Availability and Application of Information and Communication Technology Infrastructure, and Academic Performance of Public and Private Secondary School Chemistry Students in Calabar

Nja Cecilia O.[1] and Idiege Kimson J.[2]

[1]Department of Science Education, University of Calabar, P.M.B. 1115, Calabar, Cross River State, Nigeria | Email: njacecelia@gmail.com

[2]Department of Science Education, University of Calabar, P.M.B. 1115, Calabar, Cross River State, Nigeria | Email: kimsonidiege@gmail.com

Abstract: This paper investigated access and application to Information and Communication Technology (ICT) infrastructure and academic performance of public and private schools chemistry students in thermochemistry in Calabar, Cross River State, Nigeria. Three research questions were raised and one hypothesis was formulated. Do teachers in both public and private schools have access to ICT Infrastructure? Do teachers in both public and private schools have the necessary ICT skills? and To what extent do academic performance of chemistry students differ with regards to school type. The null hypothesis stated that, there is no significant difference in the academic performance of Chemistry students with regards to school type. The study undertook a expo-faco design and had a sample size of 20 teachers from 20 randomly selected secondary schools in Calabar Education Zone. 60 chemistry students constituted the sample for the research. Two instruments were used for the study: Information and Communication Technology Teachers' Questionnaire (ICTTQ) and Chemistry Achievement Test (CAT). Finding showed that chemistry teachers in public school had more ICT skills than the teachers in private schools. Private school teachers in turn had opportunity for more access to computer without internet services. Both public and private school teachers had a high percentage of ICT skills in communication in social networks there was a low percentage (%) in use of spread-sheet to plot graphs. Both public and private schools do not have phone for teachers' use in the teaching of Chemistry. The null hypothesis seeking for no significant difference in academic performance of Chemistry students with regard to school type was retained. Recommendations were made among which was, regular training of teachers in ICT usage and ICT infrastructure supplied to schools should be taken seriously.

Key words: ICT, Private, Public, academic performance, teachers schools

1. INTRODUCTION

Information and communication Technology (ICT) can be said to be the range of technologies of information that are used in the process of collecting, storing, editing, retrieving and transfer of information in various forms (Olakulehin, 2007). ICT can also be referred to as that which encompasses all equipment and tools (inclusive of traditional technologies of radio, video and television to the newer technologies of computers, hardware's, firmware etc.) as well as the

methods, practices, processes, procedures, concepts and principles that come into play in the conduct of information and communication activities (Federal Ministry of Education, Nigeria, 2010).

In this 21st century, ICTs are becoming a natural part of man's daily life and therefore will soon be needed for people's social work and even personal lives. The use of ICT falls into four major categories: Constructing knowledge and problem solving (through the internet, E-mail. CD ROMS, data bases, video-conferencing) using process skills, aiding explanation of concepts and communicating ideas using power point, desktop publishing (WCEA, 2002).

Chemistry teaching and learning has suffered a lot of set back as evidence in SSCE examination results of chemistry from 2008, 2009, 2010, 2011 and 2012 where the obtained results were 26.10%, 54%, 51%, 56% and 33% respectively. A quick look at the result above showed that Chemistry students did not perform well in external examinations (Ademola, Olufunke and Amoke, 2013).

Chemistry as a subject is required according to JAMB Brochure 2015 to study courses like Medicine and Surgery, Pharmacy, Engineering, Chemical Education, Nursing, Agriculture. A credit pass in chemistry is a mandatory requirement for admission. In Nigeria, science (Chemistry) teaching at various levels still retain the old conservative approach and if this situation would be made to change, then there is the need for diagnostic study into the use of ICTs in teaching chemistry (Aladejana,2007).

Decline in academic performance of chemistry students can be linked to methodology and instructional materials used in teaching. Methods and instructional materials that do not bring science closer to society, and in this way, many initiatives may not be found within the science community. Promoting children interest is very important to high academic achievement.

Educators and teachers need to understand the learning needs and different learning styles of our students to equip them to contribute to using the tools of chemistry to improve the human condition and that of our environment and to help each one of them understand the crucial role that chemistry plays in our lives (Mahaff, 2011).

The use of ICT in teaching is a relevant and functional way of providing education to learner that will assist in imbibing in them the required capacity for the world, of work (Aladejana, 2007).

When different Information Communication technologies are used in teaching chemistry, learning by students becomes inevitable as students can retrieve required information within a short time, information can be accessed and disseminated electronically within a short time via e-books, e- journals and can improve their learning by using different ICTs. These ICTs can be in the form of wireless networks internet, search engines, databases, websites and web technologies (Danner and Pessu, 2013).

Teachers are the vehicles to drive home the implementation of ICTs in schools. This is so as teachers are the only one that can change from teacher-base instruction to learner- based learning where teachers facilitate learning. In view of the above, this paper attempted to find out the ICT skills that teachers possess both in public and private schools, professional training in ICT that are opened to teachers and the academic performance of students in both public and private schools.

The challenge is to find out how prepared are the teachers in Cross River State to take up this challenge in our classroom in this 21st century. Do teachers have access to ICTs in public and private schools? What effect does it have on the academic performance of Chemistry

students? There is no significant difference between Government (public) and private secondary school students.

2. LITERATURE REVIEW / THEORETICAL UNDERPINNING

Constructivist and conceptual change theory was pioneered by Jean Piaget. Constructivism is a learning theory and epistemology that has influenced much of science education lately. It states that learner constructs their own knowledge of the world through their past experiences. Students therefore do not learn by sitting in the classroom listening to the teacher, memorizing repackaged assignments and spitting out answers.

They must talk what they learn, write about it, relate it to past experiences and apply it to their daily lives. They must make what they learn part of them. Teaching is the act of impacting knowledge and in doing so, teachers are minded that learning will only take place when the learner is engaged with the subject matters that the instructor intends. Three important factors that are very crucial in teaching and learning are; what the learner already know, the abilities of the learner and motivation (Shell, 2010). Teachers are to be reminded that the old Chinese Proverb (Chinese Confucian Philosopher Vunzi, 312-230BC) which states:

"Tell me, I will forget

Show me, I will remember

Involve me, I will understand"

is still applicable in our 21st Century.

Literature had shown that students learn better when ICT is integrated in teaching and learning process. Students report higher attendance, motivation and academic performance as a result of ICT programs (Dzidonu, 2010). The number of school dropouts reduced to greatly with the use of ICT in schools (Rebecca, & Marshall, 2014). This is so as internet enticed school dropout to return to school. The use of ICT in schools help to develop future workforce that can effectively participate in the increasing networked world and the emerging knowledge economy (Mingaine, 2013).

Higgins & Moseley, (2011) conducted a study on the use of ICT in teaching and learning and discovered that, teachers who use ICT get their students motivated and the class thus became enjoyable, teaching was more interesting, easier and more diverse, more fun for them and students. High cost interview of maintenance of ICT infrastructure has been a great challenge in the implementation of ICT in schools (Farrell, 2007) Economic realities has not allowed for the implementation and integration of ICTs in teaching and learning in secondary schools yet in Nigeria.

ICT infrastructure in schools especially in Africa (Hennessy, 2010) has been a big challenge. In many schools, access to internet service, charges on software's which requires licensing hinders the availability of ICT infrastructure in schools (Aguya, 2010). In another study conducted by Obota; Oluoch & Makani (2015), 60% had radio, 46% had audio learning cassette, 33% had computers and 20% had video for learning. Aledejana's (2007) research in Nigeria, revealed that 20% of the schools have computers which children had access to, no school had laptop, LCD projector, or video-recorder.

Teachers' skills in many studies have shown to be inadequate for carrying out effective ICT integration in schools (Hennessey, 2010). In Africa, efficient implementation of ICT in schools has been hampered as trained personal that have correct skills are missing (Dzidonu,

2010). In a study carried out by Aledejana, (2007), 88% of teachers lacked the required skills in ICT. 72% cannot access the internet, 64% cannot start up or shut down a computer safely.

3. METHODOLOGY

This research study under-took a expose-facto design. Two instruments were used for this study: A four point scale Questionnaire, named ICT teachers' Questionnaire (ICTTQ) and Chemistry Achievement Test (CAT). The researchers used simple random sampling technique to select the sample for this study. A sample of 20 schools which comprised 20 teachers and 60 students were used. The sample schools used consist of 10 public schools and 10 private schools.

4. RESULT AND FINDINGS

Table 1: shows Teachers' access to ICT infrastructure in public schools

Infrastructures	No access	Access on demand	Permanent access
Desktop computer without access	60%	30%	10%
E-reader (to read books, newspaper on screen).	90%	-	10%
Digital camera/ camcorder	90%	-	10%
Computer laboratory	50%	30%	20%

Table 1 above showed that 60% of teachers do not have access to desktop computers with internet service, 90% do not have access to E-reader, 90% do not have access to camera/camcorder and 50% do not have access to the computer laboratory.

Table 2: Teachers' Access to infrastructure in private schools:

	No access	Access on demand	Permanent access
Desktop computer without internet service	25%	75%	-
E-reader	50	38	12
Digital camera/camcorder	100%		-
Computer laboratory	25%	25%	50%

Table 2 above showed that in private schools, teachers who do not have access to Desktop/computer without internet were only 25%. Teachers who do not have access to E-reader were 50%. It also showed that 100% of teachers do not have access to Digital Camera/camcorder. 50% of teachers had permanent access to the computer laboratory.
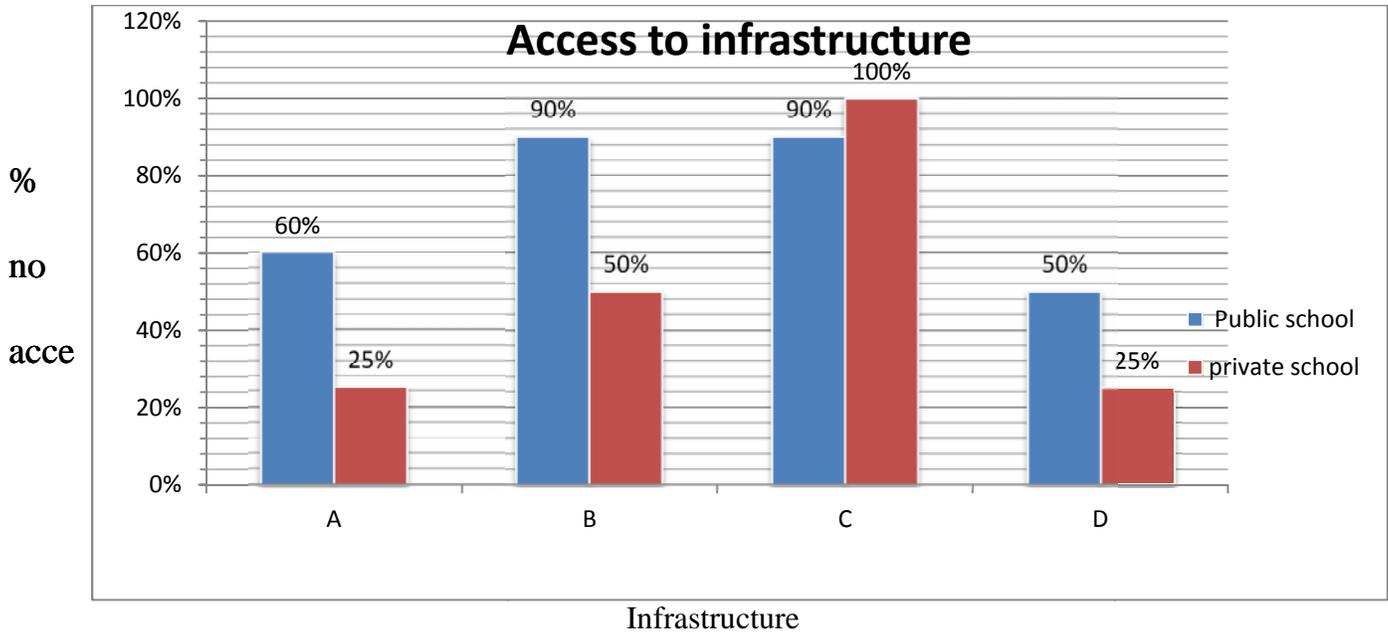
Fig 1: Bar chart of % access to ICT infrastructure
A= Desktop, computer without internet access
B= E-reader (to read books and newspapers on the screen)
C= Digital camera/camcorder
D= Computer laboratory

Table 3: Teachers' skills in the use of ICT in public schools

Teachers' skills in the use of ICT	A lot	Some what	little	None
Produce a text using a word processing programme	33%	0	33%	33%
Use e-mail to communicate with others	33%	22%	22%	22%
Edit text online containing internets links and images	33%	11%	11%	44%
Create a Data base	44%	0	0	56%
Use a spreadsheet to plot a graph	22%	33%	0	67%
Create a presentation with simple animation functions	44%	0	0	56%
Participate in social networks	67%	0	0	33%
Teach students how to behave safely online	56%	0	11%	33%
Prepare materials to be used with an interactive white board	56%	0	0	44%
E-mail a file to someone, teacher or student	56%	11%	0	33%

Table 3 revealed that 33% of teachers in public schools could produce a text using word processing programme. Teachers could only communicate through e-mail by 33% and 44% of the teachers could not edit a text online containing interactive links and images. The Table also showed that 44% of teachers could create a data base. In the case of using spread sheet to plot graphs, 22% of teachers could do that. In participating in social networks, 67% of teachers can effectively do that, while 56% could teach students how to behave safely online. Teachers who could prepare materials to be used with an interactive white board were 56%, E-mail a file to someone, teacher or student where 56%.

Table 4: Teachers' skills in the use of ICT in private schools

Use of ICT	A lot (%)	Somewhat (%)	Little (%)	None (%)
Produce a text using a word processing programmed	63%	12.5%	12.5%	12.5%
Use e-mail to communicate with others	50%	25%	12.5%	12.5%
Edit text online containing internet links and images	12.5%	25%	37.5%	25%
Create a data base	37.5%	12.5%	12.5%	37.5%
Use a spread sheet to plot graph	37.5%	12.5%	12.5%	37.5%
create a presentation with simple animation function	25%	12.5%	25.5%	37.5%
Participate in social networks	50%	12.5%	12.5%	12.5%
Teach student how to behave safely online	25%	12.5%	25%	37.5%
Prepare materials to use with an interactive board	25%	12.5%	25%	37.5%
Email a file to someone, teacher or student	37.5%	0	12.5%	50%
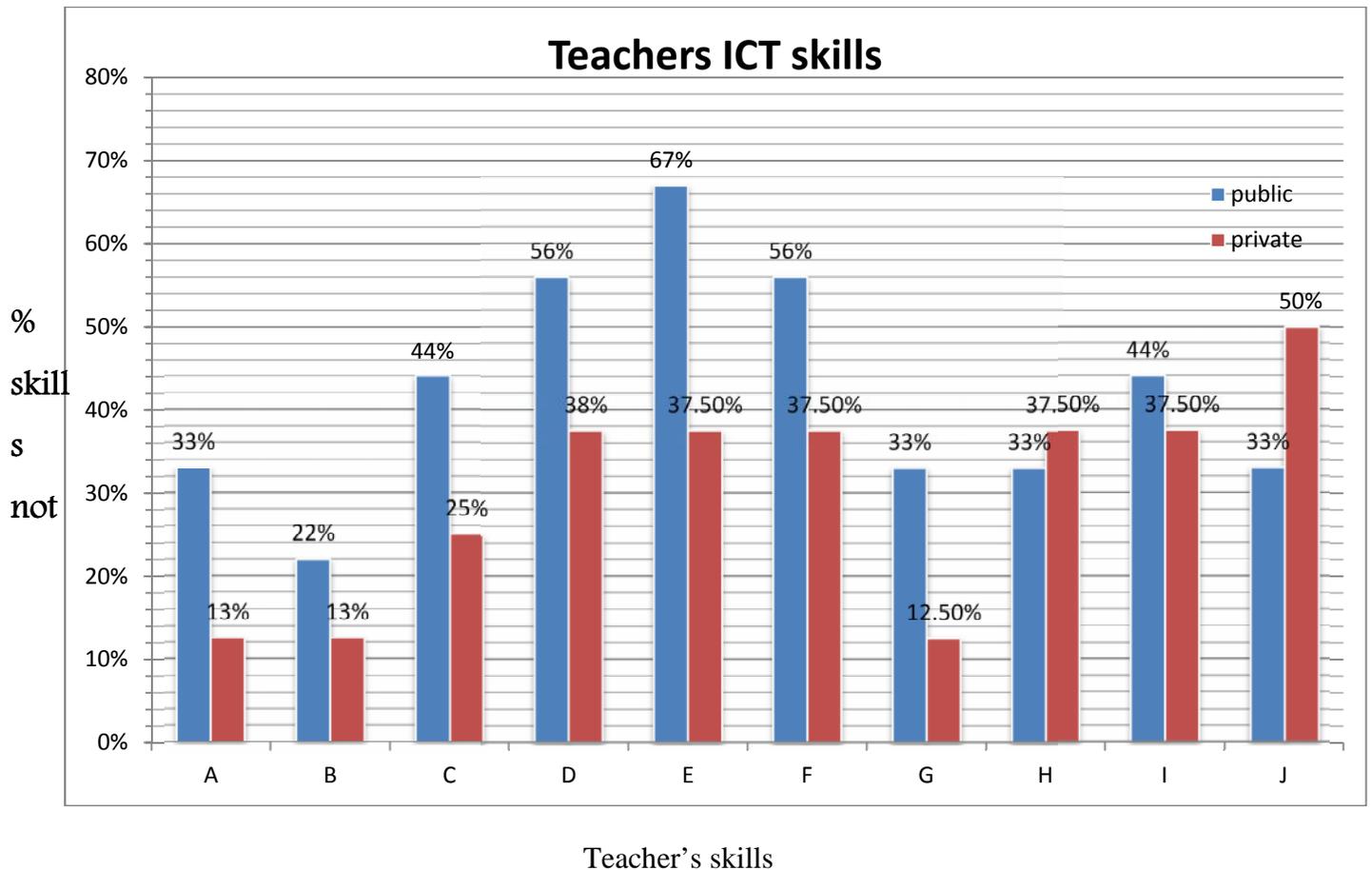
Teacher's skills

Fig2: Bar chart of % teachers' skills in the use of ICT

A= produce a text using a word processing program

B= use E-mail to communicate with others

C= edit text online containing internet links and images

D= create a data base

E= use a spreadsheet to plot a graph

F= create a presentation with simple animation function

G= participate in school work

H= teach student how to behave safely online

I= prepare materials to be used with an interactive white board

J= E-mail a file to someone, teacher or student

Table 4 and figure 2 above revealed that, 63.0% of teacher could produce a test using a word processing programme. 50% of teachers were able to use E-mail to communicate with others. 12.5% could edit a text online containing internet links and images. In creating data base, 37.5%

could do that while 37.5% of students could use a spread sheet to plot graph a lot. 25% could create a presentation with simple animation function and with regards to participation in social network, 50% of teachers were involved. 25% of teachers could teach students how to behave safely online. The Table also showed that 25% of teachers could prepare materials to be used in an interactive board, while 37.5% teacher could email a file to someone, student or teacher.

Table 5: Independent T test of chemistry students' academic performance between public and private schools.

Variable school type	N	X⁻	SD	t-value
Public	30	9.37	3.19	
Private	30	10.50	2.03	1.64
Total	60			

p<0.05; df =58; critical t =2.0

Table 5 showed the X⁻ (mean) performance of public school students to be 9.37 while the private schools had a mean of 10.50. The result showed that private school students had a higher mean.An independent t-calculated value was 1.64, which is less than the tabulated or critical value of 2.00. The result showed that the academic performance of students with 58 degree of freedom at 0.05 significant levels was not statistically significant. Therefore, the null hypothesis was retained.

4.1 DISCUSSION OF FINDINGS

From the questionnaire, the section that investigated access to infrastructure in school by teachers showed that private schools had 75% access on demand to computers that was not connected to internet. Whereas their counterparts in Public school had 30% access to computers without internet connection. Digital camera/camcorder had virtually no access to teachers of both Public and Private schools. A cursory view of Table 1 and 2 showed that access to infrastructure is a serious challenge in Chemistry Education in Calabar. This result is in line with earlier work of Farrell, (2007), Hennessy, (2010) and Agugo, (2010). The situation was not different from the similar findings of Aledejana (2007) who discovered that no school had video-recorder.

Teachers' skills in ICT recorded the highest score for participation in social network as the result showed that 67% of teachers in Public schools were able to participate in social network. Their private counterparts were not left out as 50% of private teachers were able to participate on social network. This cannot be unconnected with the fact that teachers do have cell phones and engage themselves a lot in social network as they relate with each other. Perhaps the frequencies with which these phones are utilized differ because of closed monitoring in private schools than public school teachers. Private school teachers are more keenly supervised with little or no spare time to interact more often than the public school teachers.

Teacher's skills in ICT can be said to be very poor in the use of spread sheet to plot graphs as only 22% of teachers from Public schools could perform the operation. Teachers from private schools could plot graph using a spread sheet. More than the teachers from public schools who devoted more time in interacting in social networks. Generally the results shows clear evidence that private school teachers do not have ICT skills as those from Public schools. This may not be unconnected with the fact that Public schools teachers are more exposed to ICT

training workshops than their counterparts who are in private schools. The proprietor of private schools may not have sufficient funds to sponsor their teachers for workshops on regular basis as public school teacher do.

Analysis from Tables I showed that teachers from Public schools do not have access to the computer by 60%, whereas those in private school do not have access by 25%. Even though the teachers from Public schools have more computer skills than private school teachers, they do not have access to computers in school. In 2012, Cross River State government provided teachers in Public schools with laptops/computers which they could only use at home. The computers were substandard and have since packed up. Even with the short duration of its application, the public school teachers became more exposed to the use of ICT application tools before they went bad.

The null hypothesis seeking to find out if there was a significant difference in the academic achievement of students in Government (public) and private schools was rejected. This was so as calculated t-value of 1.64 was lower than the table value of 2.00 at 0.05 significant levels and at 58 degree of freedom. This result would not be unconnected with the fact that both Public and Private school teachers did not use ICT in the teaching of chemistry. They all have to use the same conventional method of teaching chemistry. From the foregoing, there was no difference in the performance of students in thermochemistry performance test administered to the students from both public and private schools.

5. CONCLUSION

ICT in Calabar municipality schools is in a deplorable state. As seen from the information received the problem is both with the education stalk holders in the provision of ICT infrastructure and the teachers' literacy levels in the use of ICT. Several challenges are responsible for its full actualization. These include poor IT infrastructure, inadequate ICT manpower, epileptic power supply and high cost of ICT facilities among others.

Chemistry teachers in public school had more ICT skills than the teachers in private schools. Private school teachers in turn had opportunity for more access to computer without internet services. There was no significant difference in the academic performance of chemistry student in public and private schools with regard to the use of ICT. This is not unconnected to the fact that ICT is not in use in the classrooms.

The researcher therefore recommended that Government should be more serious with ICT implementation and integration in schools by putting the ICT laboratory into permanent use, regular ICT training for teachers, more computers and laptops to be sent to schools, video camcorders should be provided.

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