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INTERACTIVE ICT LABORATORY USAGE IN A DEVELOPING ECONOMY: CHALLENGES & PROSPECTS

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Abstract

This paper seeks to highlight the myriads of challenges inherent in the use of an interactive Information and Communication Technology (ICT) laboratory in a developing economy. Challenges ranging from the operational efficiency to security which are quite critical to the successful running of labs on a day-to-day basis are considered in this research. Specifically, this paper seeks to reveal some key requirements often ignored at the planning and implementation stages of establishing and managing an interactive ICT laboratory in developing economies. Moreover, the paper also establishes a link between the locations of installed computing facilities in interactive laboratories and the usage of the respective devices, and hence the self-adjudged productivity of each end-user. The results presented serve as a useful tool and guide for policy planners, implementers, researchers and laboratory managers, especially those related with institutions of higher learning in developing economies.

Introduction

Nowadays, the use of ICT laboratories for teaching and research has become a global concept [1]. Although teaching at higher levels of education mostly concentrates on giving information, other objectives include: development of understanding and application of concepts; expression power; reasoning and thinking power; judgement and decision making learning reinforcement among others.

With the level of infrastructure, class size, availability of qualified teachers especially in developing countries, it is often quite challenging to achieve all the aforementioned objectives simultaneously.

Lately, ICT provides a mechanism through which most of these objectives could be reasonably realized. ICT laboratories are noted for providing access to different information sources, enabling online interactions where students and teachers can exchange ideas and views on any subject of interest. They are equally known to provide learners with the opportunity to work on any live projects with other learners and experts from across the globe.

It is common knowledge that in developing economies, it is often the case that little end-user feedback is taken into consideration especially when setting up and running an ICT laboratory. Even in situations where potential end-user requirements is elicited, it is often the management perspective that is implemented leading to bottled-up frustrations on the part of the end users which could negatively impact on their productivity.

Setting up and Managing an interactive laboratory in a developing economy is often an art as well as a science. Approaching the subject from a scientific point of view includes a careful survey as well as planning on the composition as well as the intended users to provide a rewarding experience for the parties concerned.

From the artistic perspective though, emphasis could be placed both on the aesthetics as well as the pragmatics. This paper is more concerned with the pragmatics than the aesthetics. Specifically, the paper seeks to establish, using empirical evidence, the salient influence of ICT facilities or lack of it on user experience and how this impact on perceived end-user productivity levels.

The rest of the paper if organized as follows: Section II presents an updated literature on the advances in the subject area; Section III focuses on the research methodology adopted giving details of how the primary data sources were obtained including the tools used in the data analysis. Section IV gives a comprehensive discussion of the results and how these address the research questions espoused in this paper. The paper is concluded in Section V with a summary of the research findings together with recommendations for future work.

Related Works

The role of ICT in schools has been emphasized by the researchers in [2]. Based on their research findings, educational institutions try to inculcate ICT in their respective curricular in order to enable teachers and students to access relevant and up-to-date knowledge. In addition, ICT serves as an invaluable tool for the evaluation of students as well as teacher performances.

A digital laboratory has been defined as a network of computers, together with appropriate software, which provides most of the functions of a conventional (analogue) language lab together with integration of video, word-processing and other computer applications. A digital lab has many benefits some of which have been observed to out-

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weigh its downside. However, it is observed that emphasis is often placed on the deployment of ICT facilities without adequate consideration for the laboratories that house the hardware and software which constitute the computer systems.

Taking advantage of digital laboratory, the authors of [3] explored the nature of creativity and hence the design of creativity enhancing computer systems. Although their research is multi-disciplinary by design, it is firmly founded on human-computer interaction and creative practices.

Information and Communication Technology (ICT) is a term often used to refer to a broad spectrum of technologies (i.e., hardware and software) that can store, retrieve, manipulate, transmit and receive information electronically in a digital form [4].

Interactive ICT lab has become a must-have in most institutions of learning nowadays. It is the bedrock upon which present and future knowledge stands and thrives. It is common knowledge that most laboratories in developing countries lack the basic infrastructure required for efficient and effective lab experience.

ICT labs are supposed to be specialized therefore cannot afford to be just another lab the way it is in most cases. The way we have them in most setups will not provide the support needed for development. Most labs in developing economies are still being crisscrossed with wires, low internet bandwidth and inadequate facilities required for effective lab experiences.

Siti et.al [5] conducted an exploratory study to investigate the usage of network resources by ICT Teachers. The study is aimed at using the outcome to manage network usage in school computer laboratories which will also serve as a guideline to develop a new model for network management tasks in school computer labs generally. Although this work favourably compares to ours, the focal area of this paper clearly differs in terms of category as well as the data sources. Besides, this paper seeks to also establish a relationship between the usage of the ICT devices vis-a-vis the location of the devices in the computing labs.

Laboratories can be remotely managed as shown by the authors of [6]. The Remote Lab Management System (RLMS) is built with web space management, data warehouse, communication board functionalities, among others to provide connectivity and diagnostics services. The challenge of basic infrastructure availability however, renders this solution unsuitable for developing economies at the moment.

Using Cloud resources, the authors of [7] present a proposal for a platform to create and manage virtual computing laboratories. Using their proposed platform, a teacher can create customized virtual machines that learners can use to get access to the necessary computing resources to attend lab sessions. The machines for the lab are designed to be accessed using remote desktop protocol and can be managed by non-experts. This lofty idea seems plausible for advanced economies where availability of basic infrastructure is assured for a greater majority of the potential users.

Research Methodology

A. Data Source

The primary data was sourced through a system of questionnaires administered to ICT laboratory users in three different higher institutions of learning in Nigeria (a developing economy). Specifically, the respondents were randomly selected without any bias in order to increase the level of credibility of the data.

B. Respondents

As mentioned in the preceding section, the respondents were restricted to ICT laboratory users only. Besides, the respondents were only verbally asked if they would like to partake in the survey. No any form of bias (e.g., gender, age, education level, sexual orientation, religion among others) was considered in the selection of the respondents in this research.

C. Instruments

In order to elicit the required information from the respondents, a questionnaire was designed with open-ended questions. The questionnaire comprised of 2 sections namely, demographic and ICT lab usage information respectively. The demographic information sought are limited to gender and age group only while the ICT laboratory usage comprises of several multiple-choice questions, where the respondents were required to select the most appropriate answers in each case.

IV. Results and Discussions

The percentage age distribution of the respondents in this research is given in Fig. 1. Not surprisingly, it is obvious from the figure that the bulk of the respondents fall within the age bracket of 18-25, which is consistent with the age group of those undergoing higher education, especially in the universities. Although the research questionnaires were

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administered in the ICT labs exclusively, several other users who were not students also took part, resulting in the statistics presented in Fig. 1

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Fig. 2 presents the percentage distribution of the hours spent in the ICT lab as advanced by the respondents.
Although no specific hour of the day was given, over half of the respondents indicated that they spent between one and three hours using the ICT lab per day. What is glaringly curious from this figure is perhaps the over 30% of the respondents who spent less than an hour in the ICT labs per day. This may not be unconnected with the state of the ICT infrastructure which could either be unavailable when needed or could be disrupted resulting in the user becoming frustrated and hence leaving the ICT laboratory prematurely. Therefore, it is not surprising that only a few number of the respondents indicated that they spent between five hours and more using the ICT laboratory per day.

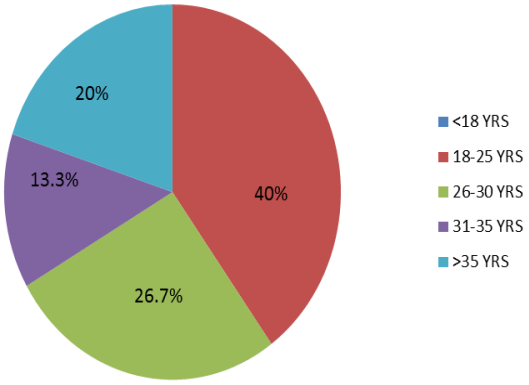

Fig. 1. Age distribution of Respondents

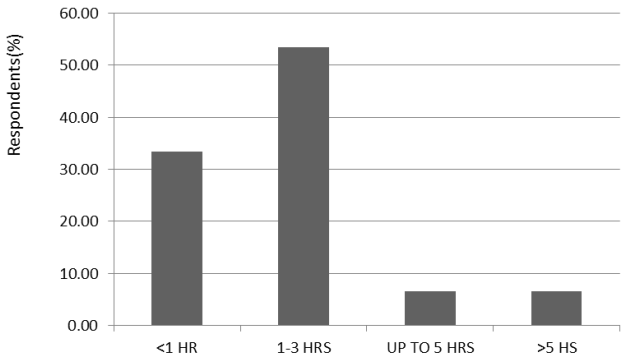

Fig. 2. Distribution of Hours Spent in the ICT lab by the Respondents

When asked about the number of days in a week the respondents use the ICT labs, the result of the response is as presented in Fig. 3. From Fig. 3 it can easily be deduced that majority of the respondents indicate that they use the ICT labs five times or more. This again is consistent with the official working days (i.e., Monday to Friday) in this part of the world. The fewer numbers who however indicates they use the ICT labs between once and thrice in a week. The reason for this could be attributed to either the aforementioned infrastructural deficiencies or it could be due to other commitments such as attending non-lab based course lectures among others.

X-raying the major concerns of each respective respondent based on their individual experiences of using the ICT labs resulted in the chart presented in Fig. 4. Nearly half of the respondents worry more about availability of network connectivity than other concerns such as light/electricity and availability of ICT facilities (e.g. computers, laptops, etc.). Frequent network downtime is nearly a uniform concern among the respondents spread among the various institutions where this research was conducted. Security is however does not constitute a concern to the respondents as evidenced in the result (0%).

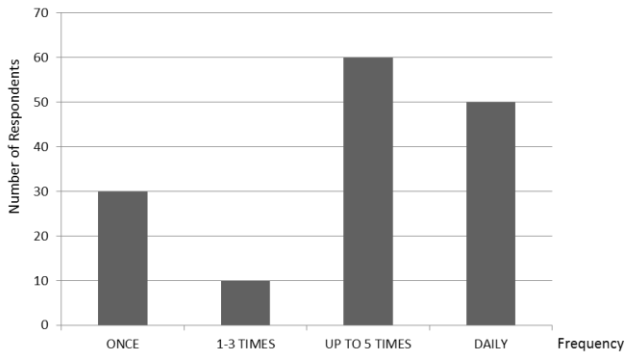

Fig. 3. Distribution of Weekly ICT lab Usage

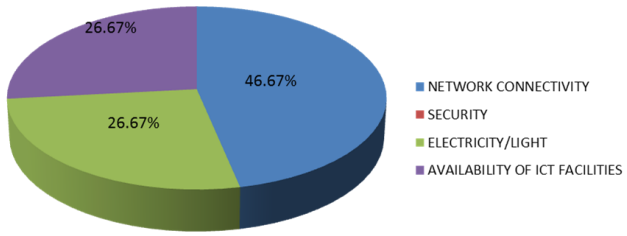

Fig. 4. ICT lab Usage Concerns

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Closely related to the concerns of the ICT labs users is what constitutes the major obstruction experienced during lab usage. Fig. 5 presents the percentage distribution of the major obstructions experienced by our respondents. From this figure, network failure emerges as the major obstruction source with about 45% of the respondents pointing to it. Distraction from noise emanating from fellow lab users comes second while light/electricity obstruction comes a distant third accordingly. Because most ICT labs in developing economies often rely on back-up electricity generating sources, it is not surprising that a smaller number of the respondents pointed to it as a major obstruction source. What this means is that policy formulators and implementers, especially in higher institutions, should ensure strict compliance with laid down rules on ICT lab usage.

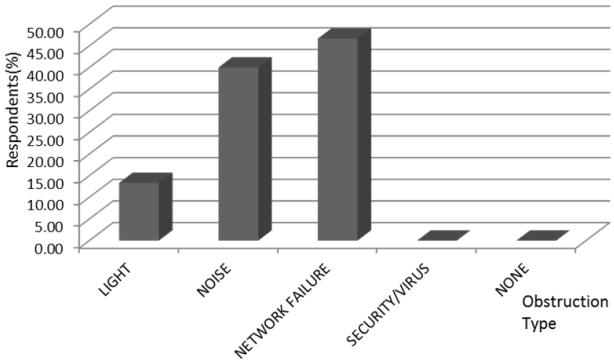

Fig. 5 Major Obstructions to Lab Users

In order to ascertain the correlation between the use of preferred ICT lab facility (i.e., computer) and the level of individual productivity as adjudged by the respondents, Fig. 6 presents the results of our findings.

About 60% of the respondents affirmed that they realized a high level of productivity when they use their preferred ICT lab facility (i.e., computer). Moreover, 20% of the respondents realized a very high level of productivity when they use their preferred computers. Although a small percentage of the respondents record no difference or low levels of productivity when using their preferred systems, this number is incomparable to the 80% whose productivity is significantly improved when using their preferred choice of computer system in the ICT lab. What this result signifies is that with increase in the choice of ICT facilities (especially computers) to the users, their individual productivities are likely to increase proportionately.

Table I presents the demographic data of the respondents highlighting the age distribution of their weekly ICT lab usage. From that table, it can easily be deduced that majority of the respondents who use the ICT laboratory for minimum of five times per day are those within the 18-25 years age bracket.

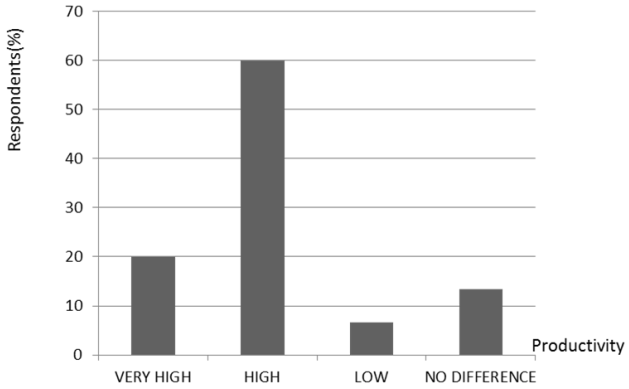

Fig. 6. Productivity When Using Preferred ICT Lab Facility

	Once	1-3 times	Up to 5 times	Daily
Age Group				
< 18 Years				
18-25 Years			30	30
26-30 Years		10	20	10
31-35 Years	20			
> 35 Years	10		10	10

TABLE I: Age Distribution of Weekly ICT Laboratory Usage

The gender distribution of the ICT lab users based on the hours spent in the labs is given in TABLEII. Eighty male respondents, representing over 53% of the total population spend between zero to three hours in the ICT lab daily while correspondingly fifty female respondents or about 33% of the total population spent equal amount of time in the ICT lab per day.

	< 1 hr.	1-3 hrs.	Up to 5 hrs.	> 5 hrs.
Gender				
Male	30	50		10
Female	20	30	10	

TABLE II: Gender Distribution of Hours Spent in the ICT Laboratory Per Day

The age distribution of the hours spent in the ICT lab per day is given in TABLE III. From this table, it is obvious that the group whose ages fall within the undergraduate category (i.e., 18-25 years) predominantly spend more time in the ICT laboratory than the older groups. A plausible explanation for this can be seen from the lifestyles of the younger generation who are much more exposed to the use of ICT facilities than their older counterparts.

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In an attempt to establish a link between an individual user's productivity and their choice of an ICT facility (i.e., computer) we inquired of the respondents whether or not they each had a system they would prefer to use in the laboratory. The collated result from the respondents, sorted based on their respective age groupings, is given in TABLE IV.

	< 1 hr.	1-3 hrs.	Up to 5 hrs.	> 5 hrs
Age Group				
< 18 Years				
18-25 Years	10	40	10	
26-30 Years		30		10
31-35 Years	20			
> 35 Years	20		10	

TABLE III: Age Distribution of Time Spent in the ICT Laboratory Per Day

	Yes	No
Age Group		
< 18 Years		
18-25 Years	40	20
26-30 Years	20	20
31-35 Years		20
> 35 Years	10	20

TABLE IV: Age Distribution of ICT Facility Usage Preference

The age distribution of the respondents based on their respective concerns as ICT laboratory users is given in TABLE V.

	Con.	Sec.	Light	ICT Fac.	Others
Age Group					
< 18 Years					
18-25 Years	20		10	30	
26-30 Years	20		20		
31-35 Years	10		10		
> 35 Years	20				10

TABLE V: Age Distribution of the Major Concerns to ICT Lab Users

From this table, it is clear that majority of the respondents are more worried about network connectivity than other concerns (i.e., light/electricity, security, availability of ICT facilities, etc.). This singular concern cuts across all the three institutions of higher learning from where the primary data is sourced. In the same vein, network connectivity is the overwhelming concern cutting across all the age groups as evidenced in the table. What this result means to policy planners and implementers is that greater emphasis should be placed on the availability of network connectivity than other issues confronting the ICT lab users in higher institutions of learning.

V. Conclusion

In this paper a research into the usage of ICT laboratories is conducted. Specifically, the paper focuses on empirical and primary data sources obtained from users of interactive ICT laboratories in three different higher institutions in a developing economy. This is deliberate in order to improve the integrity of the data, since all the respondents are adults whose participation in the research is voluntary. Moreover, because the research was carried out in each of the respective ICT laboratories with the respondents supplying the data as they use the ICT facilities, chances of errors due to memory relapse is minimized.

The results reveal the spread of the general concern among ICT lab users in developing economies, especially as it relates to age and gender. Another important revelation is the relationship that exists between the self-adjudged productivity of individual ICT lab users and their choice of ICT lab facilities (with emphasis on computer system). Further studies are likely to reveal the details of this correlation.

Moreover, because majority of the respondents attested to the fact that with their choice computer systems, the levels of their respective productivity is at least high, it then calls for further empirical investigation to ascertain the details of this productivity measure.

Acknowledgments

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Biography

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