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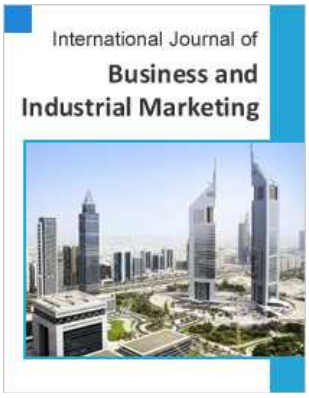

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Human Factor in Application of Technology and Operational Cost Reduction in Nigerian Tertiary Institutions

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Abstract
History is full of technology breakthroughs in education, all striving to increase productivity and efficiency; we've seen technology changing the way we get things done, sometimes in a disruptive way. It has also been observed that the application of modern information technologies to educational activities and services in Nigerian tertiary institutions seems inadequate probably due to a variety of factors, including human factors, fear, and the state of infrastructural development of the country. Not a few practitioners also believe that there is hardly much benefits that can be derived from the use of IT applications thereby giving preferences for it resistance or poor adoption. Those who are aware of its benefits are afraid of being eliminated from their jobs; though knowing that its application to educational routines such as acquisitions, administration, delivery, circulation, information retrieval and control would facilitate effective and efficient operational cost reduction. Most recently mission critical computing systems have been introduced in educational processes and automated tasks, resulting in increased efficiency and operational cost reduction, but can these technologies help keep the standard and the level of productivity? That's where technology can support but not replace humans. Education therefore relies on human ability to respond to the unexpected, to handle the odd conditions and ask the right questions to fix the problems at hand. Today, employees in our educational institutions are loaded with numerous activities, is it reasonable to expect they'll be able to respond appropriately to all conditions, what are the human elements that should be taken in to consideration in the design, adoption and implementation of modern educational technologies? These issues and more will be addressed in this paper. In addition, this paper adopts a socio-technical systems approach to examine how operational efficiency in the educational sector can be enhanced from a human factors perspective.

1. Introduction

In the Nigerian educational sector, 'Human Factors' has become synonymous with management of employees in our educational system (Adeyemi, 2004; Anunobi, 2005;

Ayo, 2001). However, there is much more to the discipline than this. All boundaries and divisions created by man are artificial, and subject matter boundaries in the complex world of education are both artificial and arbitrary (Aguolu and Aguolu, 2002; Ani, Esin and Edem, 2005; Aniekwu and Ogbeide, 2002). However, when addressing a topic such as the role of Human Factors in educational efficiency some structure is essential (Ani, Esin and Edem, 2005; Aniekwu and Ogbeide, 2002; Anunobi, 2005; Ebijuwa, 2005; Ehikhamenor, 1993). As a result this discourse is organised around a socio technical systems framework to impose some structure on the chaos (Ekong, 2005). This structure also reflects the organisation and application of information technologies in our tertiary institutions and clarifies the influences that affect the manner in which it operates. Humans play a central role in our educational activities. Occasionally, however, a worker does not or is not able to do his or her job correctly or in the required time. These human performance failures can result in a number of unwanted consequences, such as mass failure, examination malpractices, absenteeism, high operational cost, declining standards, personal injury, and equipment damage (Adeyemi, 2004; Aguolu and Aguolu, 2002).

Two major categories of human performance failures associated with educational operations are errors and violations of policies, processes, or procedures (Awolusi, Onikoyi and Akamo, 2015). We often refer to these violations as procedural non-compliance. Although errors are *unintentional* deviations from the expected action or behavior, the worker who violates policies, processes, or procedures, does *so intentionally*. Well-intentioned individuals often commit violations trying to finish a job, and not simply for comfort or to reduce workload. During educational activities, there is an assumption that workers will follow the institution's policies, processes, and procedures as written. When this assumption is broken, it places the whole basis of the desired standard at risk (Ebijuwa, 2005). In some cases, employees may commit violations because of factors dictated by his or her immediate situation, such as time pressures, insufficient staff, or unavailability of tools or equipment. In other cases, violations have become common practice and have become almost automatic. *In Nigeria educational system, m*anagement and regulators often know about and unofficially condones routine violations, making these violations more of a management issue than an individual worker issue. In rare cases, a employee will break rules while disregarding the consequences (Adeyemi, 2004; Aguolu and Aguolu, 2002).

Despite the inherent challenges, and the globalization of education, there is persistent and increasing pressure on employees in Nigerian tertiary institutions to achieve effective and sustainable performance. These are mainly due to the following:

-Increasing regulatory demands and audits
-Increasing use of 2nd and 3rd Gen technologies
-New emerging threats
-New skills and training required
-Increasing demands for qualitative education by Nigerians
-Increasing students demands

Consequently, to meet the aforementioned challenges, the need and Importance of Information Technology in Nigerian Educational system cannot be overemphasis (Adeyemi, 2004; Aguolu and Aguolu, 2002; Ayo, 2001).

1.1. Need

- Education is a life long process therefore anytime anywhere access to it is the need
- Information explosion is an ever increasing phenomena therefore there is need to get access to this information
- Education should meet the needs of variety of learners and therefore IT is important in meeting this need
- It is a requirement of the society that the individuals should posses technological literacy
- We need to increase access and bring down the cost of education to meet the challenges of illiteracy and poverty-IT is the answer (Osundina, 1973; Ortiz-Zapata and Quintana, 2007).

1.2. Importance

- access to variety of learning resources
- immediacy to information
- anytime learning
- anywhere learning
- collaborative learning
- multimedia approach to education
- authentic and up to date information
- access to online libraries
- teaching of different subjects made interesting
- educational data storage
- distance education
- access to the source of information
- multiple communication channels-e-mail, chat, forum, blogs, etc.
- access to open courseware
- better accesses to children with disabilities
- reduces time on many routine tasks (Oni, 2004; Oketunji, 1999; Ojo-Igbinoba, 2003).

2. Information Technology (IT) in Education

The pace of change brought about by new technologies has had a significant effect on the way people live, work, and play worldwide. New and emerging technologies challenge the traditional process of teaching and learning, and the way education is managed. Information technology, while an important area of study in its own right, is having a major impact across all curriculum areas. Easy worldwide communication provides instant access to a vast array of data, challenging assimilation and assessment skills. Rapid communication, plus increased access to IT in the home, at

work, and in educational establishments, could mean that learning becomes a truly lifelong activity—an activity in which the pace of technological change forces constant evaluation of the learning process itself. The term "Information Technology" (IT) has been variously defined. Marshall (1984) defined it as the coming together of computing and telecommunications for the purpose of handling information; the application of technologies to information handling; including generation, storage, processing, retrieval and dissemination. It is also concerned with the acquisition, processing, storage and dissemination of information-textual, numerical, pictorial and vocal. It is a broad-based term comprising the gathering (acquisition), organization (packaging), storage and retrieval (dissemination) of information that can be in textual or numerical (books, documents), pictorial and vocal forms (audio–visual) or a combination of all the above (multimedia), using a combination of computer and telecommunications devices. Emuakpor (2002) defines it as all forms of technology applied to the processing, storing and transmitting information in electronic form; stressing that the physical equipment used for this purpose include computers, communication equipment and networks; fax machines and electronic, pocket calculator. Ayo (2001) viewed it as the use of computer system and telecommunications equipment in information handling; consisting of essentially three basic components viz: Electronic processing using the computer; Transmission of information using telecommunication equipment; and Dissemination of information multimedia (Akeke,. Akeke, and Awolusi, 2015; Nwizu, 2008; Nwokedi, 2007).

2.1. Significance of IT in Education

- *Access to variety of learning resources:* IT aids plenty of resources to enhance the teaching skills and learning ability. With the help of IT now it is easy to provide audio visual education. The learning resources are being widens and widen.
- *Immediacy to information:* IT has provided immediacy to education. Now in the year of computers and web networks the pace of imparting knowledge is very very fast and one can be educated anywhere at any time.
- *Any time learning:* One can study whenever he wills irrespective of whether it is day or night and irrespective of being in India or in US because of the boom in IT.
- *Collaborative learning:* Now IT has made it easy to study as well as teach in groups or in clusters. With online we can be unite together to do the desired task. Efficient postal systems, the telephone (fixed and mobile), and various recording and playback systems based on computer technology all have a part to play in educational broadcasting in the new millennium.
- *Multimedia approach to education:* Audio-Visual Education, planning, preparation, and use of devices and materials that involve sight, sound, or both, for educational purposes. Among the devices used are still and motion pictures, filmstrips, television, transparencies, audiotapes, records, teaching machines, computers, and videodiscs.
- *Authentic and up to date information:* The information and data which are available on the net is purely correct and up to date.
- *Online library:* Internets support thousands of different kinds of operational and experimental services one of which is online library.
- *Distance learning:* Distance Learning, method of learning at a distance rather than in a classroom. Late 20th-century communications technologies, in their most recent phases multimedia and interactive, open up new possibilities, both individual and institutional, for an unprecedented expansion of home-based learning, much of it part-time.
- *Better accesses to children with disabilities:* Information technology has brought drastic changes in the life of disabled children. IT provides various software and technique to educate these poor peoples (Ani et al., 2005; Aniekwu and Ogbeide, 2002; Anunobi, 2005; Ayo, 2001).

2.2. Theoretical Proposition

Various pedagogical perspectives or learning theories may be considered in designing and interacting with educational technology. These theoretical perspectives are grouped into three main theoretical schools or philosophical frameworks: behaviorism, cognitivism and constructivism (Capron, 2000; Daniel, 2000; Ekong, 2005).

2.3. Behaviorism

This theoretical framework was developed in the early 20th century based on animal learning experiments by Ivan Pavlov, Edward Thorndike, Edward C. Tolman, Clark L. Hull, and B.F. Skinner. Many psychologists used these results to develop theories of human learning, but modern educators generally see behaviorism as one aspect of a holistic synthesis (Ehikhamenor, 1993; Idowu and Mabawonku, 1999).

B.F. Skinner wrote extensively on improvements of teaching based on his functional analysis of verbal behavior and wrote "The Technology of Teaching", an attempt to dispel the myths underlying contemporary education as well as promote his system he called programmed instruction (Onikoyi,. Awolusi, and Boyede, 2015). Ogden Lindsley developed a learning system, named Celeration, that was based on behavior analysis but that substantially differed from Keller's and Skinner's models (Nwalo, 2000; Marshall, 1984).

2.4. Cognitivism

Cognitive science underwent significant change in the 1960s and 1970s. While retaining the empirical framework of behaviorism, cognitive psychology theories look beyond behavior to explain brain-based learning by considering how

human memory works to promote learning (Chisenga, 1995; Capron, 2000). The Atkinson-Shiffrin memory model and Baddeley'sworking memory model were established as theoretical frameworks. Computer Science and Information Technology have had a major influence on Cognitive Science theory. The Cognitive concepts of working memoryand long term memory have been facilitated by research and technology from the field of Computer Science. Another major influence on the field of Cognitive Science is Noam Chomsky. Today researchers are concentrating on topics like cognitive load, information processing and media psychology. These theoretical perspectives influence instructional design in the educational sector (Madu, 2002).

2.5. Constructivism

Individual (or psychological) constructivism (such as Piaget's theory of cognitive development, and social constructivism) has a primary focus on how learners construct their own meaning from new information, as they interact with reality and with other learners who bring different perspectives. Constructivist learning environments require students to use their prior knowledge and experiences to formulate new, related, and/or adaptive concepts in learning (Termos, 2012). Under this framework the role of the teacher becomes that of a facilitator, providing guidance so that learners can construct their own knowledge. Constructivist educators must make sure that the prior learning experiences are appropriate and related to the concepts being taught. Jonassen (1997) suggests "well-structured" learning environments are useful for novice learners and that "ill-structured" environments are only useful for more advanced learners. Educators utilizing a constructivist perspective may emphasize an active learning environment that may incorporate learner centered problem based learning, project-based learning, and inquiry-based learning, ideally involving real-world scenarios, in which students are actively engaged in critical thinking activities (Aramide and Bolarin, 2010). Theoretical perspectives and scientific testing influence instructional design. The application of theories of human behavior to educational technology derives input from instructional theory, learning theory, educational psychology, media psychology and human performance technology (Jaiyeola, 2007).

Educational technology and e-learning can occur in or out of the classroom. It can be self-paced, asynchronous learning or may be instructor-led, synchronous learning. It is suited to distance learning and in conjunction with face-to-face teaching, which is termed blended learning. Educational technology is used by learners and educators in homes, schools (higher education), businesses, and other settings (Aramide and Bolarin, 2010; Badu, 2004).

3. Application of Information Technology to Education in Nigeria

Educational technology is the effective use of technological tools in learning. As a concept, it concerns an array of tools, such as media, machines and networking hardware, as well as considering underlying theoretical perspectives for their effective application. Educational technology is not restricted to high technology. Nonetheless, electronic educational technology, also called e-learning, has become an important part of society today, comprising an extensive array of digitization approaches, components and delivery methods. For example, m-learning*emphasizes* mobility, but is otherwise indistinguishable *in principle* from educational technology.

Educational technology includes numerous types of media that deliver text, audio, images, animation, and streaming video, and includes technology applications and processes such as audio or video tape, satellite TV, CD-ROM, and computer-based learning, as well as local intranet/extranet and web-based learning. Information and communication systems, whether free-standing or based on either local networks or the Internet in networked learning, underlie many e-learning processes. The integration of information technology in teaching is a central matter in ensuring quality in the educational system (Osundina, 1973; Trostinikor, 1970). Ogunsola (2004) explained that the pace of change brought by new technologies has had a significant effect on the way people live, work and play worldwide. Internet use has, today, revolutionalised access to information for the business world, libraries, education and individuals.

The extent to which e-learning assists or replaces other learning and teaching approaches is variable, ranging on a continuum from none to fully online distance learning. A variety of descriptive terms have been employed (somewhat inconsistently) to categorize the extent to which technology is used.

1. E-learning: Synchronous and asynchronous

E-learning may either be synchronous or asynchronous. Synchronous learning occurs in real-time, with all participants interacting at the same time, while asynchronous learning is self-paced and allows participants to engage in the exchange of ideas or information without the dependency of other participants′ involvement at the same time. Synchronous learning refers to the exchange of ideas and information with one or more participants during the same period. Examples are face-to-face discussion, online real-time live teacher instruction and feedback, Skype conversations, and chat rooms or virtual classrooms where everyone is online and working collaboratively at the same time. Asynchronous learning may use technologies such as email, blogs, wikis, and discussion boards, as well as web-supported textbooks, hypertext documents, audio video courses, and social networking using web 2.0.

2. Linear learning

Computer-based training (CBT) refers to self-paced learning activities delivered on a computer or handheld device such as a tablet or smartphone. CBT initially delivered content via CD-ROM, and typically presented content linearly, much like reading an online book or manual. For this reason, CBT is often used to teach static processes, such

as using software or completing mathematical equations. Computer-based training is conceptually similar to web-based training (WBT) which is delivered via Internet using a web browser.

3. Collaborative learning

Computer-supported collaborative learning (CSCL) uses instructional methods designed to encourage or require students to work together on learning tasks. CSCL is similar in concept to the terminology, "e-learning 2.0" and "networked collaborative learning" (NCL). Collaborative learning is distinguishable from the traditional approach to instruction in which the instructor is the principal source of knowledge and skills.

4. Media:

Educational media and tools can be used for:

- task structuring support: help with how to do a task (procedures and processes),
- access to knowledge bases (help user find information needed)
- alternate forms of knowledge representation (multiple representations of knowledge, e.g. video, audio, text, image, data)

Numerous types of physical technology are currently used: digital cameras, video cameras, interactive whiteboard tools, document cameras, electronic media, and LCD projectors. Combinations of these techniques include blogs, collaborative software, ePortfolios, and virtual classrooms.

5. Audio and video

Radio offers a synchronous educational vehicle, while streaming audio over the internet with webcasts and podcasts can be asynchronous. Classroom microphones, often wireless, can enable learners and educators to interact more clearly. Video technology has included VHS tapes and DVDs, as well as on-demand and synchronous methods with digital video via server or web-based options such as streamed video from YouTube, Teacher Tube, Skype, Adobe Connect, and webcams. Telecommuting can connect with speakers and other experts. Interactive digital video games are being used at K-12 and higher education institutions.

6. Computers, tablets and mobile devices

Computers and tablets enable learners and educators to access websites as well as programs such as Microsoft Word, PowerPoint, PDF files, and images. Many mobile devices support m-learning. Mobile devices such as clickers and smartphones can be used for interactive audience response feedback. Mobile learning can provide performance support for checking the time, setting reminders, retrieving worksheets, and instruction manuals. OpenCourseWare (OCW) gives free public access to information used in undergraduate and graduate programs. Participating institutions are MIT and Harvard, Princeton, Stanford, University of Pennsylvania, and University of Michigan.

7. Social networks

Group webpages, blogs, wikis, and Twitter allow learners and educators to post thoughts, ideas, and comments on a website in an interactive learning environment.

8. Webcams and Whiteboards

Webcams and webcasting have enabled creation of virtual classrooms and virtual learning environment. Whiteboards predate tablets and other technological tools, but current interactive whiteboards and smartboards allow learners and instructors to write on the touch screen.

9. Screencasting

Screencasting allows users to share their screens directly from their browser and make the video available online so that other viewers can stream the video directly. The presenter thus has the ability to show their ideas and flow of thoughts rather than simply explain them as simple text content. In combination with audio and video, the educator can mimic the one-on-one experience of the classroom and deliver clear, complete instructions. Learners have an ability to pause and rewind, to review at their own pace, something a classroom cannot always offer.

10. Virtual classroom

A virtual learning environment (VLE), also known as a learning platform, simulates a virtual classroom or meetings by simultaneously mixing several communication technologies. For example, web conferencing software such as Go To Training, WebEx Training or Adobe Connect enables students and instructors to communicate with each other via webcam, microphone, and real-time chatting in a group setting.

11. Learning management system

A learning management system (LMS) is software used for delivering, tracking and managing training and education. For example, an LMS tracks attendance, time on task, and student progress. Educators can post announcements, grade assignments, check on course activity, and participate in class discussions. Students can submit their work, read and respond to discussion questions, and take quizzes.

12. Computer-aided assessment

Computer-aided assessment (e-assessment) ranges from automated multiple-choice tests to more sophisticated systems. With some systems, feedback can be geared towards a student's specific mistakes or the computer can navigate the student through a series of questions adapting to what the student appears to have learned or not learned.

13. Electronic performance support system

An electronic performance support system (EPSS) is, according to Barry Raybould, "a computer-based system that improves worker productivity by providing on-the-job access to integrated information, advice, and learning experiences". Gloria Gery defines it as "an integrated electronic environment that is available to and easily accessible by each employee and is structured to provide immediate, individualized on-line access to the full range of information, software, guidance, advice and assistance, data, images, tools, and assessment and monitoring systems to permit job performance with minimal support and intervention by others."

14. Turnitin

Turnitin is an Internet-based plagiarism-prevention service created by iParadigms, LLC, first launched in 1997. Typically, universities and high schools buy licenses to submit essays to

the Turnitin website, which checks the documents for unoriginal content. The results can be used to identify similarities to existing sources or can be used in formative assessment to help students learn how to avoid plagiarism and improve their writing.

15. iThenticate

iThenticate is a plagiarism detection service for the corporate market, from iParadigms, LLC, which also runs the websites Turnitin and Plagiarism.org. The service was launched in 2004, as result of market demand. While iThenticate is best known as a plagiarism detection service, collaborative efforts with the user base have created a number of new use cases. The most prominent aside from plagiarism detection include intellectual property protection and document-versus-document(s) analysis.

4. Humans are Fallible

Although, hardware and software systems have improved educational deliverables over the past 30 or 40 years through the use of automated procedures and processes, media, E-Learning, quality assurance and monitoring, student participation and increased enrolments, inclusive education, distance learning, and international collaborations control room design, but with humans still in the loop either in the design, operation or maintenance there has to be an understanding that mistakes will happen. Humans are fallible and they make high degree of errors and that has to be taken into account which means there has to be a very robust and inclusive educational technologies. That is where processes, quality assurance and integrity management can come together. Educational process safety is the prevention of unplanned and uncontrolled decline in standards from. That definition works hand in hand with integrity management which is the assurance that educational processes are fit and ready to go by approving and establishing competent people, effective systems and dependable information technologies. Benefits from integrated educational processes and integrity management include:

- Being in control, resulting in improved standards, commitments, health, job satisfaction, safety and reducing operating costs;
- Full regulatory compliance, and performance benefits;
- Reduced staff turnover and improved educational internationalization;
- Compliance with the ability to reliably meet ever more demanding regulatory requirements
- Educational technology backbone to a culture that ensures safety and integrity are integral parts of day to day operations.
- Delivery of performance which means a more proactive approach and managing improved performance sustainably.

4.1. Strategies for Reducing Operating Costs

Reducing and controlling educational costs has become a necessity in this financially challenging environment. The following strategies are among those available for reducing and controlling costs in our tertiary institutions:

4.1.1. Budget, Plan and Monitor

A budget provides a roadmap for the financial management of our educational institutions including controlling costs. Historical results along with the effects of current revenue and cost trends provide the basis for a budget and can help predict the future financial health of our institutions. It will also provide the benchmark for reporting future financial results. Monthly reviews of actual performance and standards compared to budgeted amounts will provide the information necessary to react quickly to variances to the plan.

4.1.2. Review Purchasing Procedures of Educational Materials and Technologies

Purchasing procedures for ICT and other educational materials should be examined for possible areas for reducing costs. During the review, a check of authorization processes should take place to ensure adherence to authorization limits. The review should also look for adequate controls on spending limits and the number of people authorized to make purchases (Ubogu, 2000).

4.1.3. Review Suppliers

An analysis of the existing base of suppliers could also reveal opportunities for reducing costs by consolidating purchases for additional buying power. Consolidation of suppliers will also produce a reduction of administrative expenses due to processing fewer purchase orders, invoices and payments (Rana, 2009; Patra, 2008). Additionally, try negotiating with current suppliers for better pricing and consider proposals from alternative suppliers to lower costs in all operating expenses areas including the small expenses.

4.1.4. Ask Employees to Analyze Expenses

Assigning a team of competent staff to analyze an expense category can identify areas of expense reduction. Employees can often identify items with less expensive alternatives that will meet the needs of the institution (Ubogu, 2000; Rana, 2009).

4.1.5. Engage Outside Help

When internal resources aren't adequate to perform the reviews and analysis necessary to reduce and control costs, consider hiring an independent, objective outside firm to benchmark and assess current costs. The consultant could also perform an operational audit of educational purchasing processes, negotiate with suppliers, and implement cost savings recommendations (Ubogu, 2000; Rana, 2009). There are consultants available who will perform this service on a contingency basis.

4.1.6. Human Factors Training

Educational Systems and teaching aids can undergo a design to react properly to an incident, but it can't just stop there. Both teaching and non-teaching staff (operators) will

need proper training, to reduce operating cost. The educational systems cannot prevent every little discrepancy, but the right problem solvers in the right culture with the right technology will solve problems before they escalate. One way to ensure strict adherence to standards, guidelines and processes is to implement lifecycle management that will not only allow the employees to work with issues that are known today, but also tackle those that appear down the road (Oketunji, 2001; Oketunji, 2000; Ojedokun, 2000; Odion and Adetona, 2009).

When looking at the human factors, think about the entire lifecycle. When the designers created the system, did they understand the risks? Did they use reasonable levels of probability? How about the consequences? Did they mitigate those factors? Educational equipment will continue working for years, but other factors intervene. Technology will not fix a problem unless the right processes and the right best practices are in place. Technology will help enable people to make the right decision. But the culture has to be there to enforce them to make the decision in the first place. Research and experience have shown that human factors training can address many of the issues that contribute to compromise and fraud in our educational institutions. Training provides the knowledge to understand important guidelines, circulars and procedures and to integrate them into the work environment. Training can promote awareness and affect attitude. It reduces costs associated with human performance issues (Patra, 2008; Oketunji, 2001).

4.1.7. Human Factors Integration

The application of human factors integration in educational system design can increase operational effectiveness and reduce costs over full life cycle of the teaching aid or system. The purpose of human factors integration (HFI) is:

-Ensures application of human factors knowledge about human characteristics throughout the design, development, and evaluation of technology systems

-Provides balanced development of technical, operational, and human aspects

-Provides an audit trail demonstrating human factors issues have been adequately addressed during educational system design and development

-Provides comprehensive guidance to educational system developers, system procurers, employees, regulatory authorities, students and the society at large (Ojedokun, 2000; Odion andAdetona, 2009).

4.2. Criticism and Disadvantages of Technology adoption in Education

Many institutions spend large sums of money on technology. However, no institution looks at technology return on investment (ROI) to connect expenditures on technology with improved student outcomes (Odion andAdetona, 2009). New technologies are frequently accompanied by unrealistic hype and promise regarding their transformative power to change education for the better or in allowing better educational opportunities to reach the masses. According to Branford *et al*, "technology does not guarantee effective learning" and inappropriate use of technology can even hinder it. Adaptive instructional materials tailor questions to each student's ability and calculate their scores, but this encourages students to work individually rather than socially or collaboratively (Kruse, 2013). Social relationships are important but high-tech environments may compromise the balance of trust, care and respect between teacher and student (Badu, 2004).

4.2.1. Massively Open Online Courses (MOOCs)

MOOCs, although quite popular in discussions of technology and education in developed countries, are not a major concern in most developing or low-income countries. One of the stated goals of MOOCs is to provide less fortunate populations (i.e., in developing countries) an opportunity to experience courses with US-style content and structure. However, research shows only 3% of the registrants are from low-income countries and although many courses have thousands of registered students only 5-10% of them complete the course. MOOCs also implies that certain curriculum and teaching methods are superior and this could eventually wash over (or possibly washing out) local educational institutions, cultural norms and educational traditions (Ubogu, 2000; Rana, 2009; Patra, 2008).

4.2.2. Over-Stimulation

Electronic devices such as cellphones and computers facilitate rapid access to a stream of sources, each of which may receive cursory attention. Students have always faced distractions; computers and cellphones are a particular challenge because the stream of data can interfere with focusing and learning. Although these technologies affect adults too, young people may be more influenced by it as their developing brains can easily become habituated to switching tasks and become unaccustomed to sustaining attention. Too much information, coming too rapidly, can overwhelm thinking. Technology is "rapidly and profoundly altering our brains" (Ubogu, 2000; Rana, 2009).

4.2.3. Socio-Cultural Criticism

According to Lai, "the learning environment is a complex system where the interplay and interactions of many things impact the outcome of learning." When technology is brought into an educational setting, the pedagogical setting changes in that technology-driven teaching can change the entire meaning of an activity without adequate research validation. If technology monopolizes an activity, students can begin to develop the sense that "life would scarcely be thinkable without technology (Bryson, 1990; Chisenga, 1995).

4.2.4. Digital Divide

The concept of the digital divide is a gap between those who have access to digital technologies and those who do not. Access may be associated with age, gender, socio-economic

status, education, income, ethnicity, and geography (Cohn and Lefolli, 1995).

5. Conclusion, Recommendations and Policy Implications

Technologies have contributed immensely to educational development in Nigeria. This has led to the speed on acquisition, processing, storage, retrieval and dissemination of educational operations. ICT has also help to curb the problem of information explosion in this information era. However, when the capabilities and limitations of the human are better understood, then efficiency and standards benefits may accrue. In one instance it was forgotten that *Management* involves people. In the other aspect, perhaps because it was blatantly obvious, it was central to the plan. Operational efficiency will only be marginally enhanced through changes made solely to the *Machine* or *Medium* component. Automation does not replace human work; it merely changes its nature. Perhaps the greatest lesson, though, is that significant changes in efficiency will not be driven by changes in the (hu)*Man*, *Machine* or *Mission* alone. Revolution is required, not evolution. Ultimately, changes in standard and efficiency are dictated by what the *Medium*, in the form of society and legislation, will tolerate and these aspects of the *Medium* are risk averse. In summary, neither human factors nor technologies can be considered in isolation from its socio-technical context.

Teacher training ensures effective integration of classroom technology. The current school curriculum tends to guide teachers in training students to be autonomous problem solvers. This has become a significant barrier to effective training because the traditional methods of teaching have clashed with what is now expected in the present workplace. Today's students in the workplace are increasingly being asked to work in teams, drawing on different sets of expertise, and collaborating to solve problem. These experiences are not highly centered on in the traditional classroom, but are twenty-first century skills that can be attained through the incorporation and engagement with technology. Changes in instruction and use of technology can also promote a higher level of learning among students with different types of intelligence. Technology is not the end goal of education, but rather a means by which it can be accomplished; educators must have a good grasp of the technology being used and its advantages over more traditional methods. If there is a lack in either of these areas, technology be a hindrance rather than benefit to teaching.

The evolving nature of technology may unsettle teachers who may experience themselves as perpetual novices. The ways in which teachers are taught to use technology is also outdated because the primary focus of training is on computer literacy, rather than the deeper, more essential understanding and mastery of technology for information processing, communication, and problem solving. New resources have to be designed and distributed whenever the technological platform has been changed. However, finding quality materials to support classroom objectives after such changes is often difficult. Random professional development days are inadequate. Teachers may not feel the need to change the traditional education system because it has been successful in the past. This does not necessarily mean it is the right way to teach for the current and future generations. However, learning styles and the methods of collecting information have evolved, and "students often feel locked out of the worlds described in their textbooks through the depersonalized and abstract prose used to describe them".

The application of IT to education in Nigeria still has room for improvement, thereby making its impact limited. Several problems were identified for this condition–inadequate funding; insufficient facilities and constant power failure; among others; hindering the maximization of its expected benefits. Aramide and Bolarinwa (2010) corroborated the prevalence of these problems, by stating that "the major constraints hindering the use of audiovisual and electronic resources include poor power supply, poor infrastructure, lack of adequate skill, high cost, and unavailability".

6. Recommendations and Policy Implications

Based on the reviewed studies, the following recommendations and policy issues are desirable for improved human-technology interface (Ubogu, 2000; Oketunji, 2001; Oketunji, 2000), as a catalyst for cost reduction in Nigerian educational development

1. More generous financial support should be made available to provide the basic ICT infrastructural facilities

2. Since Information and Communication Technology (ICT) has come to stay, both academic and non-academic staff that are not computer literate should take positive steps to remedy their deficiencies

3. Effective and efficient power supply supplemented with standby generators should be provided to check the menace of frequent electricity power failure. In the same vein, the government should address the problem of erratic power supply more seriously not through military order but through research and development.

4. The assistant of some donor agencies such as Education Trust Fund (ETF) and Open Society Initiative for West Africa must be actively enlisted (OSIWA)

5. Every division of the Nigerian academic system should be automated in order to facilitate and create an avenue for effective services.

6. Imported educational technologies /equipments should be tax free.

7. IT educational policy must ensure:

- Up-to-date qualifications in the information society
- Up-to-date qualifications gained against the background of a high general level of education in the population will be decisive if Nigeria is to maintain competitiveness and its share of the global labour

market in the information society. IT skills and IT understanding are thus central prerequisites for the individual, both now and especially in the future.

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