

**ENHANCING QUALITY STEM EDUCATION THROUGH THE ACQUISITION & UTILIZATION OF INFORMATION COMMUNICATION TECHNOLOGY FACILITIES IN KOGI STATE.**

**By**

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**Abstract**

*This paper investigated how to enhance quality Science Technology Engineering and Mathematics Education through the acquisition and utilization of ICT facilities in Kogi State. Two research questions and two hypotheses guided the study and descriptive survey design was adopted. The estimated population was 1038 teachers out of which a sample size of 148 was obtained using Multistage sampling technique. A researcher designed questionnaire tagged Acquisition and Utilization of ICT facilities in STEM (AUICTSTEM), validated by 3 experts in science education was used for data collection. Coefficient of stability of the instrument was determined using Pearson product moment formula to be 0.84. Mean, standard deviation and z-test was used to analyze the data. The findings of the study revealed that there is no significant difference in the mean rating of teachers' extent of acquisition and utilization of ICT facilities for enhancement of quality STEM delivery in Kogi State. Based on the findings of the study, it was recommended that government and other stakeholders on education should organize training and periodic needs assessment to determine the level of acquisition and utilization of technological facilities for STEM quality teaching and learning.*

**Keywords:** quality, STEM Education, acquisition, utilization, facilities

**Introduction**

It is axiomatic that no educational system can rise above the quality of the teachers. Education is the most reliable instrument for the development of any nation. Education is a vital key to the development of both human and natural resources of any nation (Yinka, 2011). Quality education is that which is relevant to the vast and fast changing needs of the society especially in this 21<sup>st</sup> century. Some of These needs according to Yinka (2011) are the need for language communication in a complex and with revolutionary advances in food production and processing, Shelter and environmental safety, arms and armament, housing, medicine, industry, Clothing, Transportation, commerce and computerization. In order to meet the needs of the society in this 21<sup>st</sup> century, there is the need for quality STEM education through the acquisition and utilization of ICT facilities

In this 21<sup>st</sup> century, ICT facilities had great impact on all aspects of the society. Virtually there is no area of life either at home and in work place where this ICT has not made impact. It has expanded the understanding of the world at large. It allows people in all areas of life to benefit from the powers of computer, as personal tools to collaborate in groups and to communicate locally and globally. In education generally and STEM education in particular the potentials of ICT is used to augment and enhance conventional educational system or provide alternative choice of learning procedure to learners. Also, it is used to introduce new ICT based educational systems such as computer based distance learning, online learning, e-learning & virtual learning. ICT is thus introduced either to improve current teaching approach or to introduce new teaching techniques.

The importance of ICT in enhancing the quality of STEM education cannot be over emphasized because it is one of the most powerful learning tools available, that can support communication networks and also provide the learners with fast and researchable access to a vast amount of information. STEME means Science Technology Engineering and Mathematics Education. It is the act of teaching science, technology, engineering and mathematics education to young scientist (learners). ICT supports independent learning like the national open university of Nigeria and other distance learning programmes. Quality STEM education benefit the individual and the society in a number of ways, for instance the knowledge of STEM education assists in providing solutions and offer contributions to problems such as human over population, food production, pollution, disease and pandemic, insecurity to lives and property, global warming and human genetics.

However, the types of teaching that has persisted in STEM over the years, is mainly the memorization of facts handed down by the teacher. This type of teaching is contrary to modern way of teaching science. Novak (2012) reported that teaching science and particularly physics, chemistry, mathematics and engineering disciplines have become abstract and of little use to children of developing countries like ours. Of all the factors that could be responsible for the situation described above the teacher and his skills and method of teaching are the major factors (Abuh, 2021).

However a number of innovative approaches to STEM teaching in some schools and the curriculum have been revised to give quality STEM education to students. The application of computer, internet to STEM instruction is worthwhile at this time of knowledge explosion. No doubt, the exploration of ICT may likely facilitate the learning of STEM and bring it to the real life experience of student. Omale (2018) is of the view that the use of conceptualized information technology facilities in STEM teaching and learning will likely improve understanding and elaboration of scientific concepts and processes. At secondary level of education, teachers either male or female are known to embark on the task of providing and enhancing functional learning for students. Teachers are managers of learning process who are groomed in specialized areas, highly organized, self-motivated, possess brilliant interpersonal skills, possess excellent strategic thinking ability, ready to take challenges, demonstrate the desire to learn, develop, and importantly be computer literates and technology compliance. (Amony, 2021). Technology is the branch of scientific or engineering knowledge that deals

with the creation and practical use of digital or computerized devices, methods, systems among others. It is referred to as systems hardware and processes that use digital or signals to achieve a particular set of user -defined results (Wikipedia, 2020). Technologies are electronic tools, systems, device and resources facilities that generate store or process information (United Nations, 2020). It is the utilization of digital electronics knowledge from information technology that enhances quality education (Wikipedia, 2021)

The researcher defined ICT facilities as those electronic devices or tools that aid the reception and transfer of information as well as knowledge and skills from one person to another and from one location to another in the learning environment. ICT facilities are significant facilitators in educational system in this era that is characterized by globalization and competitiveness. Development in computers , tablets, information and communication gadgets, among others are making learning easier by merging efforts of teachers as well as learning resources (wikipedia2021). In fulfilling their required obligation as regards teaching and learning, the male and female as professionals need to acquire, possess and update their knowledge both intellectually and technically in consonants with the advances in information and communication technological facilities to enhance acquisition and transfer of knowledge as well as enhancement of teaching and learning process in the school. The ICT facilities include computer, internet connectivity, multimedia projector, digital camera, school phones/ smart phones, photo copying machines, scanners/ scanning machines, broad casting technologies, ( radio and television ) there is increasing interest in how computer and internet can improve education at all levels in both formal and informal settings. The use of ICT in teaching and learning has no doubt increased students' creativity and participation in the learning process.

The use of ICT has been identified as a major tool for in provide quality teaching and learning (Major, 2013). These ICT facilitate according to mayor, use for improve quality teaching and learning of stem education include computer the internet, compact disk, digital radio, projector, multi-media, video- conferencing facilities etc. The use of these facilities by teachers enhances flexibility and quality of teaching, virtually and interdisciplinary interaction among others (Oguche, 2015). In the view of Gusen (2019), the acquisition and utilization of ICT facilities depend on some factors like adequate funding, provision, vision of users of ICT, formulation of ICT, policy and provision of electricity. In the same vein, and Ochai (2012) note that ICT has not been fully utilized by teachers and students in most secondary school due to challenges ranging from Erratic power supply, high cost of ICT facilitate and inadequate security in stem education teaching and learning similarly study by Omade (2021) found that ICT facilitate were net utilized by teaching and learning because of inadequate power supply and high cost of ICT facilities. These press great challenge to quality teaching and learning of STEM education. Hence the need to carry out the study to investigate how to enhance quality stem education in the 21<sup>st</sup> century through the acquisition and utilization of information and communication technology facilities.

## **Statement of the Problem**

The advent of information technology is said to facilitate the rapid increase in the equality of education, production and dissemination of information, ideas, etc across the globe, through the internet and satellite which are transmitted within seconds across the world. Information communication technology is believed to be one of the key drivers to the increase in the quality of education in Nigeria and all over the world. Information and communication technology [I C T] facilities can enhance and compliment learning and teaching in every curriculum area when properly utilized. Some of the variety of information and communication facilities for teaching STEM as stated by Gado (2017) includes the computer, internet, worldwide web [www], electronic mail, digital calculator, audio tape, digital camera etc. Hence, the teachers of STEM education can use I CT facilities to promote, facilitate and improve learning in various classrooms. Despite the above benefits of ICT in enhancing quality STEM education in the 21<sup>st</sup> century, teacher's acquisition and utilization of I CT for effective teaching and learning of STEM is still under attack due to challenges surrounding its operation. It is one thing to have I CT facilities available and another thing is to utilize it.

Unfortunately, the secondary education system has not leverage appropriately on information and communication technology to maximize the benefits of technology education. Also it seems that information and communication technological facilities are either lacking or grossly inadequate in public secondary schools in the state. It is observed that some of these technological facilities have not been utilized to aid learning process. It is against this backdrop that the paper sought on how to enhance equality STEM education in the 21<sup>st</sup> century through the acquisition and utilization of I C T facilities in Kogi East education zone of Kogi state.

## **Purpose of the Study**

The purpose of the study is to investigate the acquisition and utilization of available information and communication technological facilities to enhance quality STEM education in the 21<sup>st</sup> century. Specifically the study determines:

1. The extent of acquisition of information and communication technological facilities for the enhancement of quality STEM education in senior secondary school in Kogi state
2. The extent teachers utilize information and communication technological facilities in teaching learning process In senior secondary school in Kogi state

## **Research Questions**

1. What is the extent of acquisition of information and communication technological facilities for enhancement of quality STEM education in SSS in Kogi state?
2. What is the extent of utilization of information communication technological facilities in teaching & learning of STEM education in SSS in Kogi state?

## **Research Hypotheses**

The following null hypotheses guided the study:

1. There is no significant difference in the mean ratings of male and female teachers on acquisition of ICT for enhancing quality STEM education in SSS Kogi state
2. There is no significant difference in the ratings of male and female teachers on the extent of utilization of ICT facilities in enhancing quality STEM education in SSS Kogi State

### **Methodology**

The study adopted descriptive survey design. The population of the study consisted of 1038 teachers in the 32 public secondary schools in Kogi East education zone of Kogi state. Multistage sampling technique was used to sample 148 teachers as the sample size. Simple random sampling techniques was used to sample three local Government areas out of nine Local Government Areas in the Zone. Ten (10) senior secondary schools out of the existing 32 secondary schools in the zone were sampled using purposive sampling technique since gender was a moderating factor in the study. Instrument tagged acquisition and utilization of ICT facilities to enhance STEM education (AUICTFSTEM) was used for data collection. The Instrument has two parts [A &B], part A. sought information on demography of the respondents while part B was on the issue of the study. The questionnaire contained 25 items. The response format for extent is very high extent =4, high extent = 3, moderate extent =2, low extent = 1.

The face and content validation of the instrument was established by an expert in measurement and evaluation and two experts in the department of science education Prince Abubakar Audu University, Anyigba, their comments and corrections were effected in the final draft of the instrument. The coefficient of stability of the instrument was determined using Cronbach alpha formula. The reliability index was found to be 0.84. The questionnaire was designed by the researcher in form of a check list showing the extent of acquisition and utilization of ICT for effective teaching & learning for the enhancement of quality STEM education. The researcher with the help of a trained research assistant administered 150 questionnaires out of which 148 were completely filled and returned. Data collected were analyzed using mean and standard deviation for research questions and Z-test was used to test the hypotheses at 0.05 level of significant.

### **Results.**

The results were presented based on the research questions and hypotheses that guided the study.

**Research question one:** What is the extent of acquisition of ICT facilities for enhancement of quality STEM education in SSS Kogi State?

**Table 1**

*Mean Ratings and Standard Deviation Scores of Male and Female Teachers on Acquisition of ICT Facilities in Teaching and Learning Process*

S/N	Items	Male Teachers n=70			Female Teachers n=78		
		Mean	S-deviation	Decision	Mean	S-deviation	Decision
1	Computer/Desktop	2.72	0.91	High extent	2.71	0.90	High extent
2	Internet Connectivity	2.40	1.10	Low extent	2.37	1.06	Low extent
3	Multimedia projector	2.25	1.14	Low extent	2.20	1.11	Low extent
4	Smart electronic board	2.21	1.07	Low extent	2.15	1.04	Low extent
5	School telephone /smart phone	2.54	0.94		2.51	0.95	High extent
6.	Educational software and e-learning	2.20	1.16	Low extent	2.21	1.21	Low extent
7	Photo copying machine	2.60	0.97	High extent	2.61	0.97	High extent
8	Audio visual aids	2.28	1.20	Low extent	2.29	1.20	Low extent
9	Digital camera	2.24	1.20	Low extent	2.25	1.27	Low extent
10	Video devices	2.54	1.10	High extent	2.55	1.10	High extent
11	Power point generation	2.25	1.14	Low extent	2.30	1.12	Low extent
12	Scanner	2.52	0.98	High extent	2.33	1.18	Low extent
13	Computer Room	2.60	0.96	High extent	2.51	1.141	High extent
14	Printers	2.521	1.00	High extent	2.541	1.15	High extent
	Cluster Mean	2.431	1.07	Low extent	2.40	1.12	Low extent

The result of data analysis on Table 1: showed that mean of scores of male and female teachers for items 1, 5, 7, 10, 12, 13 and 14 are higher than the benchmark mean value of 2.50 and this indicated that they was high extent of acquisition of those ICT facilities. The male and female teachers mean rating for items 2,3,4,6 8,9 and 11 are below the cut off mean score of

2.50 indicating low extent of acquisition of those ICT facilities. Cluster mean for male and female teachers is 2.43 and 2.40 respectively which are below criterion mean value of 2.50. This indicated that there was low extent of acquisition of ICT facilities for enhancing quality STEM education in public secondary school in Kogi state.

**Research question Two:** what is the extent of utilization of ICT facilities in teaching and learning of STEM education in SSS Kogi State?

**Table 2**

*Mean Rating and Standard Deviation Scores of Male and Female Teachers on Utilization of ICT Facilities in Teaching and Learning of STEM Education*

S/N	Items	Male Teachers n=70			Female Teachers n=78		
		Mean	S-deviation	Decision	Mean	S-deviation	Decision
1	Utilization of laptop computer	2.6	11.02	High extent	2.70	0.95	High extent
2	Use of internet to obtain instructional resources	2.52	1.13	High extent	2.54	1.12	High extent
3	Utilization of computer room for practical	2.60	1.01	High extent	2.61	1.09	High extent
4	Uses of educational software in teaching	2.31	1.14	Low extent	2.21	1.71	Low extent
5	Use of scanners to duplicate instructional materials	2.52	1.13	High extent	2.54	1.12	High extent
6.	Use of audio visual or voice projector	2.30	1.60	Low extent	2.31	1.58	Low extent
7	Use of printers in printing instructional materials	2.54	1.12	High extent	2.60	1.10	High extent
8	Use of electronic white board in lesson delivery	2.35	1.15	Low extent	2.38	1.13	Low extent
9	Use of smart phone in sourcing teaching materials	2.53	1.05	High extent	2.61	1.09	High extent

10	Use of projector for power point lesson Delivery	2.34	1.16	Low extent	2.40	1.14	Low extent
11	Using digital camera to monitor class room activities	2.40	1.09	Low extent	2.42	1.10	Low extent
	Cluster Mean	2.43	1.17	Low extent	2.46	1.20	Low extent

Table 2 shows that the mean scores of male and female response for item 15, 16, 17, 21 and 23 are higher than the criterion mean value of 2.50 and this indicate there was a high extent of utilization of available ICT facilities as regards the items. Also the male and female mean rating for items 18,19,20,22,24 and 25 are below the cut off mean score of 2.50 indicating low extent of utilization of available ICT facilities as regard the items. The overall standard deviation scores of male and female response stood at 1.17 and 1.20 respectively are closer, indicating similarity in their response. The male and female had cluster means of 2.43 and 2.46 which are below the benchmark of 2.50, showing that there were low extent of teachers utilization of the available ICT facilities for the enhancement of quality system education in Kogi East education zone of Kogi state. The over standard deviation scores of male and female response stood at 1.17 and 1.20 respectively are closer, indicting similarities in their responses in each cluster.

**Research Question One:** There is no significant difference in the mean ratings of male and female teachers on acquisition of ICT facilities for enhancing quality system education in SSS Kogi State?

**Table 3**

*The Z-Test Summary of Male and Female Teachers Mean Rating of Acquisition of ICT Facilities for Enhancing Quality Stem Education in Kogi State*

Respondent Remark	N	$\bar{X}$	SD	Z-cal	Z-Crit	DF	Sig	
Male teachers	70	2.46	1.05	0.07	1.96	147	0.05	Not Significant
Female Teachers	78	2.45	1.08					

Table 3 shows that the Z-calculated Value of 0.07 is less than Z- critical value of 1.96 at 0.05 level of significance and 147degree of freedom. This implies that the null hypothesis is not significant. Therefore, there is no significant difference in the mean rating of male and



female teachers on the acquisition of ICT facilities for enhancing quality STEM education in Kogi East Education zone of Kogi State.

**Hypothesis Two:** There is no significant difference in the mean ratings of male and female teachers on the extent of utilization of ICT facilities in enhancing quality STEM education in Kogi east education zone of Kogi state.

**Table 4**

*The Z-Test Summary of Male and Female Teachers mean Rating on the Extent of Utilizations of ICT Facilities in Enhancing Quality STEM Education*

Respondent Remark	N	$\bar{X}$	SD	Z-cal	Z-Crit	DF	Sig	
Male teachers	70	2.57	1.01	0.26	1.96	147	0.05	Not Significant
Female Teachers	78	2.60	1.08					

In table 4, the Z- calculated value of 0.26 is less than z-critical value of 1. 96 at 0.05 level of significance and 147 degree of freedom. Thus, the null hypothesis is not significant. Therefore, there is no significant difference in the mean ratings of male and female teachers on the extent of utilization of available ICT facilities in enhancing quality system education in Kogi East education zone of Kogi State.

### **Discussion**

The results of the analysis of data shows homogeneity in the responses of the male and female teachers and low extent on the acquisition of ICT facilities such as laptop computers /computers, internet connectivity, printers among others for enhancing quality stem education in the public secondary in Kogi State. In the view of Gusen (2019), the acquisition of ICT facilities depend on some factors like adequate funding, provision of adequate security, constant supervision of users of ICT, formulation of ICT policy, provision of electricity and the high cost of ICT facilities. This finding is in agreement with the findings of Nwachukwu (2017) that –there was inadequate computer gadget for quality teaching of stem courses.

Similarly, Omiunu (2014) indicated that public schools lack most of the computer facilities for enhancing quality teaching and learning of STEM disciplines. From the above, it is obvious that lack of computers and other technological facilities are evidently inadequate for enhancing quality STEM education in the public secondary schools in different parts of the state under consideration. Also the findings further revealed that there was low extent of utilization of the available technological facilities that could enhance quality stem education delivery. This means that teacher rarely utilize or use available ICT Facilities for teaching and learning of stem subject in secondary schools. This is contrary to the finding of Omiunu (2014) who found out that the computer was used for typing. This implies that, even though the ICT

facilities maybe available, teachers' low extent of utilization may affect the quality of STEM education negatively.

The low extent of utilization could be as a result of lack of instructional media / Technological facilities in the schools which give low extent of their utilization in the teaching and learning of STEM courses. Ochai (2012) noted that ICT has not been fully utilize by teachers and student alike in most secondary schools in STM education teaching and learning due to challenges ranging from erratic power supply, high cost of ICT facilities and inadequate security. Similarly, study by Omade (2021) found that ICT facilities were not utilize by teachers in the teaching and learning because of inadequate power supply and high cost of ICT facilities.

### **Conclusion**

The findings have shown that ICT facilities are very crucial in education and STEM education in particular. They enhanced quality delivery of instruction in secondary schools which makes them essential part of teaching and learning Despite the role of ICT facilities in enhancing quality STEM education, the study revealed that the extent of acquisition in still low. Consequently, the extent of utilization of availability ICT facilities has militated the achievement of objectives of secondary schools. The researcher is therefore making a clarion call for synergy between government and educational stakeholders in providing ICT facilities. Also servicing teachers should be trained on how to use these facilities in teaching and learning process in secondary schools for the enhancement of quality science instructional delivery in this 21<sup>st</sup> century.

### **Recommendations**

1. Stakeholders should organize periodical refreshers programme on the current trend on the utilization of ICT facilities and applications for secondary school teachers to keep the up to date in the dynamic field of ICT.
2. Stakeholders and privileged individuals in the society should provide current ICT facilities and internet access thereby enabling teachers prove on the quality of the output that can enhance quality stem education
3. Government and other stakeholder on education should carry out periodic needs assessment in secondary schools to determine level of acquisition of technological facilities for stem teaching and learning.

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