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Effect of Information and Communication Technology on Students' Cognitive Achievement and Interest in Metalwork Technology in Technical Colleges

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Abstract
The studydetermined the effect of information and communication technology on students' cognitive achievement and interest in metalwork technology in technical colleges. Two research questions were answered and two null hypotheses were tested at 0.05 level of significance. Quasi-experimental design was used for the study. Population of the study was 248 National Technical Certificate (NTC) year 11Metalwork studentsin state owned technical colleges. Purposive sampling technique was used to draw 121students fromfour out of the six technical colleges' .Instruments for data collection were:Metalwork Achievement Test (MAT),Metalwork Interest Inventory (MII) and lesson plans.The instruments MAT, MII and lesson planswere face and content validated by three experts, two from the Department of Technology and Vocational Education and one from Computer Science Department- all in NnamdiAzikiwe University Awka. Test–retest method was used toestablish reliability of MAT and was calculated using Pearson Product Moment Correlation which yielded a correlation coefficient value of 0.76 whileCronbach alpha reliability coefficient method was used to determine the reliability of MII as0.81. The experimental group was taught metalworkusing information and communication technology (ICT) technique while control group was taught metalwork technology using lecture-demonstration teaching method (L-DTM). Arithmetic mean and standard deviation were used to answer the research questions and Analysis of Covariance (ANCOVA) was used to test the null hypotheses. Findings of the study revealed that students taught metalwork using ICT achieved significantly higher and developed better interest than those taught using L-DTM. Based on the findings of the study, it was concluded that ICT has positive effect and is moreinnovative and effective mode of instruction with capacity to enhance students learning outcomes and inspire interestin metalwork technology in technical colleges. Consequently, it was recommended among others that technical colleges'teachers should use ICT in teaching metalworkin order to improvestudents' overall achievement and interestin metalwork trade. Therefore, school administration should provide opportunities for in-service training and equipmetalwork workshop with computers and relevant software thatwould enableteachers and students to acquire requisite skills needed in the application of ICT for teaching and learning of metalwork in technical colleges.

Keywords: *Information and Communication Technology,CognitiveAchievement, Interest, Metalwork Technology and Technical Colleges.*

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I. Introduction

Technical colleges are the post basic school level of vocational education system in Nigeria, They are established to produce craftsmen and master craftsmen. In technical colleges, students are trained to acquire relevant knowledge and skills in different occupations forgainful employment. According to Federal Republic of Nigerian, FRN, (2013), the students of technical colleges upon graduation are expected to either be employable in the industry or be self-employed. In order to achieve this goal, technical college curriculum was split into different trades with corresponding modules so as to enable learners choose and accomplish trades of their interest successfully. Technical colleges offer the following trades; bricklaying/blocklaying and concreting, vehicle body work, electrical installation and maintenance works, fabrication/welding craft practice, automobile electrical works, electronics works, mechanical engineering craft practice, motor vehicle mechanics works, refrigeration and air-conditioning work, general wood workand generalmetalwork.

Metalwork trade in vocational education is the art of studying different metals; develop skills in using the metals to form different objects According to Oranu, Nwoke and Ogwo (2002) metalwork involves activities in occupations that entails designing, processing and fabrication of metals. The technological concept of metalwork requires specific competency for occupational success. The main trust at this level of education involves practical training using newer methodologies of applying science, materials, tools, devices, equipment, machinery, and other resources to enable competent workers solve practical problems. UNESCO, (2002) stated that information and communication technology facilities for teaching technical and vocational trade subjects should be available, accessible and utilized in teaching and learning in the classroom.

Thus it becomes imperative toapply thetheory of Digital Natives in the light of currentlearningconceptsparticularly in metalwork technology. The current generation of students is digitally and media literate, technologically-savvy and are able to use other learning approaches than former generations. The digital generation was born after 1980 and since their early childhood the digital generation is closely connected with and socialized by digital media and information and communication technologies such as TV, video games, computers and later the internet and mobile communication. Also, the digital generation has a different learning approach than former generations, e.g. non-linear learning or multi-switching and multi-tasking. This marks the emergence and expansion of information and communication technology and the penetration of those technologies in all social areas and individual spheres of life. The persons born from this period on are related to ICT in a special, close way and have an in-depth understanding to use digital technologies (Gasser, 2009). The Digital Natives, as there are usually called, spend a lot of time with digital technologies. This also implies, that digital media has a significant impact on the identity formation and the personal development. Furthermore they are highly connected and prefer acting in networks (keyword: peer orientation).The concept of the Digital Natives implies that today's students are more familiar with new information and communication technology than former generations. The early and intensive experience with digital technologies thereforeaffects the ways of learning, working and communication.

Information and Communication Technology (ICT) is the means of accessing, receiving, storing, processingsending ideas, transferring of information through computers and other communication facilities. The application of Information and Communications Technology (ICT) in education has revolutionized teaching and learning process. Students with diverse learning styles arelikely able to maximize their learning potential when instructors use ICT to support their teachings. ICT has a major role to play in forming the new worldwide economy to deliver fast changes in the society. ICT has advanced and changed at greatspeed that the developing countries have not been able to catch up with the revolution andmay have been left behind. ICT acts as the foundation stone of the contemporary world; thus, understanding this technology and its fundamental concepts is considered as part of the essentials of education (UNESCO, 2002). It enables the learners to be more independent, reflective and self-regulated in their learning processes. According to the UNESCOdocument, ICT has the potentials to revolutionize classroom instruction, where and how learning occurs as well as the roles of students and educators in the instructional processes.

In classroom teaching and learning processes, the use of ICT is imperative as it gives chance to the instructors and learners to operate, store, control and retrieve data as well as to promote self-regulated and active learning (Ali, Haolader& Muhammad, 2013). ICT-based learning includes an expanded propensity towards collaborative learning among learners and instructors, not just in a specific classroom. This kind of collaboration is in contrast to the conventional learning environment, for example, distance learning inspires educators and learners to engage in learning even after school time (Agrahari, & Singh, 2013)). The system helps instructors to plan and prepare lessons and design materials such as course content (Ali, Haolader& Muhammad, 2013).The rapid growth of this system has prompted a revolution in learning as innovative technological advancement in education has involved the re-examination of new techniques and instruments inthe instructional process.

However, teachers using ICT may generally accomplish the following results in a student-centered teaching: less lecturing, increased individual instruction, more time spent in coaching and advising students, increased interest in teaching and increased productivity. ICT could also help to make complicated things simple to comprehend by simulations that once morecould add to real learning situations. The use this modern

technologymay likely motivate the students and arouse interest in teaching and learning processes as well as enhance the overall cognitive achievement.

Cognitive achievement could be defined as a mental capability that involves the ability to reason, plan, solve problems, think abstractly, comprehend complex ideas, learn quickly and learn from experience (Robinson, 2005). Cognitive abilitiesare aspects of mental functioning, such as memorizing and remembering; inhibiting and focusing attention*;* speed of information processing; and spatial and causal reasoning*(*Dehn, 2008).Cognitive achievement is brain-based skills we need to carry out any task from the simplest to the most complex. Individual differences between people are measured by comparing scores on tests of these mental abilities. Also, cognitive achievement connotes attainment in a school subject as symbolized by a score or mark on a test (Okoro, 2013). Antherson (2003) contended that cognitive achievement depends upon several factors among which are the instructional methods, learning environment and the learners. Additionally, in the context of this study cognitiveachievement isthe measure of aptitudesfor learning in specific instructional domains particularly as it's obtainsin metalwork. Furthermore, cognitive achievement of students in this context is also perceived as the learning outcome of students on metalwork showing the extent of mastery on the subject matter.Students are easily attracted to those activities whichthey view as having the potential to meet their needs and that appear compelling and interesting.

Interest is a persisting tendency to pay attention and enjoy some activities (Onyenga, 2008). Musa, (2009) defined interest as a zeal or willingness of participating in activity from which one derives some pleasure. Musa further stated that interest is a tendency to become absorbed in an experience andto continue in it. Ogwo and Oranu (2011) laid emphasis on the need for teachers to stimulate students' interest in learning without which students' achievement will be minimal. Interest most often is directly tied to the content or instruction, it also directs and enhances learning. It is what one perceives in these engagements that shape ones' interest. In the educational environment, students' interest, especially in metalwork could play a significant role in facilitating their knowledge acquisition and achievement.In the context of this study, interest is an affective behaviour that can be aroused, sustained in teaching and learning through appropriate teaching method. The assumption is that when effective method is used for instruction, it aids learners to internalize what has been taught in order to correctly and successfully apply the concepts learnt at a later date. But, the most predominantly teaching method used in Nigerians' technical colleges is lecture-demonstration method which may not promote students interest in the subject matter.

Lecture-demonstration teaching method (L-DTM) is known as the traditional talk-chalk method of teaching with the teacher sometime showing afew examples on the black board. Here the teacher does the talking and demonstrating while students serve as receiver who usually listen and taking down notes. Eze and Osuyi (2018) described lecture/demonstration teaching method as the type of teaching method in which the teacher is the principal actor while the learners watch with the intention to act later. This teaching method may not promote positive students achievement and may not beable tomaintain students'interest in the subject matter of metalwork. Indeed students' poor academic performance/achievement in public examinations may be traceable to the use of this ineffective teaching method.

Okorafor, (2010) in a study stated that ICT has comprehensively impacted its benefits on every society as the utmost change agent of human development. It is difficult world over today to think of any aspect of human life-such as education, communication, research, banking, medicine, trade, culture, among others that are not ICT driven. In recent times, there has been an extraordinary advocacy both nationally and internationally for the use of ICT in instructional and learning processes (Okoro&Ekpo, 2016). The educational field has thus been influenced by ICT, which has explicitly influenced instructional process and research. It became imperative to integratethis modern instructionaltechnology in learning, particularlyin metalwork classroom to eradicate students' poor performance in public examination. It is against this background and the quest for better ways of effective teaching especially in metalwork concepts that the researchers decided to investigatethe effect ofICT on cognitive achievement and interest of metalwork technology students in technical colleges.

Statement of the Problem

ICT is causing a revolution and if any education sector does not join, it will not only be old fashioned, but, in few years, but also, it will be out of competition in the world market. The new technology requiresteachers' to apply newroles, new pedagogies, and new approaches in teaching. The successful integration of ICT particularly in metalwork classroom will depend on the ability of technical teachers to re-structure the learning environment, develop innovative ways of using technology,and hence encourage technological literacy and as well asenhance knowledge deepening and knowledge creation. In metalwork industry there have been complex changes in the systems. Components of lathe machines, milling machines,sharpening machines and drilling machines that are imported or assembled in Nigeria are computerized. These new developments have greatly brought about changes in the skills required of metalwork craftsmenfor employment in the industry. However, most of these newdevelopments in machines components and systems are not reflected in the learning contents of the training of metalwork students in Nigeria technical

colleges. Invariably, there is a mismatch of metalwork study and the skills required for employment in the metalwork industry.

Additionally, emphasis has been placed on this area of educational system to meet the technological objectives of the nation. Yet, these objectives have not been fully achieved over the years due to problemsof ineffective teaching at the technical colleges. The lecture-demonstration teaching methodwhich has become a traditional method of instruction in technical colleges has not yielding positive outcome. The failure of this method of instruction has resulted to poor academic performance, lack of interestand poor performance on the job making the realization of the technological objectives of the country difficult to achieve. The question now is, how would students' cognitive achievement be improved and to alsoarouse and sustain interest of learners? This could be possible through a paradigm shift from L-DTM to more appropriate and effective teaching method which introduces the use of ICT in teaching metalwork. This has arouse the interest of the researchers to explore if using ICT in teaching metalwork could improve students' cognitive achievement as well as sustain their interest in the subject of metalwork.

Purpose of the Study

The purpose of study therefore is to determine if using ICT to teach metalwork technology to students in technical colleges would improve their cognitive achievement and sustain their interest in the subject better than teaching them with L-DTM. Specifically, the study sought to determine the:

1. Mean cognitive achievement scores of technical college students taught metalwork using ICT and those taught with L-DTM.
2. Mean interest scores of technical college students taught metalwork using ICT and those taught with L-DTM.

Research Questions

The following research questions guided the study:

1.What are the mean cognitiveachievement scores of technical college students taught metalwork using ICT and those taught using L-DTM?
2. What are the mean interest scores of technical college students taught metalwork using ICT and those taught using L-DTM?

Hypotheses

The following null hypotheses were tested at 0.05 level of significance:

1. There is no significant difference between the mean cognitiveachievement scores of technical college students taught metalworkusing ICT and those taught using L-DTM.
2. There is no significant difference between the mean interest scores of technical college students taught metalworkusing ICTand those taught with L-DTM.

II. Method

The design of the study was quasi-experimental design. Specifically, the study used pretest, post-test and non-randomized control group design. Intact-classes were therefore used to avoid disruption of normal class lessons especially as there was no randomization to locate the research subject into classes or groups (Nworgu, 2015). The study was conducted in technical colleges in Delta State. The population of the study was 148 National Technical Certificate (NTC) year 11 students. This comprised all the students offering metalwork in Government owned Technical Colleges in Delta State.The sample of the study was made up of 121 National Technical Certificate (NTC) 11 students. Purposive sampling technique was used based on availability of professionally qualified staff, facilities for teaching, regular electricity supply to power the machines and willingness of classroom teachers to participation as research assistance.

The instruments namely:Metalwork Achievement Test (MAT),Metalwork Interest Inventory (MII)and lesson plans were developed by the researchers and used for the data collection and teaching in this study. The 50multiple choice test items of MAT was used as pre-test and there after the treatment, instrument MAT was reshuffled and the colour of the paper changed before administering it as post–test. Table of specifications of was used to allocate questions on the MAT content areas in the cognitive affective and psychomotor domain. Items in the MAT were constructed with strict adherence to the application of levels of revised edition of Anderson and Krathwohl (2001) Bloom's taxonomy of educational objectives as follows: remember, understand, apply, analyze, evaluate and create.

MAT and MII wereface and content validated by three experts. Two experts from the Department of Technology and Vocational Education and one from the Computer Science Department- all in NnamdiAzikiwe University, Awka. The experts' were requested to scrutinize the test items for clarity, suitability of the language and coverage of the content area. All observations and suggestions were noted and corrected to prepare the final copy for the study. Content validity of the instrument was ensured by adopting the taxonomy of educational

objectives.The area of interest are academic, leisure, vocational and general. It was based on five point Likert type scales of strongly Agree (SA), Agree (A), Undecided (U), Disagree (D) and Strongly Disagree (SD).

The reliability of the instrument was established using test-retest method. Copies of MAT were administered twice to 21 NTC year 11Metalwork students drawn from Ofagbe Technical College,Ofagbe,Delta State who were not part of the population. Reliability estimate method of test retest reliability using manual computation with the Pearson Product Moment Correlation between the two sets of scores yielded a correlation coefficient value of 0.76.The estimate of internal consistencymethod forMII used Cronbach alpha and reliability technique, which yielded reliability coefficient valued of 0.81.

Experimental Procedure

The researchers sought and obtained permission from the principals'of technical colleges' concerned for the involvement and participation of their students and teachers in the study. The metalworklesson plans for (experimental and control groups) that were used for the study were developed by the researchers.An orientation programme was organized for participating metalwork normal classroom teachers(research assistants) in the first week. Separate sessions were organized for the two groups of teachers (experimental and control groups). One group was trained on the use ICT-computer tutorial software, problem solving software, drill and practice involving real world situations that students learn in their working areas. The control group was trained in using lecture-demonstration teaching method which employed using charts, illustrations on the chalkboard.

The instruments MAT and MII were administered as pre-test to both experimental and control groups through the help of the (research assistants) normal classroom teachers in their schools in the first week. The administration lasted for one hour in each school. The teacherscollected andmarked scripts. The scores were recorded and the treatment began in the second week.

The treatment (teaching) lasted for a period of six weeks. The teaching of the following topics that form part of MAT are: soldering operations, forging operations, drilling operations, lathe machines and milling machines for both control and experimental groups commenced in the second week of the experiment and followed normal school time-table for five working days. The subject teachers in both technical colleges taught the lessons to prevent bias which could occur if someone else taught the lessons. This could introduce bias due to teacher effect. As earlier said, the experimental group was taught usingICTwhile the control groups was taught using lecture-demonstration teaching method in their normal classroom.

The post-test was administered after six weeks by the class teachers (research assistants). The experimental group wrote the examination using the computers. The scoring of the examination, storing to the database and displaying of results was done instantly. The control group wrote the examination conventionally and the research assistants supervised the examination, marked the scripts, recorded and made the scores available to the researchers. MAT items which were used during the pre-test stage were also used for the post test. However the MAT items were reshuffled. This was done for both experimental and control groups respectively. It must be noted that the reshuffled MII items were administered as posttest to the students and scores recorded. This was to determine the interest of the students after the two groups must have been exposed to teaching with the two methods.

Method of Data Collection and Data Analysis

The research questionswere analyzed usingmean scores and standard deviation. Because there was no randomization of the research subject into the experimental and control groups, rather intact groups were used, the Analysis of Covariance (ANCOVA) was employed to test the hypotheses at 0.05 level of significance.In testing the hypotheses, if p-value was less than the level of significance (0.05), the null hypothesis was rejected but if the p-value was greater than or equal to the level of significance at (0.05), the null hypothesis was accepted. Data analysis was done using Statistical Package for the Social Sciences (SPSS) version 20.

III. Results

Table 1

Mean and Standard Deviation for Pre-test and Post-test Cognitive Achievement Scores of Students

		Cognitive Achievement				
Groups		**Pretest**		**Post test**		
	No	**Mean**	**SD_1**	**Mean**	**SD_2**	**Mean Gain**
Exp. Group	61	25.18	3.49	37.45	5.39	12.27
Cont. Group.	60	23.19	3.46	32.33	10.63	9.14

**Exp. Group=Experimental Group DI; Cont. Group =Control Group*

Table 1 showsthat the experimental group had mean gainof 12.27 which is higher than 9.14 gained by the control group. This result shows that computer based instruction was more effective than the L-DTM in improving students' achievement in metalwork technology. This shows that those students taught with computer based instruction maintained higher cognitive ability that strengthening their academic performance.

Table 2
Mean and Standard Deviation for Pre-test and Post-test Interest Scores of Students

Groups		Interest				
		Pretest		Post test		
	No	Mean	SD_1.	Mean	SD_2.	Mean Gain
Exp. Group	61	104.18	13.53	134.33	14.13	30.15
Cont. Group.	60	107.67	10.71	119.83	10.86	12.16

**Exp. Group=Experimental Group DI; Cont. Group =Control Group*

Table 2 shows the experimental group had mean gain of 30.15 which is higher than '12.16 gained by the control group. The result shows that those taught using ICTdeveloped better interest than those with L-DTM in metalwork concepts. This could be as a result of introduction of ICT that has aroused their interest in metalwork technology.

Table 3
ANCOVA Summary of Differences in Cognitive Achievement of Students in Metalwork Trade

Source	Type III Sum of Squares	Df	Mean Square	F	P-value.
Corrected Model	527.406[a]	2	263.703	3.829	.025
Intercept	861.793	1	861.793	12.512	.001
Pretest achievement	413.802	1	413.802	6.008	.016
Method	89.686	1	89.686	1.306	,000
Error	6749.762	118	68.875		
Total	119655.000	121			
Corrected Total	7277.168	120			

a. R Squared = .072 (Adjusted R Squared = .054)

Table 3shows that there is a significant main difference in the posttest mean cognitive achievement scores oftechnical college students in the experimental group and the control groups $F(1, 100) = 1.306$, $p > 0.05$.This means that there is a significant difference between the mean cognitive achievement scores oftechnical college students taught metalwork with ICT in the experimental group and those taught metalwork with L-DTM in the control groups. Therefore, the null hypothesis was rejected**.**

Table 4
Summary of ANCOVA on Mean Difference Interest Scores on Technical College Students in Metalwork

Source	Type III Sum of Squares	Df	Mean Square	F	P-value.
Corrected Model	30115.841[a]	2	15057.920	94.978	000
Intercept	15027.530	1	15027.530	94.787	.000
Pretest interest	89.227	1	89.227	.563	.455
Method	30019.939	1	30019.939	119.352	.000
Error	15536.991	118	148.541		
Total	1663525.000	121			
Corrected Total	45652.832	120			

a. R Squared = .660 (Adjusted R Squared = .653)

Table 4shows that there is a significant main difference in the posttest mean interest score oftechnical college students in the experimental group and the control groups ($F(1, 100) = 119.352$, $p < 0.05$). This means that there is a significant difference in the mean interest scores oftechnical college students taught metalwork with ICT in theexperimental groupand those taught metalwork with L-DTM in the control group. Therefore, the null hypothesis was rejected.

IV. Discussion

Findings of the study revealed that students taught metalwork using ICT achieved higher in their mean posttest scores than those taught using lecture-demonstration teaching method. This finding is in agreement with Agrahari and Singh (2013) who found that ICT has a positive effect on student achievement scores in chemistry at secondary level.Likewise, Safdar, Yousuf, Parveen and Behlol (2011) concluded that ICT has a positive effect on students' achievement scores.

Findings further showed that students taught metalwork using ICT had develop better interest than those taught using lecture / demonstration teaching method. This finding agrees with that of Onyenga (2008)who found that students developed interest well when taught through ICT as compared to those who were taught through conventional instructional strategy. Utilizing ICT in the study inspires the interest of metalwork studentsas well as upgrade the comprehension and enhance their memory.

Furthermore, the findings of this study revealed that there was a significant difference in the mean academic achievement andinterest students in the experimental and control groups. This finding is in agreement withAvinash and Shailja (2013) who found that the ICT programme is more effective than the conventional teaching approach in terms of students' achievement scores in chemistry.This contradicts the findings of Andoh, (2012) who concluded that ICT does not have an effect on students' achievement scores. Likewise, Mbaeze, Ukwandu and Anudu (2010) found that there was a significant relationship between ICT and students' academic performance.

Significance of the Study

The findings of this study should be of enormous benefit to the following groups: students, teachers, curriculum planners, future researchers, education policy makers, society and parents. The findings of the study should be of immense benefit to students, in the sense that the knowledge provided in the study should enhance their academic performance and arouse interest. Additionally, the findings of the study should impact positively on students/graduates in the sense that they would acquire skills/competencies, pertinent knowledge through their active participation in the lessons using ICT. Similarly, the awareness of the findings of the study should enable metalworkteachers to properly deliver their lessons using the lesson plans and treatment procedure provided in the study. This would guide them to effectively apply ICT in teaching metalwork. This should make them more resourceful to develop innovative, reflective competence and self-confidence in discharging their responsibilities in a conducive learning environment. The knowledge gathered in this work could enable curriculum planners/technical and vocational education stakeholders, such as NBTE, recommend effective methods of teaching metalwork in technical colleges as well as aptly integrate ICT into the curriculum accordingly.

The findings of this studyshould beof substantial benefit to the future researchers in the sense that it should provide empirical data for future research/investigations in related or allied professions. This could as well contribute meaningfully to their knowledge particularly in metalwork. The knowledge of the findings of the study, should greatly aid the Ministry of Education in the procurement of ICT equipment for effective teaching and learning in technical colleges.

V. Conclusion

Based on the findings of this study, it was concluded that ICT has positive effectand is very effectiveapproach of instruction. It is also more innovative and captures students' interest. Additionally, it improvedstudents' capacity oncognitive achievement,arouses and sustained interestinlearning metalwork.

VI. Recommendations

Based on the findings of this study, the following recommendations were made:

1. Teachers should ensure constant and effective utilization of ICT for instruction in trades and trade related subjects/courses in technical colleges to enhance cognitive achievement and sustain students' interest
2. School administration should provide opportunities for in–service training programmes for auto mechanics trade teachers in order to equip them with competencies needed in the use of ICT for instruction.
3. Curriculum planners should formally adopt ICT for instruction in metalwork in technical colleges and ensure its wide application.
4. Government should provide technical colleges with computers and internet facilities to enable students maximize the benefits of ICT.

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