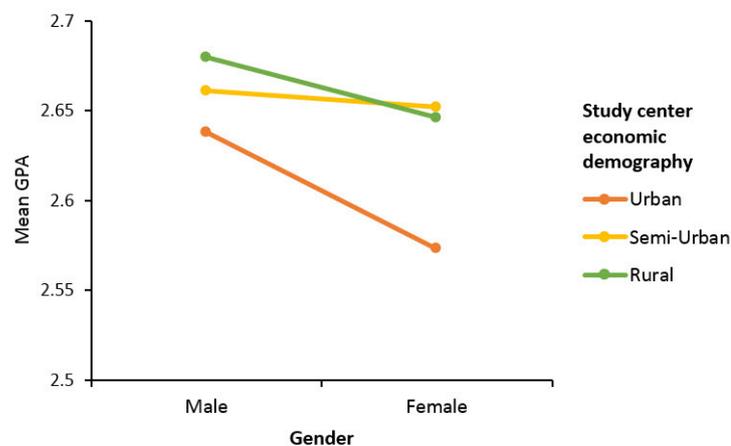
Dependent Variable: GPA.

The Post Hoc analysis (see Table 9) reveals that there is a significant difference in the mean GPA scores of male students from Urban study centers as compared to male students from Semi-Urban ($MD = -0.23, p < 0.05$) and Rural ($MD = -0.042, p < 0.05$) study centers. Considering the mean GPA scores, this finding indicates that male students from Rural study centers performed better than male students from Urban and Semi-Urban study centers. A significant difference is also found between the mean GPA of females from Urban study centers as compared to female students from Semi-Urban ($MD = -0.080, p < 0.05$) and Rural ($MD = -0.074, p < 0.05$) centers. A look at the means shows that female students from Rural study centers performed better than those from Urban study centers. Female students from Semi-Urban centers had the highest mean cumulative GPA scores, but their scores were not significantly different from those of female students from Rural study centers ($MD = 0.006, p > 0.05$), as shown in Figure 5.

Table 9. Scheffe post hoc test for multiple comparison.

(I) Post Hoc for Factor Test	(J) Post Hoc for Factor Test	Mean Difference [MD] (I-J)	Std. Error	Sig.
Male*Urban	Male*Semi-Urban	-0.023 *	0.0098	0.000
	Male*Rural	-0.042 *	0.008	0.000
Male*Semi-Urban	Male*Rural	-0.019 *	0.011	0.000
Female*Urban	Female*Semi-Urban	-0.080 *	0.009	0.000
	Female*Rural	-0.074 *	0.009	0.000
Female*Semi-Urban	Female*Rural	0.006	0.012	0.084

* The mean difference is significant at the 0.05 level. Dependent Variable: GPA of distance students.

**Figure 5.** Estimated GPA marginal means of gender per study center economic demography.

3.4. Predictive Effect of Gender and Study Center on Distance Students Performance

Binary logistic regression analysis was conducted to investigate the predictive effect of gender and study center on the performance of distance education students. Table 10 indicates the binary logistic regression statistics. A test of the full model against a constant only model was statistically significant (chi square (χ^2) = 1596.179, $p < 0.05$, $df = 24$), indicating that the predictors as a set reliably distinguished between high and low performance of students. Nagelkerke's R^2 of 0.062 (6.2%) indicates a positively low relationship between prediction and grouping. Overall prediction success of the model is 63.6% (95.5% for High and 10.6% for Low).

Table 10. Binary logistic regression statistics.

Variables	Logistic Regression Coefficient (B)	Standard Error	Wald Statistics	Degree of Freedom (df)	p-Value	Odds Ratio Exp(B)
Gender (Male)	0.198 *	0.024	69.196	1	0.000	1.219
Center			1362.009	23	0.000	
Center (1)	−0.883 *	0.100	77.349	1	0.000	0.413
Center (2)	−0.178 *	0.054	10.826	1	0.001	0.837
Center (3)	0.217 *	0.097	4.993	1	0.025	1.242
Center (4)	−1.253 *	0.105	141.696	1	0.000	0.286
Center (5)	0.530 *	0.187	8.069	1	0.005	1.700
Center (6)	0.524 *	0.060	76.531	1	0.000	1.688
Center (7)	0.508 *	0.062	66.980	1	0.000	1.662
Center (8)	0.248	0.132	3.541	1	0.060	1.281
Center (9)	0.111	0.144	0.586	1	0.444	0.895
Center (10)	0.996 *	0.082	147.714	1	0.000	2.707
Center (11)	0.175 *	0.054	10.523	1	0.001	1.191
Center (12)	0.105	0.055	3.621	1	0.057	1.111
Center (13)	0.448 *	0.050	79.636	1	0.000	1.564
Center (14)	−0.618 *	0.124	24.700	1	0.000	0.539
Center (15)	0.182 *	0.074	6.061	1	0.014	1.199
Center (16)	1.114 *	0.122	83.471	1	0.000	3.045
Center (17)	0.140 *	0.082	2.947	1	0.086	1.150
Center (18)	0.276	0.218	1.602	1	0.206	1.318
Center (19)	0.404 *	0.092	19.191	1	0.000	1.498
Center (20)	−0.346 *	0.055	39.357	1	0.000	0.708
Center (21)	0.020	0.107	0.036	1	0.849	1.020
Center (22)	1.671 *	0.107	242.723	1	0.000	5.319
Center (23)	0.341 *	0.076	20.135	1	0.000	1.407
Constant	0.231 *	0.042	30.182	1	0.000	1.260

Note: $R^2 = 0.062$ (Nagelkerke). Model $\chi^2 = 1596.179$, * $p < 0.05$.

Gender (Male) can significantly predict high performance ($B = 0.198$, $\text{Wald}[\chi^2(1)] = 69.196$, $p < 0.05$). The odds ratio of male students is $\exp(B) = 1.219$. This means that the odds of a male student performing high are 1.219 times greater than the odds of a female student. That is, male students are more likely to perform better than female students in the distance education programs under consideration.

Excluding the main campus of the university (Winneba), there are 23 study centres for the distance education program across the country. From the binary logistic regression statistics (Table 10), all study centres are significant for predicting high student performance, except for study center 8 ($B = 0.248$, $\text{Wald}[\chi^2(1)] = 3.541$, $p > 0.05$), study center 9 ($B = 0.111$, $\text{Wald}[\chi^2(1)] = 0.586$, $p > 0.05$), study center 12 ($B = 0.105$, $\text{Wald}[\chi^2(1)] = 3.621$, $p > 0.05$), study center 18 ($B = 0.276$, $\text{Wald}[\chi^2(1)] = 1.602$, $p > 0.05$), and study center 21 ($B = 0.020$, $\text{Wald}[\chi^2(1)] = 3.621$, $p > 0.05$), which are not significant. The sign of the logistic regression coefficient (B) indicates whether the independent variable has a positive or negative effect on performance. Certain study centers (1, 2, 4, 14 and 20, from Urban and Semi-Urban locations) had a negative effect on the performance of students. This means

that graduates from these study centers are likely to be low performers. The final binary logistic regression model is given by

$$P(Y) = \frac{1}{1 + e^{-(0.231 + 0.128X_1 + b_{2i}X_{2i})}} \quad (1)$$

in which $P(Y)$ is the probability of a student performing high, X_1 is the gender (1 = Male, 2 = Female), X_{2i} is the i -th study center where $i = 1, 2, \dots, 23$, b_{2i} is the regression coefficient for the i -th study center, where $i = 1, 2, \dots, 23$.

4. Discussion and Conclusions

Distance education has been introduced by teacher training institutions in Ghana as an additional way of addressing an acute shortage of trained teachers. The University of Education, Winneba, Ghana, which is mandated to train professional teachers, has established distance study centers, expanding the access to teacher education. This study measures the effectiveness of its distance education program by comparing the cumulative GPA scores of distance education graduates with those of traditional face-to-face graduates within a period of five years (2011–2015).

On the average, the performance of traditional face-to-face students is significantly better than that of distance education students. In contrast with other studies [25,26] this means that the distance teacher education program is not as efficient as the traditional program in terms of student performance. However, it is worth noting that in terms of numbers, distance learning has a very positive record. The introduction of distance teacher education programs has enabled thousands of teachers to gain qualification, usually with a guarantee of employment. Distance teacher education has therefore met the needs of a significant proportion of the teaching force in Ghana and is a sustainable approach towards teacher training. From a related perspective, it is also worth mentioning that the establishment of distance education initiatives in Nigeria has had a high degree of influence on personal and community development, since it has not only contributed towards improving the professional quality of teachers already working in the field, but also towards the increase in school enrollment and in student retention [37]. It has also been noted in [37] that, even though particular emphasis was paid to the Nigerian context, the findings may be regarded as reflective of distance education experiences elsewhere in Africa as well. Also, a case for distance education in Nigeria is made in [38], being noted that distance education is able to mitigate internal and external brain drain in tertiary institutions by utilizing Nigerian experts as teachers regardless of their locations or places of work and to adapt to the needs of the employers, making possible for employees to attend special certificate courses at their work places.

It is reasonable to assume that strengthening teacher education should improve the quality of education and teacher performance. Therefore, there is a need to implement policies in the distance teacher education program to deal with low student performance. This is because distance education students have to deal with the stress of working and studying, isolation and lack of support, which are specific challenges that must be addressed. Hence, a supportive learning environment that promotes students sense of connectedness, belongingness or community is needed for them to succeed in their course [20].

The findings of this study also show that, in Ghana, females prefer the distance education mode of delivery, rather than the traditional face-to-face mode. In developing countries, family responsibilities restrict females access to traditional education and as a result females are more likely to opt for distance education because of its flexibility in terms of time and place [21]. In Ghana, the average age for students in the distance education programs is around 30 years [31]. At this age, most women are married with children and combining the rigour of an academic environment in traditional education with family responsibilities such as pregnancy, child care and household chores is very difficult for most women. Hence more in-service female teachers opt for distance education. Thus,

the UEW distance education program has expanded the access to higher education of women who would have been otherwise left out because of family responsibilities.

It has been determined that male graduates performed better than the female graduates in the distance program. On the contrary, female graduates performed better than male graduates in the traditional face-to-face program. This finding is consistent with a study by [30], which reveals that in general, female students perform poorer than male students in distance education programs.

Studies have shown that most female students who opt for distance learning programs are married and have a lot of family responsibilities which hinder their academic progress [21,29]. On the contrary, most of the female students in the traditional face-to-face education mode are single young adults who do not have the constraint of family responsibility. From the factorial ANOVA analysis, it is seen that study center economic demography and gender combined affect the performance of distance learning students with males in the Rural study centers performing better than males in Urban and Semi-Urban study centers. However, females in Semi-Urban centers also perform better than females in Urban centers.

These findings are confirmed by a binary logistic regression, which indicate that certain Urban and Semi-Urban study centers have a negative effect on the academic performance of distance education students. In Ghana, the cost of living in Urban and Semi-Urban areas is high compared to Rural areas. Because of the low income levels of basic school teachers, in Urban and Semi-Urban areas they often engage in part-time jobs which might affect their commitments to academic work in the distance education program as compared to those in Rural areas. Therefore, there should be more focus on Urban and Semi-Urban study centers, since a number of them negatively affect the performance of distance learning students. The binary logistic regression reveals that male students have a higher chance of performing better than females in distance education program. Consequently, there is a need to explore how distance education can be made more women friendly in view of the challenges they face [31].

In most situations, distance education may require the intervention of instructors both to set the activities around the teaching materials in motion and to provide appropriate feedback, thus increasing their workload rather than reducing it. However, national emergencies such as COVID-19, which led to traditional face-to-face meetings being canceled for sizable amounts of time, are harbingers to warn for the necessity of proper planning, implementation and real-life testing of resilient and sustainable distance education systems across countries ahead of time, as possible fall-back options.

5. Limitations

A limitation of causal-comparative research design that was used in this study is that it provides weak evidence for causation of differences that existed in the performance of distance and tradition students [34]. Consequently, further studies should be carried out to investigate the factors that account for the differences in the performance of distance and tradition students with regard to teacher training. The study used cumulative GPA scores of graduates as a measure of academic performance for 2011 to 2015 cohorts of traditional and distance graduates of a Bachelor's degree of education. As a result, care should be taken in generalizing these findings since the characteristics and facilities available to these cohorts might differ from those available other cohorts. Further studies could and should be conducted to compare resources and facilities available in distance study centers as a measure of the academic performance of students. A study could also be carried out to investigate the challenges of the distance education students from Urban, Semi-Urban and Rural centers face with regard to the program in order to throw more light on the differences which exist in their academic performance.

Author Contributions: Conceptualization, W.O.A. and H.Z.; methodology, W.O.A. and H.Z.; software, W.O.A., H.Z. and P.H.; formal analysis, W.O.A., H.Z., P.G., P.H. and D.L.; investigation, W.O.A., H.Z., P.G., P.H., D.L., T.L. and B.Z.; data curation, W.O.A. and H.Z.; writing—original draft preparation, W.O.A., H.Z., P.G., P.H. and D.L.; writing—review and editing, H.Z. and P.G.; funding acquisition, H.Z., T.L. and B.Z. All authors have read and agreed to the published version of the manuscript.

Funding: The work of D.L. and H.Z. was supported by a grant of the teaching reform project of Jiangsu University. The work of H.Z. was also supported by the “Blue Project” of Jiangsu Province and the Humanities and Social Science project of the Chinese Ministry of Education (No. 20YJA630088). The work of T.L. was supported by the Social Science Fund project of Jiangsu Province (No. 17XZB007).

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The data presented in this paper are available in the article.

Acknowledgments: We thank for Aihui Peng at the Southwest University, China, for useful comments and suggestions.

Conflicts of Interest: The authors declare no conflict of interest.

References

- Darling-Hammond, L. Teacher quality and student achievement. *Educ. Policy Anal. Arch.* **2000**, *8*, 1–44. [CrossRef]
- Evans, L. Professionals or technicians? Teacher preparation programs and occupational understandings. *Teach. Teach. Theory Pract.* **2010**, *16*, 183–205. [CrossRef]
- Shulman, L.S. *The Wisdom of Practice: Essays on Teaching, Learning, and Learning to Teach*; Jossey-Bass: San Francisco, CA, USA, 2004.
- Akoto, P.V. Distance Education for Teacher Education in Ghana: An Investigation into Untrained Teachers’ Experiences. Ph.D. Thesis, University of Sussex, Brighton, UK, 2015.
- DeJaeghere, J.G.; Chapman, D.; Mulkeen, A. Increasing the supply of secondary teachers in sub-Saharan Africa: A stakeholder assessment of policy options in six countries. *J. Educ. Policy* **2006**, *21*, 515–533. [CrossRef]
- Ministry of Education. *Education Sector Performance Report 2016*; Government of Ghana: Accra, Ghana, 2016.
- Sampong, K.A. An Evaluative Study of a Distance Teacher Education Program in a University in Ghana. *Int. Rev. Res. Open Distrib. Learn.* **2009**, *10*, 1–25. [CrossRef]
- Perraton, H.; Creed, C.; Robinson, B. *Teacher Education through Distance Learning: Technology, Curriculum, Costs, Evaluation*; UNESCO: Paris, France; Division of Higher Education and Research, International Research Foundation for Open Learning: Cambridge, UK, 2002.
- Mends-Brew, E.; Asabere, N.Y. The Effectiveness of Distance Education in Ghana. *Sci. J. Appl. Math. Stat.* **2016**, *4*, 159–167.
- UNESCO. *Open and Distance Learning Trends, Policy and Strategy Considerations*; Division of Higher Education, UNESCO: Paris, France, 2002.
- Guri-Rosenblit, S. *Distance and Campus Universities: Tensions and Interactions—A Comparative Study of Five Countries*; Pergamon Press & The International Association of Universities: Oxford, UK, 1999.
- Association for the Development of Education in Africa [ADEA]. Distance Education and Open Learning in Sub-Saharan Africa: Criteria and Conditions for Quality and Critical Success Factors. ADEA and the Commonwealth of Learning. 2002. Available online: <http://oasis.col.org/handle/11599/185> (accessed on June 24, 2020).
- Perraton, H. *Open and Distance Learning in the Developing World*; Rutledge: New York, NY, USA, 2000.
- Ministry of Education. *Ministry of Education Report: Distance Education Workshop*; Government of Ghana: Accra, Ghana, 2002.
- UEW IEDE/CDE. *Center for Distance Education Admission Brochure 2016/2017*; Publications Unit, UEW: Winneba, Ghana, 2016.
- UEW. *Undergraduate Admission Brochure 2016*; Publications Unit, UEW: Winneba, Ghana, 2016.
- Ni, A.Y. Comparing the effectiveness of classroom and online learning: teaching research methods. *J. Public Aff. Educ.* **2014**, *19*, 199–215. [CrossRef]
- Laurence, A.S.; Vimala, A. School Environment & Academic Performance of Standard Six Students. *J. Educ. Ind. Stud. World* **2012**, *2*, 22–35.
- Owoeye, J.S.; Yara, P.O. School Location and Academic Achievement of Secondary School in Ekiti State, Nigeria. *J. Asian Soc. Sci.* **2011**, *7*, 21–43. [CrossRef]
- Danial, K.K.; Felix, K. The Impact of School Environment and Peer Influence on Students? Academic Performance in Vihige County, Kenya. *Int. J. Hum. Soc. Sci.* **2014**, *4*, 56–61.
- Njaya, T. Women empowerment through open and distance learning in Zimbabwe. *J. Hum. Soc. Sci.* **2015**, *20*, 83–90.
- Lei, P.W.; Bassiri, D.; Schultz, E.M. Alternatives to the grade-point average as a measure of academic achievement in college. Act research report series. *Regelmaat* **2001**, *25*, 213–217.

23. Gordon, P.C.; Perrin, A.J.; Sancar, G.; Stewart, K.G. Equitable use of grades in measuring student accomplishment: Analyses and recommendations of the subcommittee on grading. *Educ. Policy Comm. UNC Chapel Hill* **2007**, *1*, 1–8.
24. Osei, C.K.; Mensah, J.A. A comparative study of student academic performance in on-campus teaching and distance learning in a computer engineering programme. *J. Sci. Technol.* **2011**, *31*, 97–102. [[CrossRef](#)]
25. Bernard, R.M.; Abrami, P.C.; Lou, Y.; Borokhovski, E.; Wade, A.; Wozney, L.; Wai, P.A.; Fiset, M.; Huang, B. How does distance education compare with classroom instruction? A meta-analysis of the empirical literature. *Rev. Educ. Res.* **2004**, *74*, 379–439. [[CrossRef](#)]
26. Shachar, M.; Neumann, Y. Twenty years of research on the academic performance difference between traditional and distance learning: Summative meta-analysis and trend examination. *MERLOT J. Online Learn. Teach.* **2010**, *6*, 318–334.
27. Russell, B.L.; Barefield, A.C.; Turnbull, D.; Leibach, E.; Pretflow, L. Evaluating distance learning in health informatics education. *Perspect. Health Inf. Manag.* **2008**, *5*, 1–11.
28. Willging, A.P.; Johnson, S.D. Factors that influence students' decision to dropout of online courses. *J. Asynchronous Learn. Netw.* **2009**, *13*, 115–127.
29. Njuguna, F.N. Factors Influencing Enrolment into Distance Learning Programs at the University of Nairobi: A Case of Bachelors of Education Students in Lamu County. Master's Thesis, University of Nairobi, Nairobi, Kenya, 2013.
30. Papageorgiou, K.; Halabi, A.K. Factors contributing toward student performance in a distance education accounting degree. *Meditari Account. Res.* **2014**, *22*, 211–223. [[CrossRef](#)]
31. Kwapong, O.A.T.F. Widening access to tertiary education for women in Ghana through distance education. *Turk. Online J. Distance Educ.* **2007**, *8*, 65–79.
32. Tayyaba, S. Rural-urban gaps in academic achievement, schooling conditions, student, and teachers' characteristics in Pakistan. *Int. J. Educ. Manag.* **2012**, *26*, 6–26. [[CrossRef](#)]
33. Bosedede, A.F.; Emiloju, A. Rural and urban differential in student's academic performance among secondary school students in Ondo state, Nigeria. *J. Educ. Soc. Res.* **2013**, *3*, 213–217.
34. Gay, L.R.; Mills, G.E.; Airasian, P. *Educational Research, Competencies for Analysis and Application*, 10th ed.; Pearson: Boston, MA, USA, 2012.
35. Field, A. *Discovering Statistics Using SPSS*; SAGE Publications Ltd.: London, UK, 2009.
36. Ghana Statistical Service. *2010 Population & Housing Census Summary Report of Final Results*; GSS: Accra, Ghana, 2012.
37. Aderinoye, R.; Ojokheta, K. Open-distance education as a mechanism for sustainable development: reflections on the Nigerian experience. *Int. Rev. Res. Open Distance Learn.* **2004**, *5*, 1–13. [[CrossRef](#)]
38. Jimoh, M. An appraisal of the open and distance learning programme in Nigeria. *J. Educ. Pract.* **2013**, *4*, 1–8.