EVALUATING THE IMPACT OF ICT/INFORMATION TECHNOLOGY ON ARCHITECTURAL EDUCATION IN TERTIARY INSTITUTIONS

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Abstract

Over the most recent couple of decades, progressive advancements in the field of Information and Communication Technology (ICT) have altogether affected regular day to day existence. The web, advanced illustration tools, and software are clear models of this computerized transformation that has influenced the specific procedure of teaching architectural design. Architecture can be described as a technology-intensive discipline that utilizes technology, both in the process of designing and in its products, to achieve different objectives. In turn, technology transforms the discipline. The importance of technology to the discipline and to the practice of architecture has been demonstrated again and again throughout history. The main aim of this paper is to evaluate the impact of ICT on the teaching of architectural courses in three different polytechnics, (viz; The Federal Polytechnic, Ilaro, Moshood Abiola Polytechnic, and Gateway ICT Polytechnic, Igbesa) in Ogun State. Descriptive and inferential statistical analysis was carried out to sample of 200 students (NDII, HNDI, and HNDII) selected randomly through a proportional allocation from the Department of Architectural Technology to compare the use of ICT software such as AutoCAD and ArchiCAD to hand drawings for Architectural designs through the use of structured questionnaire. Empirical analysis from the result obtained showed that ICT has impacted positively on architectural education in tertiary institutions as evidenced from 92% of the total participants (students). However, the inferential analysis also buttressed the validity of the field survey carried out using Kruskal Wallis approach. Chi-square Statistic of 0.340, p-value 0.952>α=0.05, indicates that ICT has significantly impacted positively on architectural education in tertiary institutions.

Keywords: *ICT, Architectural Education, technology, Architectural design, Software*

INTRODUCTION

Architecture as is the art or practice of designing and constructing buildings. The fundamental truth for any successful building project is a very good and sound design process. The initial idea for the project emanates from the architect based on the briefs and in a way to proffer solutions to problems (Moum, 2015). Taking into account different constraints set for the project to materializes, mostly in collaboration with a design team, into a drawing illustrating the fundamental project concept (Lawson, 1997). Within this process crucial decisions must be made, starting with the architect's decision, which solutions are worth being put to the paper, to the crucial client decision, which proposed concept should be further developed? (Schön, 1983).

Architecture is a mixture of creative design and building techniques and with the increase in industrial revolutions and the technological developments, which as greatly influenced the way people built and designed (Sariyildiz & Ozsariyildiz, 1998). This means that the architect does not have any order choice than to integrate the skills of various disciplines of knowledge which are involved in the whole process of design such as dimensioning of the construction, building physics, applied mechanics, calculation of structures, building materials and techniques besides the artistic form expression of the building. (Sariyildiz & Ozsariyildiz, 1998). In the reality of the above, the computer became an important tool in the hands of architects, in the last decade architects had to deal with the developments of the Information and Communication Technology (ICT) as well. Construction is a traditional and very conservative industry but adopting this new technology became necessary for the obvious contribution of this technology (Li & Wang, 2003), forced by clients or by regulations. The Architectural Engineering and Construction industry (AEC) has embraced ICT in order to benefit from these developments to gain or maintain a competitive advantage.

Introduction of ICT in all aspects of the design and construction of facilities has been going for a few decades now. (Ganah & Kamara 2013).

ICT IN EDUCATION

Information has constantly had a critical influence on human life. Nonetheless, in the mid-20 century, there was an incomprehensive increase in information because of social advancement and the overwhelming improvement in science and technology (Ogunsola & Aboyade, 2005).

Information and communication technology (ICT) has moved toward becoming, inside a brief timeframe, one of the essential building blocks of present-day society. Numerous nations currently regard understanding ICT and acing the fundamental skills and ideas of ICT as a component of the center of education, reading, writing, and numeracy. In many countries, information and communication technology (ICT) has a lucid impact on the development of an educational curriculum. This is the era of Information Communication Technology, so to perk up educational planning it is indispensable to implement the ICT in the education sector. A student can perform well throughout the usage of ICT (Nasir, Munir, and Shad, 2011). Today, preparation of societies and government for globalization and information and communication technology revolution is one of the numerous difficulties confronting creating nations. Information and Communication Technology (ICT) includes computers, the Internet, and electronic delivery systems such as radios, televisions, and projectors among others, and is widely used in today's education field (Jo Shan Fu). According to Yusuf, Afolabi & loto (2013), ICT can make the schools more effective and beneficial, by organizing a variety of tools to enhance and facilitate teachers' professional activities.

ICT gives chances for higher institutions to speak with each other through email, chat room, mailing list, and other facilities (Yusuf & onasanya, 2004). It gives faster and easier access to more broad and current information. ICT can likewise be utilized to do tasks that are complex as it furnishes analysts or researchers with an unfaltering road for the dissemination of research reports and discoveries. Visual technologies like PowerPoint, AutoCAD, and others have become persistent in higher institutions. Making use of these technologies is perceived as a necessity or educationally appropriate Reception of these advances is seen as a fundamental - or, no less than, an instructively fitting, despite the fact that systematic examination of their use is relatively recent (Reedy, 2008).

ICT touches many aspects of storage (storage), retrieve, manipulate, transmission or receiving digital data. Even all these aspects of interdependence with each other (Lee, 2012). ICT in daily business is categorized into two:

- Basic Computer-Tools Technology Personal Computers (PCs) used at home or at work. Frequently used applications are word processing (Word/Text), Cloud Works (Spreadsheets), Database (Database), Presentation (Presentation), Internet browsers, software, Computer Aided Design (AutoCAD) and other graphics.
- Digital Communication Technology-The technology that allows the public to communicate and share digital information.

THE EVOLUTION OF ARCHITECTURE AS A PROFESSION

Architecture simply put is the art or practice of designing and constructing buildings; it was one of the earliest human necessities (Kostof, 1985). Today, architecture is a representation of all past construction cultures, an evolution of building practices (Miller & Burr, 2002). Throughout history, architectural design has been subject to change as any new material or

tool is introduced to the profession. These changes took two directions: the first is on the building forms and the second is on the building profession. During the early days of human settlements, the master builder carried out all the design, engineering and construction tasks. The advent of reinforced concrete in France towards the middle of the 1800s and its rapid use all over the world have affected architecture, and new shapes and structures were designed and built that had not been possible using concrete only. The industrial revolution resulted in a series of inventions and increased the technical knowledge in all fields including building and construction. It became difficult for the master builder to control these huge amounts of information. This led to specialization in the construction industry and new professionals came on board to join the construction team, previously the master builder himself and laborers' helping him in carrying out his job. The development of concrete by the Romans enabled architects to think of architecture in terms radically differed from those used by earlier builders. This invention radicalized Roman architecture and it became the architecture of space rather than of sheer mass. The use of the iron and glass has shaken up traditional construction. During the late nineteenth century, new building shapes were created that they were not possible using reinforced concrete. Skyscrapers, high-rise buildings, and high towers have become a key feature of many cities in different countries, such as USA, Singapore, Malaysia, and France. Advances in technology complexity in the construction process required specialization that resulted in the generation of a huge amount of information and the need for information exchanges between specialists in the design and construction process in a short time.

ARCHITECTURAL DESIGN PROCESS EVOLUTION

The architectural design process is a set procedure used by designers or architects to identify a physical form that will achieve certain functional and behavioral objectives in a particular

context. This procedure is used to prepare a set of plans and specifications that guide other stakeholders in the design and construction process – such as structural engineers, mechanical engineers, masons, electricians, plumbers, painters, and many other skilled workers – in the completion of their work. The design process, therefore, can be described as an interactive and cyclic activity involving analysis, synthesis, appraisal, and decision, applicable to a number of stages in a sequential design morphology (Maver, 1970). There have, therefore, been several attempts to represent maps or models of the design process. Since the origination of the design methods movement in the early 1960s, there have been numerous attempts to model the design and construction process (Macmillan et al., 2001). The building process contains a vast range of activities, which may be justified with respect to various design and construction disciplines. There are two main groups of process models in the AEC industry. The first group includes general process models for the whole construction process, and the second group is specified. The first group includes the most widely used model for the design and construction process, the RIBA Plan of Work. RIBA Plan of Work consisted of twelve stages that a project should go through. It set out the details of work to be carried out by each profession during each stage of the design and construction process but did not show links of information activities to indicate how particular tasks could be related (Austin et al., 1999).RIBA Plan of Work amended in 2007 was similar to the 1995 model but only reduced the number of stages to eleven. The latest attempt by RIBA was the 2013 plan of work, which suggested integrating the latest developments in ICT into the design and construction process. It is too early to comment on this work plan as it has just been released. British Airports Authority developed a process model for its project planning and development for construction and IT solutions. It identified a seven-stage project process which construction solutions progress through. At Salford University, a group of researchers, with the collaboration of a number of industry organizations, have developed a design and

construction process model called Process Protocol (Kagioglou et al., 2000). The new protocol was developed by analyzing current practices in the construction industry and comparing the construction process with similar practices in the manufacturing industry. It proposed a nine-stage project process that the design and construction process should go through. A key feature of the Process Protocol is the identification of ICT tools which may be used to support the design and construction process, and at which stages they can be used. It sets out the details of work to be done by each profession during each stage of the whole construction process. However, these models attempted either simply to describe the sequence of activities that typically occur in designing or to prescribe a more appropriate pattern of activities.

MATERIALS AND METHODS

Data Collection Method

The survey method was adopted in carrying out this research study. A sample of 200 students of the Department of Architectural studies from 3 three different polytechnics in Ogun State was selected using stratified sampling techniques. Proportional method of allocation was also adopted in selecting samples from different levels (NDII, HNDI, and HNDII) of students using CAD for drawings (preferably architectural students).

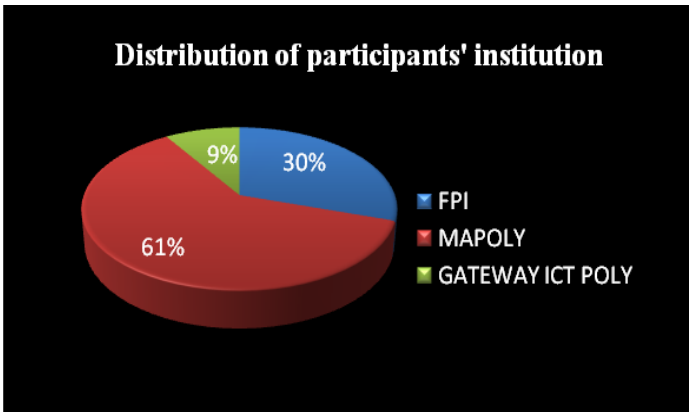


Figure1: Pie Chart showing the distribution of participants' institution

Method of Data Analysis

Descriptive and Inferential method of data analysis was applied to scaled statements to examine the order of importance using pictorial representation. The analysis was done using the Statistical Package for Social Sciences (SPSS) Version 20 (IBM Inc.).

RESULTS AND DISCUSSIONS

In this section of the paper, the graphical representation of analysis was employed to present the distribution and opinion of the sampled participants on the issues raised in the administered questionnaire.

Pictorial Representation of Participants Demographic Information

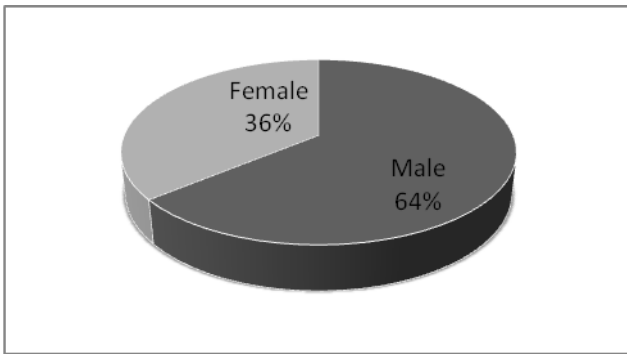
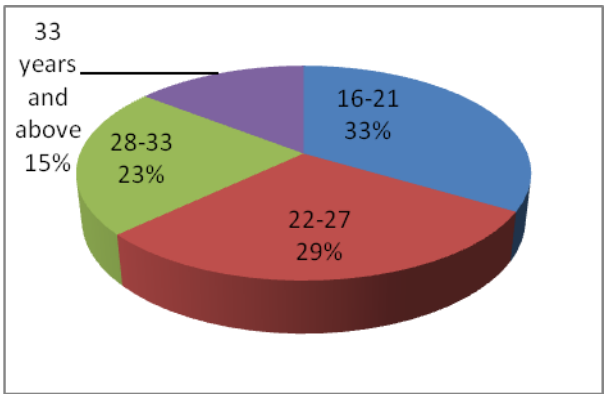


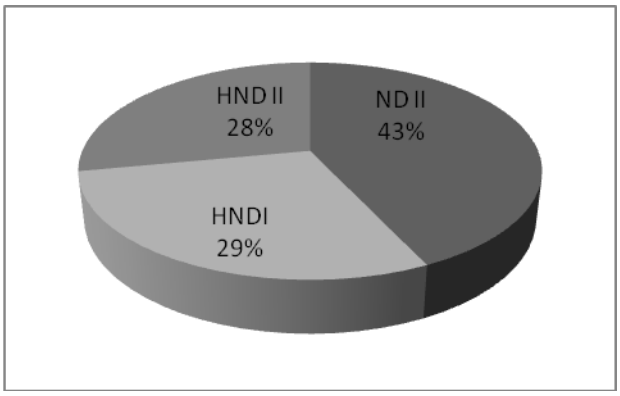
Figure 2 shows the frequency and percentage analysis of participants' demographic information according to gender. Analysis indicates that 64% of the participants are male while 36% of them are female. This indicates that majority of the sampled past students are male.

Figure 2: Pie Chart showing Gender Distribution of Participants



Based on the participants age distribution in figure 3, it indicates that majority of them are between the ages of 16-1 (38%) years old while minority(15%) of them fall between the age range of 33 years and above.

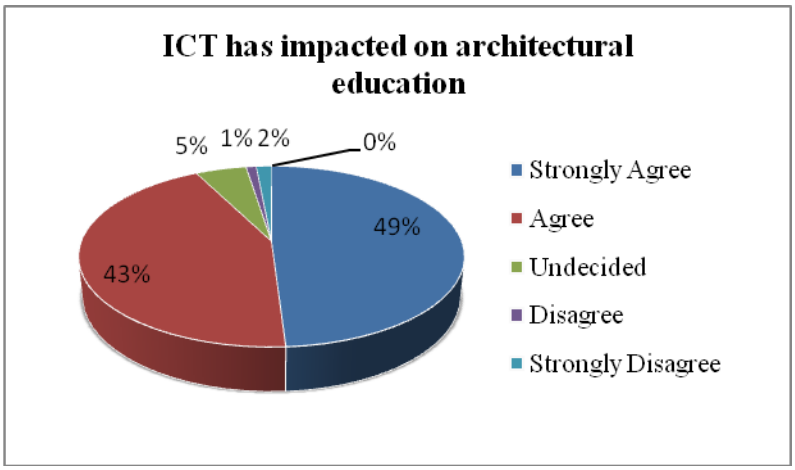
Figure 3: Pie Chart showing Age Distribution of Participants



It can also be evidenced from figure 4 that majority of the respondents were NDII students which consist about 43% of the total sample taken, 29% are HNDI students while 28% are HNDII students respectively.

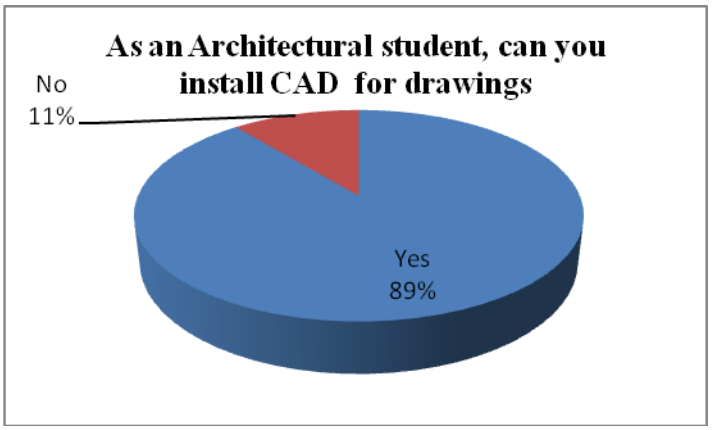
Figure 4: Pie Chart showing Distribution of participants according to levels

Analysis of participants' perception to Computer Aided Design(CAD) as a means of ICT in architectural designs



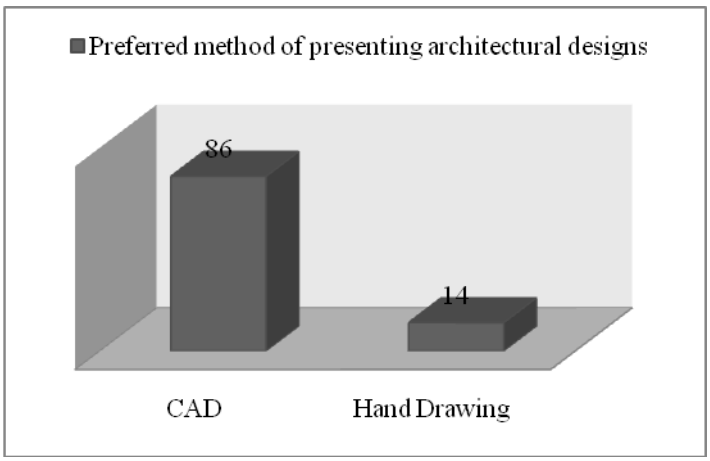
Analysis of figure 5 showed that since the weighted mean response of the five point scaled used is 4.35, it indicates that majority of the respondents agree on the fact that ICT has impacted on architectural education in Nigeria.

Figure 5: Pie Chart showing Distribution of participants' impact of ICT on architectural education



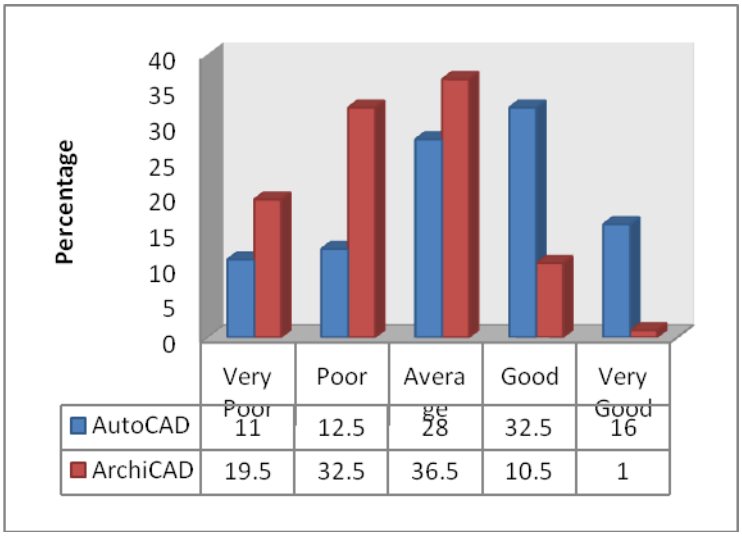
Majority of the students from the respective institutions said that, as a student of architectural design, they can install CAD software for drawings as evidenced from 89% who responded yes to the item analysed.

Figure 6: Pie Chart showing Distribution of participants' impact of ICT on architectural education



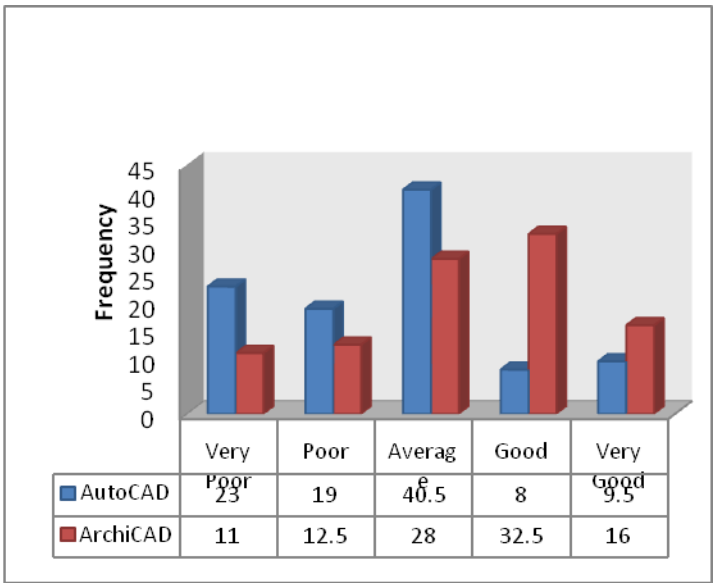
On the preferred method of presenting architectural designs, bar chart of figure 7 indicates that 86% of the participants were of the opinion that Computer Aided Designs is more preferable than hand drawing as it reduces stress and makes the work more professional.

Figure 7: Bar Chart showing Distribution of participants' on the preferred method of presenting architectural designs



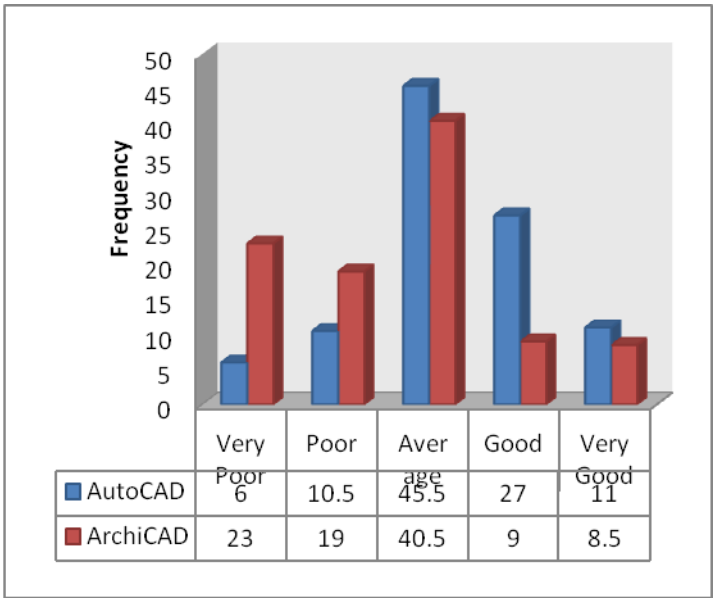
It can be evidenced from figure 8 that about 32.5%(majority) of the participants said that they are good at usingAutoCAD program commands and files, 36.5% of them said that their usage of program command and files were on average taking ArchiCAD into consideration while only 1% and 16% of the participants are very good at using AutoCAD and ArchiCAD respectively.

Figure 8: Bar Chart showing Distribution of participants' Ratings on the usage of program command and files of CAD software.



It can also be seen from figure 9 that, about 40.5%(majority) of the participants said that they are good at usingAutoCAD for two dimensional technical drawings, 32.5% of them said that their usage of program command and files were on average taking ArchiCAD into consideration while only 10% and 11% of the participants are "very good" and very poor at using AutoCAD and ArchiCAD respectively.

Figure 9: Bar Chart showing Distribution of participants' Ratings on the usage of AutoCAD and ArchiCAD for 2D drawings



On whether students can use CAD for 3D drawings, 45.5% and 40.5% (majority) of the participants opined that they are neither good nor poor at usingAutoCAD and ArchiCAD for three dimensional technical drawings, 6% and 23% of them said that they are very poor in using both softwares while only 11% and 8.5% of the participants are "very good" at using AutoCAD and ArchiCAD for 3D drawings respectively.

Figure 10: Bar Chart showing Distribution of participants' Ratings on the usage of AutoCAD and ArchiCAD for 3D drawings

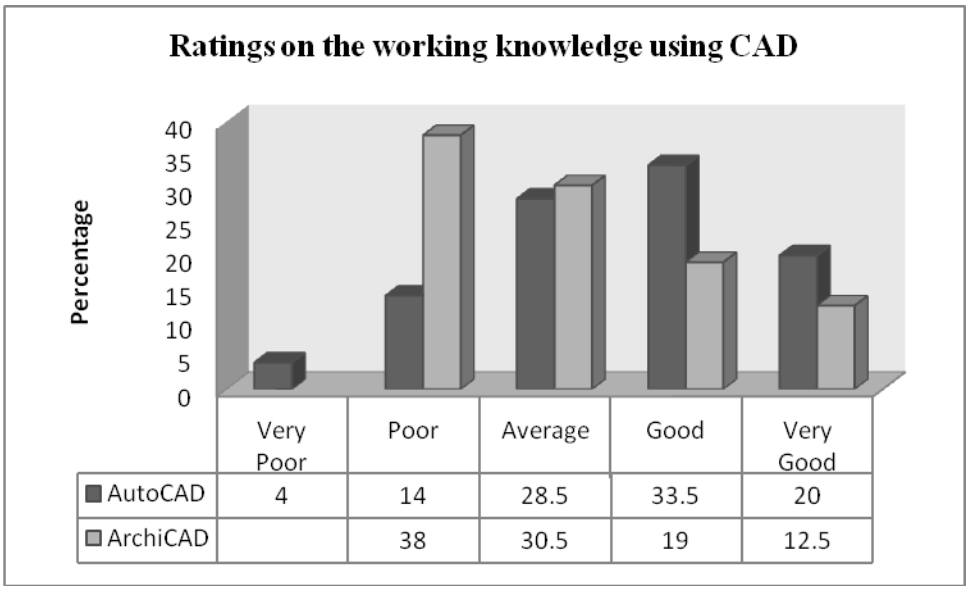


Figure 11: Bar Chart showing Distribution of participants' Ratings on general working knowledge using CAD

Empirical analyses of the research study revealed in figure 11 that majority of the participants have knowledge of CAD for architectural designs. However, it can also be evidenced that 33.5% of them are good at using AutoCAD, 38% are poor at using ArchiCAD while 20.5% and 12.5% of them are very good at using the former and latter software for architectural designs.

Table 1: H-Test (Kruskal Wallis Test) for the difference between groups of responses

	Response Level	Mean Rank	Test Statistics
Mean response	Very Poor	11.20	
	Poor	10.00	Chi-square (df, 3) = 0.340
	Average	9.50	p-value =0.952
	Good	11.30	

Source: Extracted from SPSS, Version 20

H-test method of inference reported a Chi-Square Statistic of 0.340, p-value 0.952>α=0.05, as it indicates that ICT has significantly impacted positively on architectural education in tertiary institutions.

CONCLUSION

This paper discussed the impact of information and communication technology (ICT) on architectural courses in three different polytechnics in Ogun state (The Federal Polytechnic, Ilaro, Moshood Abiola Polytechnic, and Gateway ICT Polytechnic, Igbesa). Descriptive and inferential statistical analysis was carried out to compare the use of ICT software such as AutoCAD and ArchiCAD to hand drawings. Questionnaires were distributed to the sample of 200 students (NDII, HNDI, and HNDII) selected randomly through a proportional allocation from the Department of Architectural Technology. Empirical analysis from the result obtained showed that ICT has impacted positively on architectural education in tertiary institutions as evidenced from 92% of the total participants (students). However, the inferential analysis also buttressed the validity of the field survey carried out using Kruskal Wallis approach. Chi-square Statistic of 0.340, p-value $0.952>\alpha=0.05$, indicates that ICT has significantly impacted positively on architectural education in tertiary institutions.

The above result shows that ICT has impacted positively with the use of software in teaching students various architectural designs. Architectural education at the higher institution is changing by the influence of ICT technology. The faculties giving architectural education must be aware and level up to these developments and must know about the threat that the architect profession can be lost partially or taken away by others in a long haul (Sariyildiz & Van der Veer, 2011). The level of education must be at a higher level on the field of ICT. Current visualization tools are at the end of their limits, whereby a new phase of ICT applications for architects and building engineers now is in existence. The education must be directed more to the level that the student uses the ICT tools for knowledge integration and the decision support environment to use the computers as a reliable design tool (Sariyildiz & Van der Veer, 2011).

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