UNIJERPS
Unizik Journal of Educational Research and Policy Studies VOL.9;
https://unijerps.org
2021 Impact Factor: 5.641; 2020 Impact Factor: 5.355.
July-December, 2021
Indexing and Impact Factor URL: http://sjifactor.com/passport.php?id=21363

AVAILABILITY, ADEQUACY AND EFFECTIVE UTILIZATION OF ICT RESOURCES BY PRACTICING PRE-SERVICE SCIENCE TEACHERS IN JALINGO METROPOLIS, TARABA STATE, NIGERIA

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ABSTRACT
This study investigated the availability, adequacy and effective utilization of ICT resources by practicing pre-service science teachers in secondary schools in Jalingo metropolis, Taraba State, Nigeria. The study is relevant in this global world to find ways of responding to some challenges in ICT utilization in secondary schools through tertiary institutions that are involved in training teachers. The design of the study was a descriptive survey. Ten secondary schools and 103 teaching practice science teachers was used for the study. Data collected was analyzed using descriptive statistics, Pearson product moment correlation and partial correlation. The results showed that the poor utilization of ICT resources are channelled to low availability and adequacy, of ICT resources in secondary schools in Jalingo Metropolis.The result also indicates that there is a high positive correlation between availability and utilization; and also there is a high positive correlation between adequacy and utilization of ICT resources. This implies that it is not enough to make ICT resources available, but also to make them adequately enough to go round every pre-service teacher for effective utilization. The implication of this study is that the relationship between availability and adequacy has great influence on effective utilization of ICT resources. Therefore, it is recommended amongst others that Taraba State Ministry of Education should perform an audit of school ICT resources to ensure that ICT facilities are available to a good standard across all schools in the State for effective use byscience teachers.

Keywords: Availability, Adequacy, ICT resources, Pre-service science teachers, Effective utilization.

Introduction

The world is becoming global and tertiary institutions that are involved in training of teachers are called to find ways of responding to the challenges in schools. This is more so because easy accessibility to information globally is made possible by devices such as telecommunication, computers and other electronics which are collectively referred to as Information and Communication Technology (ICT). The potential of ICT and its utilization in facilitating students' learning and improving teaching(Amuko, Miheso & Ndeuthi, 2015; Ifeakor, 2018), enhancing institutional administration and restructuring of educational programmes have been established in the literature.

The 6th edition of the National Policy on Education (FRN, 2013), clearly stipulated that all teachers in educational institutions should possess teaching qualification; their programme shall be structured to contain all that is required to ensure effective delivery of their duties; and that the Information Technology (IT) is infused into all teachers' training programme. However, this stipulation is largely not implemented in teacher education institutions in the nation due to some challenges. It is of great necessity to identify challenges associated with the use of ICT and its resources in order to proffer solutions to such problems among pre-service science teachers.

Pre-service science teachers are science education students at undergraduate level who are being equipped and impacted with scientific knowledge, skills and attitude; to practice

teaching in primary or secondary schools before their graduation, in order to confirm/determine their capability for teaching profession. It therefore important that science pre-service teachers are effectively trained and equipped through the use of ICT resources by aiding teachers training institutions to eradicate the constraints that they might encounter in achieving this target. This will enhance the effective utilization of ICT resources to facilitate teaching and learning process in science education, thereby contributing to national development.

The ICT resources are facilities that are made to perform specific tasks, or a set of routines that an application uses to request and carry out lower-level services performed by a computer's operating system. In education (science education inclusive), ICT resources is vital for teachers' education are enormous and can be employed to aid the teaching–learning process particularly in secondary schools. These resources include: on-line facilities such as ICT tutorials and projects, CD-ROM for instructional delivery, internal produced software like video conferencing and digital camera, external produced software like simulations and educational games, desktop publishing, database, spreadsheets, word processors, networking, e-mail, blogs, websites, digital content learning objects like e-books or e-learning and interactive whiteboards, hand-held devices software such as mobile phones and Personal Digital Assistants (PDA) among others.

Efficient use of ICT resources as opined by Jack and Songo (2020) needs a good and conducive climate in secondary school and tertiary science classrooms, and this can be achieved by providing adequate quantities of new technological devices, science teachers ICT training, and appropriate motivational strategies by government. ICT resources contribute consequently to the global trend in Teacher education towards producing a new generation of teachers who can successfully employ digital technologies (ICTs) for delivering educational services successfully. Training teachers in using ICT resources in the classroom appear to have had more success in science than in other subjects.

The introduction and the use of ICT resources in teaching and learning is facing the challenge that hinders the spread of ICT technology in different schools; hence, teaching through ICT becomes ineffective. Like other developing countries, teachers are facing the problem of integrating ICT in classrooms due to lack of ICT competencies, attitude and perceptions towards the use of ICT, limited motivation, and inadequate ICT facilities that could be supplied to all schools (). Investigation of secondary school teachers' knowledge on the use of ICT in the whole process of teaching and learning according to Rashid and Francis (2016) revealed that teachers' knowledge on the use of ICT facilities tended to increase the practice of the use of available ICT resources. According to Amuko et al (2015), effective utilization of ICT resources in secondary schools is also largely dependent upon the availability and accessibility of ICT resources (e.g. hardware, software and communications infrastructure).

However, several research findings from related literatures (Amuko et al. 2015; Blurfon, 2012; Cakir& Onal, 2015; Danner & Pessu, 2013; Dike, 2014; Eid, 2014; Ifeakor, 2018; Itighise & Babayemi, 2018; Nwana, Ofoegbu & Egbe, 2017; Okoli & Osuafor, 2018; Sad & Nalcaci, 2015;Taşpolat, 2016), it is evident that in some schools teachers and students accessibility to ICT is very limited because of the inadequacy of ICT tools and where they are privilege, they spent less time to access internet. The challenges to effective utilization of ICT resources as revealed by Jack and Songo, (2020) can be basically linked to issues of availability and adequacy of ICT resources; with non-availability of indigenous computer packages. The availability and access to ICT resources in Nigerian universities and colleges of education where science

teachers are produced is very low as indicated by several studies (Egomo, Enyi, & Tah, 2012). The aforementioned researchers noted that ICT facilities are mostly used for research and administrative purposes in Nigeria tertiary educational institutions than for teaching and learning. The quantity and range of ICT resources available to the practicing pre-service science teachers and science educators is crucial to effective utilization and integration of ICTs into science classroom in secondary schools.

Also, there still exists teachers' ineffective utilization of ICT resources in the science classroomsas revealed by Jack and Songo, (2020). The findings by Nwagbo and Ugwuanyi,(2015) has indicated the positive effect of ICT resources such as interactive computer learning packages for effective instructional science delivery. According to Amuko et al (2015), school related challenges include to inadequate provided ICT resources such as infrastructural facilities like desktop/laptop, projectors, interactive white board, internet services among others. Also, according to Bello (2017), limited ICT resources such as subject-specific software, computers, multimedia projectors, interactive whiteboard, e-learning facilities, broadband internet access, and so forth are inadequate in teacher education institutions and this inadequacy might results to lack of access by most teacher educators leading to challenges of using ICT resources effectively.

But, there still exists a gap in the present study area, Jalingo, Taraba State, in investigating Science teachers ICT competencies and accessibility, which motivated the study. have indicated incompetence and inadequate knowledge of ICT use as one of the challenges encounter by practicing pre-service teachers. It is based background that this study aims to determine the extent in the availability, adequacy and effective utilization of ICT resources by practicing pre-service science teachers in secondary schools in Jalingo metropolis, Taraba State.

Research questions

The following questions were also raised to guide the study:

1) What are the mean available values of ICT resources in secondary schools in Jalingo Metropolis, in Taraba State?
2) What are the mean adequate values of ICT resources in secondary schools in Jalingo metropolis?
3) What are the mean utilization values of ICT resources by pre-service science teachers in secondary schools in Jalingo metropolis?
4) What is the relationship between the availability and adequacy of ICT resources in secondary schools in Jalingo metropolis?
5) What is the relationship between the availability and utilization of ICT resources by pre-service science teachers in secondary schools in Jalingo Metropolis, Taraba State?

Research Method

The research design used for this study is a descriptive survey, since it used survey (in this case questionnaire) for data collection or to gather data about varying subjects. This data aims to know the extent to which availability and adequacy of ICT resources influences pre-service science teachers' utilization in science classrooms. The population of the study comprised all the practicing pre-service science teachers in all the secondary schools in 2019/2020 academic session offering the basic science-subjects in Jalingo metropolis, Taraba State, Nigeria. Ten secondary schools were purposively selected and a sample size of 103 pre-service science teachers were used as sample. In order to avoid bias, only schools with science teachers and also offers the basic science subjects are considered fit for the study with pre-service science teachers undergoing teaching practice.

The instrument used for collecting data was a 4-points Likert scale questionnaire titled; Pre-service Teachers'

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Effective Utilization of ICT resources. The questionnaire was adopted and categorized into three sections (10 items per section) titled: Section A- Availability of ICT Resources, Section B- Adequacy of ICT Resources, and Section C- Utilization of ICT Resources. The 4-Likert points scale response was Strongly agree, Agree, Strongly disagree and Disagree with numerical values of 4, 3, 2 and 1 respectively; and average mean of 2.5. The Level of Availability and Utilization of Means equal to or greater than 3.00 (≥3.00) are high, means between 2.99-2.50 are moderate, while means equal to or less than 2.49 (≤2.49) are low or lesser than 2.5 test-value.

In testing the questionnaires validity, a content and face validity was done by experts (arbitrators) in the field of science education outside this study after it was scrutinized and corrected to see how well the different items in a single dimension combine to measure the same thing. To establish the validity of the instrument, the questionnaire was subjected to face and content validation by three experts in Science Education. They made corrections regarding the relevance of the items as well as clarity and comprehensiveness. Their suggestions and corrections were used to modify the instrument.

In testing the reliability of the instrument, Alpha (Cronbach) coefficients were calculated for the components of each measurement scale to verify internal consistency. The internal consistency estimates for every component of each dimension (section) with reliability indexes of 0.81, 0.72 and 0.75 respectively; which were considered reliable and good for the study.

The responses to the items of instruments were analyzed through the use of SPSS 16.0 version; where mean, sum and standard deviation were used in order to answer research questions 1, 2 and 3; Pearson product moment correlation coefficient to answer research question 4 and 5; and Partial correlation, at 0.05 level of significancec.

Presentation of Results

***Research Question One*:** What are the mean available values of ICT resources in secondary schools in Jalingo Metropolis, in Taraba State?

Table 1: Descriptive Statistics Responses to Availability of ICT Resources

S/N	Statement of Item	N	Mean	SD	Level
1	Electronic book (e-book) are available for me to use in teaching practice	103	1.46	0.51	Low
2	Personal Digital Assistant (PDA) or mobile phone is available for classroom use.	103	1.31	0.47	Low
3	The school I teach has its website available to enhance science teaching and learning.	103	1.56	0.50	Low
4	There is availability of on-line ICT services through Local Area Network or Wide Area	103	1.53	0.51	Low
5	The school I teach has blog platform to promote teaching and learning.	103	1.25	0.44	Low
6	The school I teach has database platform for students' bio-data, records of results, exam questions, staff records, visitors' log, and punishment records.	103	1.63	0.49	Low
7	Spreadsheet (e.g. Ms. excel), word processor (e.g. Ms. word), simulations, educational games are made available on school computers; for preparing students' result, to make lesson plans or notes, to aid teaching and learning.	103	1.65	0.48	Low
8	The school also make available a functioning projector and interactive whiteboard for classroom use	103	1.34	0.48	Low
9	I have access to e-mail or on-line chatting to support teaching and learning	103	1.28	0.46	Low
10	I have access to at least a CD-ROM or flash disk for storing information about students and instructional materials.	103	1.94	0.50	Low
	Overall Mean		1.50		Low

The analysis in Table 1 shows that mean responses to all the 10 items (means between 1.25-1.65) are low according to the means scores classification used for this study (less than 2.5 test-value) from a 4-points Likert scale. This indicates that the availability of ICT resources is low

having overall mean response of 1.50; which equally shows that low availability of ICT resources contributes negatively to effective utilization of ICT resources in secondary schools. The findings therefore revealed that the mean available values of ICT resources in secondary schools in Jalingo Metropolis, in Taraba State is low.

***Research Question Two*:** What are the mean adequate values of ICT resources in secondary schools in Jalingo Metropolis, in Taraba State?

Table 2: Descriptive Statistics Responses to Adequacy of ICT Resources

S/N	Statement of Item	N	Mean	SD	Level
11	Application software such as ms. excel, ms. Word ms. Power point e.t.c. per desktop or laptop.	103	1.69	0.47	Low
12	On-line ICT services such as LAN or WANe.t.c. at least one of them.	103	1.25	0.44	Low
13	School/Science club blog spots (at least one of it).	103	1.22	0.42	Low
14	School website and e-mail addresses (World Wide Web), at least one each.	103	1.53	0.51	Low
15	E-mail or E-learning (at least 10 books per subject).	103	1.34	0.48	Low
16	Computer desktops or laptops per teacher.	103	1.28	0.46	Low
17	Internet services, such as e-mail, chatting, Skype call etc. per computer system.	103	1.19	0.40	Low
18	Projector and interactive white board per Classroom.	103	1.25	0.44	Low
19	School or departmental database (at least one of it).	103	1.31	0.47	Low
20	Flash disk or CD-ROM(at least one per teacher).	103	1.34	0.48	Low
	Overall Mean		1.34		Low

From the Table 2, the analysis shows that mean responses to all 10 items (means between 1.22-1.69) are low according to the means scores classification used for this study (lesser than 2.5 test-value) from a 4-points Likert scale. This indicates that the adequacy of ICT resources is very low having overall mean response of 1.34; which equally shows that low adequacy of ICT resources contributes negatively to effective utilization of ICT resources in secondary schools since teachers rarely have access to the ICT tools.The findings therefore revealed that the mean adequate values of ICT resources in secondary schools in Jalingo Metropolis, in Taraba State is low

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***Research Question Three*:** What are the level mean utilization values of ICT resources by pre-service science teachers in secondary schools in Jalingo Metropolis, in Taraba State?

Table 4: Descriptive Statistics Responses to Utilization of ICT Resources

S/N	Statement of Item	N	Mean	SD	Level
21	I go on-line for students' tutorials, mailing and others	103	2.38	0.49	Low

22	I can switch on the computer and switch it off after use.	103	2.78	0.42	Moderate
23	I use (engage in) telex-conferencing to support students' collaboration	103	1.21	0.42	Low
24	I enter data that concerns me on school database and use such data if needed.	103	2.33	0.51	Low
25	I usually use projector and interactive whiteboard for classroom teaching and learning.	103	1.19	0.40	Low
26	I frequently engage myself with e-learning and e-books to aid teaching and learning process.	103	2.40	0.50	Low
27	I use spreadsheet and word processing software to prepare students' results and my lesson notes respectively.	103	1.25	0.44	Low
28	I use power-point to present or deliver my lessons in the classroom.	103	1.18	0.40	Low
29	I use my e-mail to give class instructions to students and also reply them on-time through their e-mail addresses.	103	1.09	0.22	Low
30	I make use of flash disk or CD-ROM to keep students' records, and for other instructional purposes.	103	1.38	0.49	Low
	Overall Mean		1.62		Low

From the Table 3, the analysis shows that mean responses to almost all items (items- 21, 23,24, 25, 26, 27, 28, 29 & 30) are below 2.5 average value except for (items-22, M=2.78) that is above average value. The overall Mean response is 1.62 showing low utilization level according to the means scores classification used for this study (lesser than 2.5 test-value) from a 4-points Likert scale. Therefore, the mean utilization values of ICT resources in secondary schools in Jalingo Metropolis, in Taraba State is low. This indicates that the utilization of ICT resources is low, and very poor having which equally shows that poor availability and adequacy or accessibility of ICT resources contributes negatively to effective utilization of ICT resources in secondary schools.

***Research Question Four*:** What is the relationship between the availability and adequacy of ICT resources in secondary schools in Jalingo Metropolis, Taraba State?

Table 4: Correlation Statistics of the availability and adequacy of ICT resources

		Availability of ICT Resources	Utilization of ICT Resources
Availability of ICT Resources	Pearson Correlation	1	.805
	Sig. (2-tailed)	.000	103
	N	103	1
Utilization of ICT Resources	Pearson Correlation	.805	.000
	Sig. (2-tailed)		
	N	103	103

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

From the Table 4, the result shows that the correlation between availability and utilization of ICT resources is r=.805 significant at p=.000 (2-tailed); at 0.05 level of significance. This shows that there is a high positive relationship between availability and utilization of ICT resources among practicing pre-service science teachers.Therefore, this revealed that there is a significant positive relationship between availability and utilization of ICT resources in secondary schools in Jalingo Metropolis, Taraba State.

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***Research Question Five*:** What is the relationship between the availability and utilization of ICT resources by pre-service science teachers in secondary schools in Jalingo Metropolis, Taraba State?

Table 5: Correlation Statistics of the availability and utilization of ICT resources

		Adequacyof ICT Resources	Utilization of ICTResources
Adequacy of ICT Resources	Pearson Correlation	1	.845
	Sig. (2-tailed)	.000	103
	N	103	1
Utilization of ICT Resources	Pearson Correlation	.845	.000
	Sig. (2-tailed)		
	N	103	103

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

From the Table 5, the result shows that the correlation betweenadequacy and utilization of ICT resources is r=.845 significant at p=.000 (2-tailed); at 0.05 level of significance. This shows that there is a high positive relationship between adequacy and utilization of ICT resources among practicing pre-service science teachers.Therefore, this result revealed that there is a significant positive relationship between availability and utilization of ICT resources in secondary schools in Jalingo Metropolis, Taraba State.

Based on the data analyzed and results presented, the findings from the study can be summarized as follows:

i. There is low availability of ICT resources which contributes negatively to effective utilization of ICT resources in secondary school;.
ii. There is low adequacy of ICT resources which contributes negatively to effective utilization of ICT resources in secondary schools;
iii. There is poor utilization of ICT resources by practicing secondary schools pre-service science teachers;
iv. There is a high positive relationship between availability and utilization of ICT resources among practicing pre-service science teachers; and
v. There is a high positive relationship between adequacy and utilization of ICT resources among practising pre-service science teachers.

Discussion of findings

The data analyzed on Table 1 showed that low percentage or few number of ICT resources are available to practicing pre-service science teachers in secondary schools in Jalingo metropolis, Taraba State. These teachers rarely have access to ICT resources to improve teaching and facilitate learning due to non-availability of indigenous computer packages; which are also categorized under ICT resources. The result indicates that the availability of ICT resources is low having overall mean response of 1.50; which equally shows that low availability of ICT resources contributes negatively to effective utilization of ICT resources in secondary schools. This finding agrees with previous researchers (Bello, 2017; Ifeakor,2018; Imogie, 2018; Itighise& Babayemi, 2018, Nwana et al.2017; Okoli& Osuafor, 2018; Onyegegbu,2016; Osadolar,2018). This also agrees with the fact that the availability and access to ICT resources in Nigerian universities and colleges of education where science teachers are produced is very low as indicated by Egomo et al(2012). Even with a considerable availability of some resources like database, spreadsheet and word processing software, simulations and educational games; the teachers may not still be given access to them for one reason or the other.

Table 2 data analysis indicates that majority of practicing pre-service science teachers disagree with the adequacy of

ICT resources having low overall mean response of 1.34. This limited ICT resources by implication contributes negatively to effective utilization of ICT resources in secondary schools. According to Bello, (2017), limited ICT resources such as subject-specific software, computers, multimedia projectors, interactive whiteboard, e-learning facilities, broadband internet access, and so forth are inadequate in teacher education institutions and this inadequacy might results to lack of access by most teacher educators. Despite a considerable adequacy of application software like ms.word, ms.excel, ms. Power-point per computer system; the adequacy of computer system per teacher is low. The worst of all are low adequacy of blog platform, projectors and interactive white board, and internet services (e-mail, chatting etc.) with LAN or WAN. This agrees with Jack and Songo (2020), school related challenges include to inadequate provided ICT resources such as infrastructural facilities like desktop/laptop, projectors, interactive white board, internet services among others.

From Table 3, the result shows that mean responses to almost all items are below 2.5 average value except for (item-22, M=2.78: I can switch on the computer and switch it off after use) that is above average value. This indicates that the utilization of ICT resources is very poor having overall mean response of 1.62; which equally shows that poor use of ICT resources contributes negatively to effective utilization of ICT resources teaching-learning process in secondary schools. These data show that many teachers were able to open and shut down the computer but could not use the computer applications effectively. And the worse of all is the poor use of e-mail to give instructions to students and replying mail on time. 'However, the poor use of ICT resources may probably be as a result of low availability and adequacy of these facilities; and this is similar to the opinion of Amuko et al. (2015), effective utilization of ICT resources in secondary schools is also largely dependent upon the availability and adequacy/accessibility of ICT resources (e.g. hardware, software and communications infrastructure).

From Table 4, the result shows that the correlation between availability and utilization of ICT resources is r=.805, p=.000; meaning there is a high positive relationship which is significant between availability and utilization of ICT resources among practising pre-service science teachers. This implies that it is not enough to make ICT resources available in schools but making it accessible to every science teacher use during lessons in order to promote effective teaching and learning.

From Table 5, the result shows that the correlation betweenadequacy and utilization of ICT resources is r=.845 significant at p=.000 (2-tailed); at 0.05 level of significance. This shows that there is a high positive relationship between adequacy and utilization of ICT resources among practicing pre-service science teachers.Therefore, this result revealed that there is a significant positive relationship between availability and utilization of ICT resources in secondary schools in Jalingo Metropolis, Taraba State. This implies that there is a significant influence on the strength of the relationship between availability, adequacy and effective utilization of ICT resources. This findings supports previous studies by and Nwana et al (2017); and Okoli and Osuafor, (2018).This by implication explains that if ICT resources are adequately available to practicing pre-service science teachers, the ineffective use of ICT resources will be greatly minimized. Also, the problems of integrating ICT in classrooms due to lack of ICT competencies, negative attitudee and limited motivation, and perceptions towards the use of ICT resources.

Conclusion

The major findings of the study suggest the following conclusions:

There are few number of ICT resources that are available to practicing

pre-service science teachers in secondary schools in Jalingo metropolis, Taraba State. These teachers rarely have access to these ICT resources to improve teaching and facilitate learning.The low availability and adequacy of ICT resources therefore contributed negatively to effective utilization of ICT resources in secondary schools.

The study also concludes that there is a high positive relationship between availability and utilization of ICT resources; and also a high positive relationship between adequacy and utilization of ICT resources among practising pre-service science teachers. The effective utilization of ICT resources by pre-service science teachers in secondary schools is also largely dependent upon the availability and adequacy of ICT resources.

Recommendations

Based on the conclusion drawn, the following recommendations are made:

1. Taraba State Government should perform an audit of school ICT resources to ensure that ICT facilities are available to a good standard across all schools in the State. Thereafter, financial support should be targeted to those secondary schools needing it most.
2. The lecturers that are involved in training teachers should develop and make use of ICT resources for teaching various concepts in science and give science students the opportunity to learn through these resources
3. The use of ICT resources for teaching and learning should be made compulsory in all secondary and tertiary institutions; therefore there is need for more specialist advice and support for teachers in using ICT in teaching and learning.
4. Teachers should be subjected to an audit test of ICT knowledge or delivering ICT on entry, with a gap analysis used to develop a national programme of training to sufficiently deal with the weakest areas of poor ICT usage.

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