An Evaluation Framework for New ICTs Adoption in Architectural Education

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Article Info	ABSTRACT
	The advent of new Information and Communication Technologies (ICTs) poses several challenges for its use and adoption particularly for teaching and learning purposes in most Higher Educational Institutions (HEIs). Understanding the criteria to use and how to measure success are some of the challenges faces by most departments of Architecture in Nigerian Universities. Thus, this paper has attempted to address these challenges by proposing an evaluation framework for the adoption of new ICTs in tertiary institutions of learning with particular interest in Architectural education. Baseline information collected from the department of architecture in five different Nigerian Universities was used to identify the major constraints encountered in Information and Communication Technologies adoption in Architectural education and the best approach that will promote better rate of Information Technology (IT) adoption. The major contribution of the study is that the proposed framework can be used to interpret specific results as to whether the use of technology within a particular literacy program led to improved learning, and provide a better understanding of such results in larger contexts and various aspects of other issues related to evaluation, access, and literacy learning in Architectural education.

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1. INTRODUCTION

Higher education has approached a level at which Information and Communication Technology (ICT) plays a vital role in nearly all phases of the educational process. Every institution of higher learning uses these new ICTs such as networked computers, the Internet and its associated technologies in their educational programs. The potential for new information and communication technologies for teaching and learning was recognized by early researchers [1-3]. While some argue for an internal approach to the use of ICTs in higher education by staying focused on internal factors within the institution [4-7], others are of the opinion that ICT usage should be externally influenced by the present demand on learners by their prospective employers in the market place [8-10]. Programmed instructions as well as the programming language Logo were developed over 30 years ago, and the earliest applications of time-sharing operating systems included teaching. Almost immediately, people began to ask whether the new tools would lead to better, more effective, or more efficient education.

However, the real challenge of ICT is not the development of the technology, but how to apply and use it as these technologies develop faster than our ability to adopt and use them [11]. There is need to know how to use most of these modern ICTs and at the same time be educators and mentors in a changing learning environment [12]. Even as institutions develop educational and research programs, they have not developed policies to address fundamental and relevant ICT usage and application in these programs [13]. Faculty

Journal homepage: *http://iaesjournal.com/online/index.php/IJICT*

efforts to bring ICT into their teaching and scholarly activities are rarely considered in formal faculty review and evaluation of teaching curriculum. These arguments rely upon more or less formal methods of evaluating what happens when these technologies are used. We need to understand what can be concluded about technology use and what the limits of current methods might be. We are also often called on to interpret specific results, such as to whether the use of technology within a particular literacy program led to improved learning. We need to understand how to think of such results in larger contexts and to interpret them for ourselves and others in various aspects of issues related to evaluation, access, and literacy learning.

The remaining parts of this paper are structured into the following sections: section I discussed the background of the study, section II looked at ICT usage in Architectural education, section III explained the challenges of adopting these new ICTs in Architectural education, and in section IV we elaborated on the need for a new evaluation approaches for ICT. Section V discusses the summary of findings while section VI concludes the paper.

2.   BACKGROUND OF THE STUDY

[14] posits that IT policies have been inconsistently developed or are lacking in many instances in higher institutions. According to him, where they exist, institutions have implemented policies regarding the use of computers in educational programs unevenly. Some of the fundamental policies regarding computer usage in higher institutions should include general campus policies, operating policies, plans for academic and instructional use of IT and quality of IT infrastructure.

[15] carried out research on the use of computers for cooperative work. It appears in his study that capacity development of the educators and ICT facilities that can integrate IT culture into the educational system of graduates have been taken for granted. [16] reported that several research projects have seen the issues of educating the practitioners and bringing results closer to the practice as the way forward in making the industry use the IT solutions proffered. However they believed that an important reason for not using IT solutions proffered in Architecture effectively lies in the current educational practice. [17] and [18] also shared similar views when they submitted that a shift in the educational system is overdue in their argument for the adoption of virtual universities for education in the 21st century. They disagreed that reliance on IT is seen as disempowering and as such it does not constitute attitudinal belief that is capable of weakening the resolve to digitalize the teaching and research process. This result seems not to agree with the findings of [19] that the respondent lecturers of pure and applied science related disciplines in the tertiary institutions studied seems not to believe in the use of ICT communication media for dissemination of knowledge. At best this may be a temporary position, as unfolding events in ICT advancement will make such belief unpopular.

The evidence is clear that there are many problems with the current academic system. The fact of the matter is that until 2004, Nigerian tertiary institutions instructional methods remained the same over the last 40years [15]. Those institutions that properly access the changes coming and respond in the appropriate manner will ultimately enroll into the new phase of technology enhanced learning and will be better poised to meet the demand of an evolving information society. In the long run, the effectiveness of these new digital tools will be dependent on the way in which these ICT policies are evaluated and implemented.

3.   RESEARCH METHOD

Research design plays a critical role in determining internal strategies adopted in a given study. It is important to note that the validity and reliability of findings in a study is dependent on the research approach adopted and its suitability to the problem [20].This research, being an exploratory study employed a mixed mode method by combining case studies and survey approach reach its objectives. Post-positivist research philosophy was considered in developing this research approach. Post-positivist philosophy emphasize on the need to triangulate information from different sources so as to improve both the construct and internal validity of the research [20]. 5 departments of Architecture from five different universities in Nigeria were carefully selected for our case studies while a random sample of 30 respondents cut across students, lecturers, and technical staff were randomly sampled to obtain quantitative data for the research.

For the qualitative data, a qualitative data analysis software package (NVIVO) was used to assist in coding, and derivation of themes from the interview data and was validated based on the findings of our literature review. The quantitative data obtained was analysed using SPSS for the descriptive values using simple frequencies and percentages and Cronbach's alpha value of 0.7 to validate the collected data.

4.   RESULTS AND ANALYSIS

Some educational systems have assumed that the provision of computers for teachers or increased teacher training and professional development, would lead to a more effective computer use. However, the existence of any technological artifact is no guarantee that it will be used for its intended purpose, and if computers are found in classrooms, they may not be used to their full potential. The difficulty in understanding the future implication of new technologies in society is seen in the growth of the Internet throughout the world, and in particular, in educational institutions. To this effect, a survey was conducted in five selected faculties of Architecture of five different universities in Nigeria, to show the readiness for new computerized functions and total integration of ICT in architectural education. Responses received from some universities were then tabulated as in the table below.

Table 1. Responses From Five Nigerian Universities School of Architecture

		UNIVERSITY OF UYO (%)	UNIVERSITY OF JOS (%)	FED. UNI. OF TECH, YOLA (%)	ANBROSE ALI UNIVERSITY (%)	O. A. U. ILE-IFE (%)
ACCESS TO COMPUTERS	Desktop	100	100	100	100	80
	Laptop	40	70	90	50	100
	Printer & Plotters	10	80	80	10	80
	Projector & Screen	20	80	70	20	50
Purpose of Computer Usage	Word Processing & Spreadsheet	80	100	70	50	90
	Computer Design & Presentation	80	100	50	50	90
	E-Construction Management	10	10	60	10	20
	Internet Connectivity	30	100	100	10	20
	Browsing & E-mailing	60	100	80	50	40
	Data Analysis / GIS	50	60	80	50	60
Barriers to Computer Usage	Electricity Failure	80	80	70	80	60
	Computer Cost	60	40	20	80	60
	Computer Illiteracy	60	20	20	50	10
	Fear of Data Loss Through Computer Usage	50	30	80	50	80
Readiness for New Functions	Further Internet Usage	50	100	90	80	40
	In-house Software Development	30	60	90	10	50

From Table 1, availability of computers for the design and management work varies across some Nigerian Universities. Desktops top the list as all the schools have 100% accessibility to Desktop computers in all the offices and computer studios. Computers are now considered as the enhancing part of the office furniture. It can also be said that computer presentation of design (AutoCAD) is currently in vogue which accertain the fact that most prefessionals now feel uncomfortable and incomplete without computers in their offices. Majority of the participants have access to desktop computers which is provided by the universities in various offices, but individuals with laptop vary from one University to another. Projector screens for power-point presentation is still an area to be harnessed properly as most universities use it occacssionally as the need arises.

The Architecture departmental possession of ICT facilities in most Nigerian Universities is very low. For the most essential ones needed for training the students, the average percentage representing departmental possession is less than one-quarter. Various government organs have seen the need for integrating ICT culture into the educational system in the country. However, this aspiration has not been met with required implementation seriousness. [21] has noted that most teacher trainers in tertiary institutions in Lagos State of Nigeria have gotten little or no ICT support from their employers. There has been much rhetoric about ICT deployment in teaching and research and less of reality. The purposes for which these computers are acquired by the departments for the educators also indicate that the educators are operating on general and popular ICT awareness and possess low skill and awareness of industry specific functional ICT needs. As factors such as convergence, increased bandwidth, "edutainment", multitasking and changes to traditional socialization modify everyday life; there is a corresponding need to consider the ways in which emerging practices and beliefs challenge traditional assumptions about the nature of tertiary education. Although educational institutions are by nature conservative and can be resistant to reform, the collective influence of an increase in the number of networked computers, improved teacher training, and the impetus of a transformed culture in wider society are likely to lead to a reconsideration of the nature of education.

The survey reveals that the purpose for which these computers are being used indicates that all respondents use computers for word processing and spread sheet apart from the leading role of using computers for design presentations (see Table 2). These activities are invariably the most important technological tools for managing and integrating diverse design activities and construction.

Table 2. The usage of computer in architectural design

	Practice of Architecture		Teaching of Architecture
Architects	- word processing - planners data analysis - design generation - design verification - draughting - graphic presentation	**Students**	- word processing - data analysis - design generation - design verification - draughting - Computer Aided Instrument(**CAI**)
Draughtsman	- draughting - Graphic presentation	**Lecturers**	- word processing - data analysis - design generation - design verification - draughting - Computer aided Instrument - Research/Development
Administrative and Technical Staff	- word processing - desktop publishing - graphic presentation - database management - financial record keeping - electronic mail	**Technical and Administrative Staff**	- word processing - desktop publishing - draughting - accounting - student records - bibliographic database - electronic mail
Structural Engineers	- word processing - data analysis - structural design - design verification - draughting - graphic presentation		
Quantity Surveyors	- word processing		
Services Engineers	- word processing - data analysis - design generation - design verification - draughting - graphic presentation		
Management Consultants	- word processing - data analysis - project management - graphic presentation		

In order to know the trend of progress in the new ICT technology in Architectural Education, questions were asked to know the readiness on the emerging operational functions of the participants in the global dispensation and software development. As shown in Figures 1, 2 and 3, more than 50 percent of the respondents were willing to connect to the internet on their own irrespective of the university's status on internet connectivity within the four walls of the university.

In-house software development is another new area where architecture departments can explore to develop their own software to suit their own style for easy management of students' results, course registration and distribution, staff and students records. In the developed countries, in-house software development has become a catalyst for efficient management of the academic institutions [22].

Following the report of [23] that ICT has developed in the Nigerian University System through the inputs from the computer science departments and computer centers, it follows that Architectural educators who did not go through such academic programme will be left with the option of private on-the-job training or self-taught training. [21] has reported that about 77% of the tertiary education teachers have improved their ICT capacity level through self-taught or on-the-job training. The preponderance of the self-taught training by educators requires self-motivation on the part of the learners so as to overcome learning struggles without abandoning the learning process. However, it is apparent that self-taught learners, as usual will have to pass through various stages of awareness. While some may overcome the learning struggles and move to advanced stages of awareness and adoption, many may be satisfied with the basic knowledge and be operating at the periphery of ICT knowledge, use and adoption. Formal ICT training for the Architectural educators may therefore become imperative if their products are to meet the expectations of the ICT-driven industry and global economy.

Such results are not surprising because previous classroom technologies such as television have not been widely adopted because teachers need to be convinced that challenges to the rituals of everyday classroom life are in their interest. Educational systems are inherently conservative and resistant to change. Departure from conventional practices and continuity are justified only if the intended innovation is simple, durable and reliable.
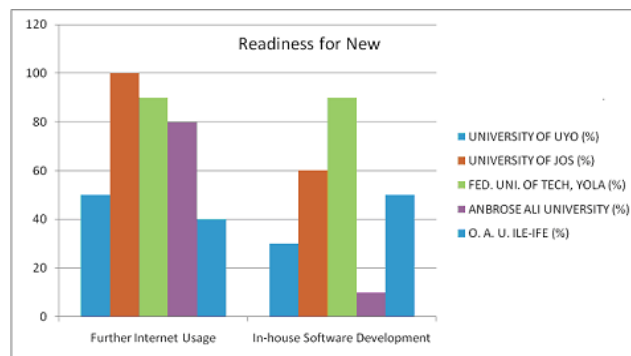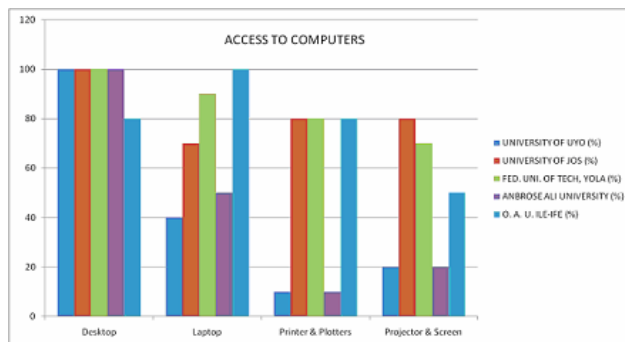
Figure 1. Readiness for new functions

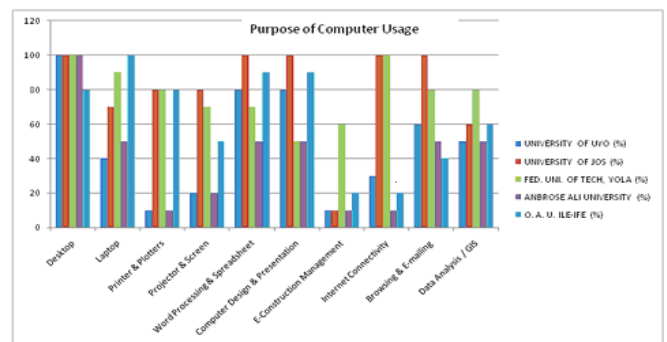Figure 2. Computer accessibility by some Universities
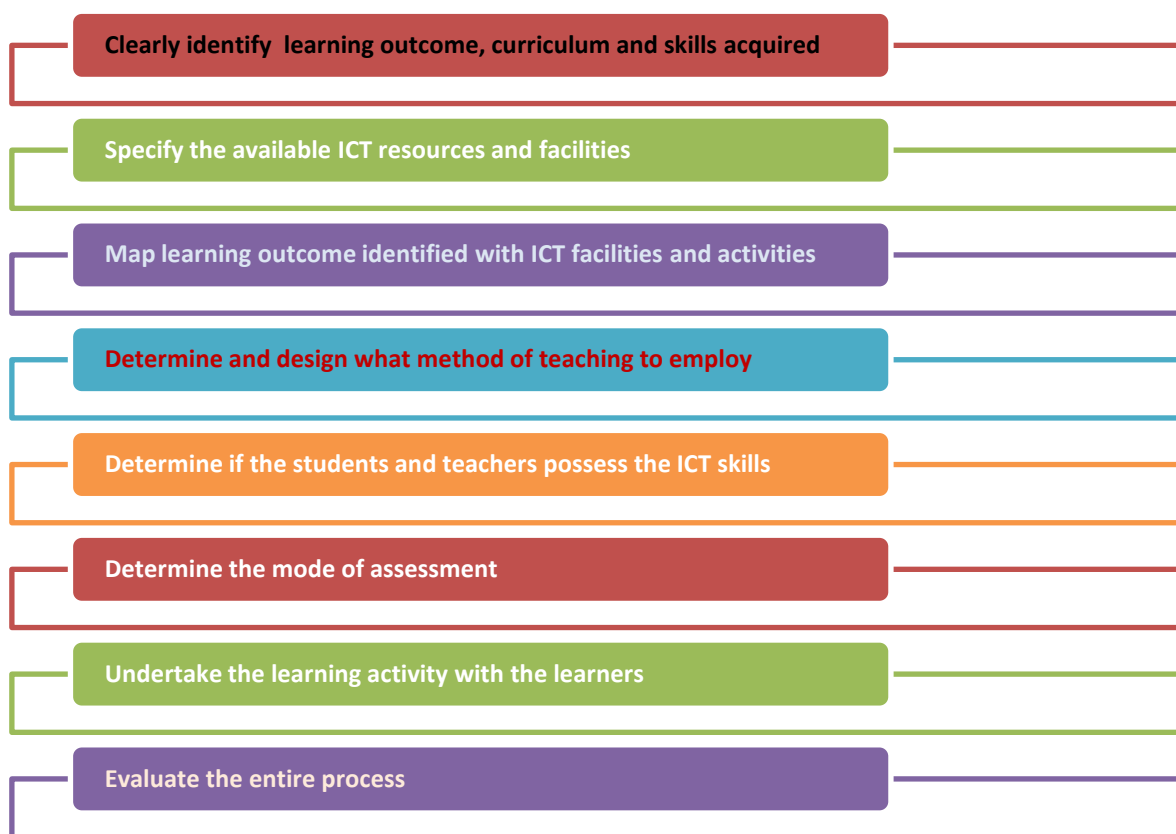

Figure 3. Computer usage by some Universities

4.1. Summary of Findings

It is apparent from this study that Architectural educators lack ICT facilities that can integrate IT culture into the educational system of the Architectural industry graduates. This is bound to have effect on how the graduates adopt and adapt to ICT in the industry, and consequently the industry is worse off for not having the capacity to deliver value in the project procurement process. This ultimately will affect the capacity of the industry to compete globally. The proficiency threshold is average. Majority of the Architectural educators are already able to understand and apply ICT to the teaching and research process and as well able to use ICT with familiarity and confidence. There is need for acquisition of further expertise so as to be able to move to later stages of ICT adoption.

The expertise level measure in proficiency terms, for the industry specific ICT tools is below average. While the expertise level for design packages is the highest it does almost not exist for other equally relevant packages being used in the project procurement process. Cost of hardware and software has been singled out as having significant impact in limiting or inhibiting the deployment of ICT tools in teaching and research process. Other factors that show some level of significant inhibition to ICT deployment are inadequate and ineffective telecommunication network, computer illiteracy among staff, attitudes of staff to ICT deployment in Architectural education and inadequate relevant software. The Architectural educators must have ICT knowledge-edge over the industry applicators of ICT tools. This is necessary to provide necessary leadership in education and in research into applications relevant for the use of the industry practitioners.

4.2. Our Proposed Evaluation Framework

We present below our proposed framework for the evaluation of any ICT enhanced learning activity:

Clearly identify learning outcome, curriculum and skills acquired

Specify the available ICT resources and facilities

Map learning outcome identified with ICT facilities and activities

Determine and design what method of teaching to employ

Determine if the students and teachers possess the ICT skills

Determine the mode of assessment

Undertake the learning activity with the learners

Evaluate the entire process

Below are the explanations for every phase of the framework.
- Clearly identify the learning outcome, aim of the curriculum and skills the learner will acquired from the training.
- Specify the available ICT resources and facilities such as computers, Internet, software packages, etc.
- Map each of the learning outcome identified earlier with the right ICT facilities and activities.
- Determine and design what method of teaching to employ e.g. discussion group, laboratory practical class, demonstration, etc. and what part the student is to play in the learning activity and the outcome.
- Determine if the students and teachers possess the ICT skills required for the learning activity and whether real-time support such as quick tips and online help, will be available to help the learner during the learning activity.
- Determine the mode of assessment, which must reflect the learning process and its expected outcome.
- Undertake the learning activity with the learners.
- Evaluate the entire process, identify its strengths and setbacks in the methodology and make appropriate inputs to the process.

5.   CONCLUSION

Information and communications technology (ICT) revolution has taken place in many tertiary institutions without institutional policies in place. The potential educational uses of these technologies are most times misused or underused while the acquisition cost remains high. Understanding the criteria to use and how to measure success are some of the challenges faces by most departments of Architecture in Nigerian Universities. Thus, this paper has attempted to address these challenges by proposing an evaluation framework for the adoption of new ICTs in tertiary institutions of learning with particular interest in Architectural education. The practical implication of this study is that the framework can help educational institutions develop policies to address fundamental and relevant ICT usage and application issues in theier learning programs.

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