UDC 378.14

Computer usage proficiency towards pedagogical knowledge and learning improvement

Oladapo Elugbadebo, Femi Johnson

Abstract

The introduction of computers and ICT related gadgets in education is presently yielding noticeable impacts and it's been widely accepted to aid learning. Thus, creating an ever increasing desire and urge in school owners, teachers, parents and students to acquire them for learning. The aim of this research is to examine the effect of computer usage proficiency on both teachers' pedagogical knowledge and students' academic performance. A total of two hundred (200) respondents selected through a stratified random sampling technique comprising of forty (40) respondents (twenty-five (25) teachers and (15) students) each from five selected Junior Secondary Schools in Ogun state, Nigeria served as the research population. Collated data were analyzed using frequency counts and Chi-Square at 0.05 alpha level of significance. Also, three null hypotheses were formulated to determine the significant relationship among computer usage proficiency, teachers' pedagogical competence and students' academic performance. Research findings revealed that computer assisted approach is the most preferred teacher's pedagogical approach indicating that old and long-service teachers show poor approach towards employing computers and ICT gadgets to aid teaching and learning. The study further established that teachers' pedagogical competence is not independent of computer knowledge which will resultantly influence students' academic performance positively.

Keywords: academic performance; computer and ICT gadgets; computer proficiency; teachers training programme; pedagogical knowledge.

Submitted:
16 May 2020
Accepted:
01 December 2020
Published online:
30 December 2020

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INTRODUCTION

The sustainable development of any nation is solely hinged on her conscious efforts towards developing human capacity with improvement in education identified as a core factor. In lieu of this, governments around the world have adopted varied methods to reform their educational systems ([Ifinedo, Rikala, & Hämäläinen, 2020](#)). Despite the methods adopted, there is still a persistent increase in failure rate as indicated in the annual reports by some countries national examination bodies. This failure rate necessitated numerous researches which identified factors such as method of teaching, teachers' characteristics, teachers' attitude and students' attitudes towards education amongst others as contributors towards poor academic performance

by students ([Ameen, Adeniji, & Abdullahi, 2019](#)). However, there has been a continuous discourse on ways of improving students' academic performance ([O'Sullivan, 2004](#)) as the shift from teacher-centered to student-centered method of teaching noted in some researches is still not yielding the much desired change as expected.

The application of computers and ICT in education could aid to avert the identified problems but are associated with some challenges ([Lawless & Pellegrino, 2007](#)). These challenges identified by Adomi and Kpangban, (2010) range from lack of ICT infrastructure, teachers' ICT competence, comprehensive ICT policy and its awareness among educators, lack of teachers' ICT pedagogical development as well as lack of teachers' computer efficacy. Evidences available from researches also suggest that teachers' intellectual resources significantly affect students' learning experiences ([Odumosu, Olusesan, & Abel, 2016](#)).

Also, a growing body of research shows that teachers' quality in pedagogy knowledge and quality of content mastery has great influence on student's performance ([Ishola & Udofi, 2017](#)). Therefore, the research sets to examine computer proficiency as a key for improving teachers' pedagogical knowledge and students' academic performance of students.

STATEMENT OF THE PROBLEM

Despite the inclusion of computer knowledge skills in the making of the most important stakeholder in education – the teachers training which is aimed at boosting teachers' pedagogical competence and resultantly academic performance, it was still well observed that academic performance keeps declining. This may pose a greater threat towards further education and national development.

Since expertise computer knowledge proficiency is almost unattainable in the teachers' training programme; thus, pedagogically semi-competent teachers are produced. This situation is seemingly obvious in the fact that teachers are mostly taught in their training in Colleges of Education with little computer knowledge (except for those who majored in computer science courses) much more to worry about being proficient which has resulted in a poor perception of computer proficiency. It is therefore pertinent, to carefully investigate how objectively the computer content knowledge is being taught, perception of teachers' in training about computer proficiency, factors limiting utilization of computer skills as learning instructions in a bid to improve academic performance among secondary school students. It is against this backdrop this research set to examine computer proficiency as a key for improving teachers' pedagogical knowledge and academic performance of students particularly in Junior Secondary Schools in Ogun State, Nigeria.

PURPOSE AND OBJECTIVE OF THE RESEARCH

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The primary purpose of this research is to ascertain how computer usage proficiency skills obtained during teachers' training programme harmonizes their pedagogical knowledge competency and with a clear objective drive the teaching-learning process in order to significantly improve academic performance.

This research will also help teachers in eliminating fear of examination failure which has persisted among junior secondary school students as it will give students the opportunity to enjoy learning through modern computer technologies to enhance comprehension and assimilation required for improved academic performance. Also, it would be of great benefit to teachers (in-service and pre-service) training programme as it will open their interest and enhance right attitude towards computer proficiency which is capable to make them more competent and effective in teaching, assessing, computing, analyzing, etc. their subject content with much ease.

Furthermore, policymakers could also include use research findings to stimulate the interest of the Government and other education stakeholders towards improving computer knowledge amongst junior secondary school students in making government investment on ICT and computers usage in schools count.

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OPERATIONAL DEFINITION OF TERMS

The meaning of under listed terms as used in this paper is defined below:

- **Secondary School Students (SSS):** Students in an education level after primary education. Education obtained by these students is termed post-primary education. It is an important stage of learning that prepares students for the tertiary level of education.

- **Computer Proficiency (CP):** Synonymous with computer literacy. It is the application of conceptual knowledge and ability towards efficient use of computers and related devices. It describes the comfort level of the teacher when using the computer and other ICT gadgets or applications that are employed to boost students learning and academic performance.

- **Teachers Training Programme (TTP):** All pre-service and in-service training received by secondary and primary school teachers in preparation for the teaching job. It is policy-structured programs that ensure teachers are pedagogically trained to professionally fit for teaching venture.

- **Teachers' Pedagogical Knowledge (TPK):** knowledge of teaching methods aimed to improve teaching and learning. It consists of all forms of scientific theories and philosophical views related to teaching and learning in education.

Concept of computer usage and ICT integration in education

A computer is an electronic device with the ability to accept, store and process data obeying sets of instructions (programs) to generate meaningful result. Computers over the years have become smaller, faster and more powerful ([Waguespack & Babb, 2019](#)). Our present day computer systems are like common pen and paper for writing especially among primary and post-primary school students. Information Communication Technology (ICT) is basically a tool incorporated into the teaching and learning environment. Shi and Bichelmeyer ([2007](#)) advised teachers not to replace what they teach, but see ICT as a tool just like a calculator, a pen or chalkboard that helps them to teach and students to learn.

du Plessis and Webb ([2012](#)) highlighted types of ICT integration in schools to include classroom learning without computer integration, usage of computer only for knowledge transmission and proper integration with classroom learning methods for effective teaching. Generally, opportunities for collaborative learning provided through the use of ICT enables the easy integration of the internet for educational resource sharing and incorporating learners-centered approach in education ([Bower, 2019](#)).

Computer literate teachers with internet access have greater probabilities of improving knowledge and skills for the benefits of their students ([Wei, Darling-Hammond, Andree, Richardson, & Orphanos, 2009](#)).

Computer usage proficiency

Professional training and development attained by teachers determine their level of computer skills integration and usage ([Bingimlas, 2009](#)). Lack of Information Technology (IT) experts in teacher's training school posed a greater challenge as in-training teachers have no training on the use of computer technology ([Bauer & Kenton, 2005](#); [Mitchem, Wells, & Wells, 2003](#); [Yurdakul, 2018](#)). An effective in teaching methodology certainly requires collaboration between subject content and ICT integration ([Shi & Bichelmeyer, 2007](#)).

Professional development should not focus on subject areas nor teaching methods only but also the application of computer technology and utilizing ICT related instructional tools ([Dudeney & Hockly, 2007](#)). The efficacy of computer technology integration is actually related to the teaching methods and design principles, rather than computer technology itself ([Joo, Park, & Lim, 2018](#)). Therefore, teachers' computer technology knowledge gained through trainings and workshops will help in identifying ways through which ICT can be integrated in the classroom ([Sheumaker, Slate, & Onwuegbuzie, 2001](#)). Teachers who also spend more time in their professional development towards implementing computer technology and transforming the teaching practices show great preparedness to teach with computer technology ([Wei, Kim, Cheng, & Luthy, 2009](#)).

An evaluation of the issues related to the integration of ICT among Libyan educators by Hbaci, Ku, and Abdunabi (2020) focusing on four selected ICT areas; basic computer operation, internet usage, adoption of peripheral technologies and advanced computer operations with three specified research questions revealed that technical oriented teachers adequately adopt the usage of ICT gadgets and are more competent than non-technical-oriented teachers. Thus, recommending necessary actions toward the adoption of ICT gadgets among teachers and other related stakeholders.

Teachers' pedagogical knowledge and competence

Pedagogical knowledge gives insight into the teachers' subject mastery and delivery of contents which constitutes factors to determine the extent to which learning has taken place (Chikasanda, Otrell-Cass, Williams, & Jones, 2013). A teacher who can present lessons in ways which are strongly appealing and appreciated by the students (Li, Garza, Keicher, & Popov, 2019) is said to possess good pedagogical knowledge. Possession of good pedagogical knowledge will make, even the student with the least cognitive ability have a better understanding and clearer picture of the lesson (Scherer, Tondeur, Siddiq, & Baran, 2018; Vongkulluksn, Xie, & Bowman, 2018).

Mitchem, Wells, and Wells (2003) asserted that teachers' competence is of particular concern when new subjects or media are introduced into the school system because teachers' experience and competence will form the foundation of their ability to implement innovation in schools. However, the notion of competence with regards to the use of ICT in education is broader (Xie, Kim, Cheng, & Luthy, 2017) than the technical skills needed to use ICT. The type of ICT competence needed by teachers is a collection of knowledge, skills, and attitudes that are inextricably bound up with the context and pedagogy (Bauer & Kenton, 2005). Yurdakul (2018) disclosure of teachers' pedagogical competence in computer knowledge will positively influence students' academic performance.

The adoption of an embedded framework to determine the relationship and correlation between technological pedagogical content knowledge (TPACK) skills and attitudes towards technology among Turkish EFL teachers' by Kozikoğlu & Babacan, (2019) found that there exist a positive, low and highly significant relationship between the duo- (teachers' TPACK skills and attitudes) towards technology.

Students' academic performance

Academic performance of students acts as a scale to which educational institution's level of success is rated (Ishola & Udofia, 2017). Parents, schools and teachers have very high expectations from students with respect to their academic performance, as it is the belief that better academic results may lead to better career options and future security (Anene, Ikerionwu, & Danladi, 2013). It is also the outcome of education, the extent to which a student, teacher or institution has achieved their educational goals. Mitchem, Wells,

and Wells (2003) described academic performance as the ability to study, remember facts and being able to communicate your knowledge verbally or on paper.

Over time students' academic performance in both internal and external examinations had been used to determine excellence in teachers and teaching. The process rate of transforming educational policy to action by teachers is also a determinant to the level of academic success achieved by the students (Hodgkinson-Williams, 2006).

Ifinedo, Rikala, & Hämäläinen (2020) performed a comparative study on the perception and integration of technology among teachers into education in Nigeria using the TPACK (Technological, Pedagogical and Content Knowledge) model to aid students' academic performance. A basic conclusion reached in the research showed that the size of classroom and number of students is also determinant to the adoption of ICT gadgets.

RESEARCH METHODOLOGY

A descriptive survey method is adopted for this paper, the method is considered appropriate because it helps to describe, examine, analyze and interpret the variables that exist in the research. Questionnaires distributed among respondents were used to elicit views of the respondents. The questionnaire is subdivided into two sections, Section A consist of the personal information of the respondent in Category I (teacher) such as teacher's gender, teacher's highest qualification, teacher's years of experience, and subject area; while the respondents in Category II (student) respond to their gender and class level. Section B comprises of twenty (20) items purportedly designed to gather information and to give respondents opportunity to decide properly before giving their most suitable opinions.

The respondents were allowed to pick one of the options provided at a time using the Four point Likert scale **SA**: Strongly Agreed, **A**: Agreed, **D**: Disagreed, **SD**: Strongly Disagreed. In addition, a simple percentage and tables were employed for the presentation and interpretation. Finally Chi-Square was used in the analysis of the data.

DATA PRESENTATION AND ANALYSIS

Demographic analysis of data

The table below (Table 1) shows that the questionnaire was evenly distributed among the selected schools with 20% of the respondents are from Alaye High School, Ayetoro, 20% of the respondents are from Ajoda High School, Ayetoro, 20% of the respondents are from Community High School, Ayetoro, 20% of the respondents are from Comprehensive High School, Ayetoro, while 20% of the respondents are from Technical College, Ayetoro.

Table 1. **Respondent's schools analysis**

S/n	School	Frequency	Percentage
1.	Alaye High School, Ayetoro	40	20
2.	Ajoda High School, Ayetoro	40	20
3.	Community High School, Ayetoro	40	20
4.	Comprehensive High School, Ayetoro	40	20
5.	Technical College, Ayetoro	40	20
TOTAL		200	100

Sources: own study

Analysis of data collected among students and teachers according to sex of respondents is depicted in the chart below ([Figure 1](#)). Forty-seven (47) female and twenty-eight (28) male student respondents participated in the research with their percentage expressed as sixty-three (63%) and thirty-seven (37%) respectively. In addition, teachers who participated and responded to this research comprised of seventy-seven (77) and forty-eight (48) females and males respectively. This shows that female respondents took the larger share in our research.

Sources: own study

Figure 1. **Gender analysis of respondents**

The data collection tool used for this research is an encompassing type with provisions for collecting specific data from teachers with a view of determining the correlation between teachers' highest academic qualification and level of student performance. Classification based on highest academic qualification ([Figure 2](#)) depicts that most of the teachers in the selected schools are Bachelor (First) degree holder. Although quite a number of the teachers felt it unnecessary to fill the section, Masters (Second) degree holders have the least number followed by Associate Certificate (NCE).

Sources: own study

Figure 2. **Teachers' highest academic qualification**

In addition, the result shown in [Figure 3](#) clearly gives the sampled teachers' years of teaching experience. A period of thirty-five (35) years is speculated by law as the highest duration for gainful and rewarding service with progressive levels of promotions until a retiring age of sixty (60) years is reached by the teacher. Classification of active teaching years and experience for this research range from (1-5, 5-10 and 10+) years analyzed in percentage. The corresponding values in percentage are 16.0, 38.0 and 8.5 respectively. However, the non-categorized fraction (students) remains 37.5 of the sampled respondents.

Sources: own study

Figure 3. **Teachers' experience by years of service**

Furthermore, the results ([Table 2](#) and [Figure 4](#)) show the class analysis and the subjects taught respectively by the sampled teachers in the selected junior secondary in the study area in the following proportion: ENGLISH Language – 42 (21.0%), MATHS – 52 (26.0%), BASIC SCIENCE – 11 (5.5%), CIVIC EDU – 8 (4.0%) and COMPUTER STUDIES – 12 (6.0%). The non-category (students) remains 75 (37.5%) of the sampled respondents.

Table 2. Class level analysis

S/n	Class level	Frequency	Percent (%)	Cumulative (%)
1	NO CATEGORY	125	62.5	62.5
2	JSS1	13	6.5	69.0
3	JSS2	10	5.0	74.0
4	JSS3	52	26.0	100.0
Total		200	100.0	

Sources: own study

Sources: own study

Figure 4. Teachers' experience by years of service

Testing of research hypotheses

H₀₁: There is no significant relationship between teachers' computer proficiency and teachers' pedagogical competence

In the process of data analysis, related items were merged to represent "Teachers' computer proficiency and teacher's pedagogical competence". [Table 3](#) answered the research hypothesis "There is no significant relationship between teachers' computer proficiency and teachers' pedagogical competence". Using the Chi-square formula as represented in ([eq. 1](#)).

$$\chi^2 = \frac{\sum(O - E)^2}{E} \quad (1)$$

given: Observed Values (O) and Expected Values (E)

Determining from the [Table 3](#), chi-square calculated ($\chi^2_{\text{Cal}} = 66.533$ and 97.024) for students and teachers respectively is greater than the chi-square critical value ($\chi^2_{0.05} = 18.307$ and 18.307). Hence, the null hypothesis which

states that “There is no significant relationship between teachers’ computer proficiency and teachers’ pedagogical competence” is hereby rejected. Thus, there is significant relationship between teachers’ computer proficiency and teachers’ pedagogical competence. This implies that teachers’ computer proficiency will have positive effect on teachers’ pedagogical competence.

Table 3. Teachers’ computer proficiency and teacher’s pedagogical competence

S/n	Respondent	SA	A	D	SD	Total	DF	X^2_{Cal}	$X^2_{0.05}$
1	Students	61	12	2	0	75	10	66.533	18.307
2		20	36	10	9	75			
3		27	20	26	2	75			
4		16	31	7	21	75			
5		31	29	13	2	75			
6		20	21	25	9	75			
7		26	19	24	6	75			
8		41	13	11	10	75			
9		20	19	22	14	75			
10		18	42	13	2	75			
1	Teachers	99	22	4	0	125	10	97.024	18.307
2		34	59	16	16	125			
3		44	34	43	4	125			
4		27	51	12	35	125			
5		52	47	22	4	125			
6		34	35	40	16	125			
7		47	30	36	12	125			
8		67	24	19	15	125			
9		35	31	35	34	125			
10		31	68	23	3	125			

Sources: own study

Alpha at 0.05 level of significance

H₀₂: There is no significant relationship between teachers’ computer proficiency and students’ academic performance.

Similarly, data items were merged to represent “Teachers computer proficiency and students’ academic performance”. Results in [Table 4](#) are analyzed with the same formula ([eq. 1](#)) answered the research hypothesis “there is no significant relationship between teachers’ computer proficiency and students’ academic performance”.

The Chi-square calculated ($X^2_{Cal} = 38.733$ and 51.880) for students and teachers respectively is greater than the chi-square critical value ($X^2_{0.05} = 16.919$ and 16.919). Hence, the null hypothesis with no significant relationship between teachers’ computer proficiency and students’ academic performance is hereby rejected. Thus, there is significant relationship between teachers’ computer proficiency and students’ academic performance. This implies that

teachers' computer proficiency will bring about a positive result on students' academic performance.

Table 4. Teachers computer proficiency and students' academic performance

S/n	Respondents	SA	A	D	SD	Total	DF	X^2_{Cal}	$X^2_{0.05}$
1	Student	33	19	19	4	75	9	38.733	16.919
2		20	38	9	7	75			
3		28	27	13	7	75			
4		24	39	8	4	75			
5		24	36	13	2	75			
6	Teachers	51	31	35	8	125	9	51.880	16.919
7		34	63	16	12	125			
8		48	43	23	11	125			
9		42	59	16	8	125			
10		38	59	24	4	125			

Sources: own study

Alpha at 0.05 level of significance

H₀₃: There is no significant relationship between students taught with ICT based equipment and traditional based method

Chi-square formula as shown in equation (1) was also used to calculate and analyze groups of data representing information about students taught with ICT-based equipment and traditional-based method. Data supplied (Table 5) is used to determine if there exists no significant relationship between students taught with ICT based equipment and traditional based method".

Table 5. Students taught with ICT-based equipment and traditional-based method

S/n	Respondents	SA	A	D	SD	Total	DF	X^2_{Cal}	$X^2_{0.05}$
1	Students	27	25	17	6	75	7	28.147	14.067
2		22	40	13	0	75			
3		15	15	30	15	75			
4		29	39	7	0	75			
5		15	27	20	13	75			
6	Teachers	40	45	30	12	125	7	50.296	14.067
7		39	62	24	0	125			
8		24	26	51	24	125			
9		51	63	11	0	125			
10		26	44	31	24	125			

Sources: own study

Alpha at 0.05 level of significance

Calculated Chi-square value ($X^2_{Cal} = 28.147$ and 50.296) for students and teachers respectively is greater than the Chi-square critical value ($X^2_{0.05} = 14.067$ and 14.067). Hence, the null hypothesis stating that there is no significant relationship between students taught with ICT based equipment

and traditional based method is hereby rejected. Thus, there exist significant relationship between students taught with ICT based equipment and traditional based method. This implies that students taught with ICT based equipment tend to perform better than students taught with the traditional method.

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CONCLUSION

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This paper is a detailed research intended to investigate computer usage proficiency as a vital key for improving teachers' pedagogical knowledge and academic performance of students in some selected junior secondary schools in Ogun State, Nigeria. A population comprising of 125 teachers and 75 students in the five (5) selected through stratified sampling technique was deployed. Research data collected were analyzed using simple percentage for demographic characteristics of the respondents and the research questions. Research hypotheses were tested with Chi-Square using SPSS data analytical tool.

The outcome of this research revealed that some teachers prior to their computer acquisition skills in their training are computer literate and the introduction of computer usage and proficiency skills or knowledge in teachers training help them (teachers) to be more effective and improve their computer skills. It can further be concluded from results obtained that computer assisted approach is the most preferred teacher's pedagogical method thus establishing that teachers' pedagogical competence in computer knowledge will positively influence students' academic performance.

Furthermore, based on the rejected hypothesis in this research. It thus revealed the significant relationship which exists between teachers' computer usage proficiency with teachers' pedagogical competence and students' academic performance.

However, recommendation for research on the design of workable and effective policies involving the inclusion of Computer and ICT skills should be look into especially in teachers training institutes to inculcate the right approaches among teachers. Conclusively, a fruitful and positive synergy among schools, teachers, parents and students towards the effective use of computer and ICT gadgets in teaching and learning will make significant impact on students' academic performance if properly implemented.

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About the authors:

Oladapo J. Elugbadebo, Federal College of Education, Abeokuta, Ogun state, Nigeria.

ORCID: <https://orcid.org/0000-0003-3344-9835>. jossydayo@yahoo.com

Femi T. Johnson, Federal College of Education, Abeokuta, Ogun state, Nigeria.

ORCID: <https://orcid.org/0000-0002-5467-855X>. femijohnson123@hotmail.com

*Ukr. J. of Educ.
Stud. and Inf.
Technol.*
2020, 8(4)