

The application and relevance of information and communication technology to architectural education

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ARTICLE INFO	ABSTRACT
<p><i>Article history:</i> Received June 08, 2023 Received in revised form June 22, 2023 Accepted July 26, 2023 Available online August 01, 2023</p> <p><i>Keywords:</i> Architecture Education Globalization Teaching Technology</p> <p>*Corresponding author: Oluropo Stephen Ilesanmi Department of Architectural Technology, Rufus Giwa Polytechnic, Owo, Nigeria Email: jsarwono@tf.itb.ac.id</p>	<p><i>The advancements in Information and Communication Technologies (ICTs) in recent times have made the world to become a global village. This phenomenon has also resulted in global pursuit of improvement in quality of education with access to information and the use of Information and Communication Technology (ICT) becoming important indices for participating in the information age. In like manner, this rapid development in Information and Communication Technology and its applications has introduced new opportunities in architectural education. This paper focuses on the application and relevance of Information and Communication Technology to teaching and learning architecture in Nigeria as a means to squaring up with the global competitiveness in architectural education. It suggests the importance of developing expertise in these applications by architectural educators, so as to carry out and provide creative direction in teaching and learning of architecture. This can bring about improving students' motivation for active, creative and explorative learning. It concludes with the need for architectural educators in Nigeria, to acquaint themselves with the methods and techniques of application of Information and Communication Technology to teaching and learning of architecture in order to become relevant in this age of globalization.</i></p>

Introduction

Globalization and technological change processes that have accelerated in tandem over the past fifteen years have created a new global economy powered by technology, fueled by information and driven by knowledge (North Central Regional Education Laboratory 1999). The emergence of this new global economy has serious implications for the nature and purpose of educational institutions (Anjana 2011). As the half-life of information continues to shrink and access to information continues to grow exponentially, architectural educators cannot remain mere

venues for the transmission of a prescribed set of information from teacher to student over a fixed period of time. Rather, they must promote learning through the acquisition of knowledge and skills that make possible continuous learning over lifetime. The illiterate of the 21st century, will not be those who cannot read and write, but those who cannot learn the use and application of ICT in their respective profession and career. This is due to the fact that the current global changes is putting pressure on all educational institutions to constantly acquire and apply new skills to teaching and learning. The International Labour Organization (ILO) defines the requirements for

education and training in the new global economy simply as “Basic Education for All”, “Core Work Skills for All” and “Lifelong Learning for All” (International Labour Organization 2002).

The technological change is also transforming the education and practice of architecture (Sudradjat 2020; Bayhan and Karaca 2020; Purwanto and Lake 2021). The newest form of education is blended learning, which combines personal interaction from live class sessions with online education for greater learning flexibility (Abrams and Haefner 2002). Reluctant to join the digital era are architectural educators teaching studio courses (Diane Marie Bender 2002), who may be unaware of the possibilities and benefits of teaching with technology. Likewise, technological change is also having an impact on the process and culture of architectural education, as evident in previous research on digitally immersed classes and studios (Matthews and Weigand 2001).

In the same manner, technology has also radically changed the way educators can exchange information with students (Haleem et al. 2022). Higher education support systems have adapted to changes in technological innovation, but architectural education in Nigeria has remained disturbingly constant. Pedagogical integration of digital media is critical to the success of future architecture and design education. With the ever-increasing need to communicate globally, distance is no longer a barrier to education (Matthews and Weigand 2001). Based on application of ICT in architecture by many architecture schools in some developed countries of the world, the authors believe that some architectural courses can be enhanced with online technologies. A popular format for teaching both in the classroom and online is blended learning (Diane M. Bender and Vredevoogd 2006). Blended learning involves both traditional face-to-face instructions, where both students and lecturer are present at the same time and place, supplemented with asynchronous and/or synchronous communication via the Internet. In comparison to courses that are completely online, courses with a combination of online and face-to-face interaction produce the same or better success rates, plus dropout rates are lower (Dziuban and Moskal 2001). This is not advocating technology as a substitute for the existing process, but as a means to enrich instruction in architectural education.

Information and communication technologies (ICTs) which include digital technologies such as computers and the Internet have been touted as potentially powerful enabling tools for educational change and reform. When used appropriately, different ICTs can raise educational quality as well as make teaching and learning an active process connected to real life. However, the experience of introducing different ICTs in other educational settings all over the world over the past several decades suggests that the full realization of the potential educational benefits of ICTs is not automatic. The effective integration of ICTs into the educational system is a complex, multifaceted process that involves not just technology but also curriculum and pedagogy, institutional readiness, teacher competencies, and long-term financing, among others. This paper is intended to help architectural educators in Nigeria develop a framework for the appropriate and effective application of ICTs in both teaching and learning of architecture in Nigeria in order to square up with the globalization trend in the profession.

Result and discussion

The evolution of ICT into architecture

Since the late 1980s architecture and architectural education have witnessed an important transformation with the introduction of computers and information and communication technology (ICT) in which they have become pervasive in all aspects of practice and education. The pervasiveness of information and communication technology in architectural education and practice has been manifested in the growing proportion and importance of Information Technology (IT) related courses in the curricula of architectural schools. Many schools have increased IT content in their curriculum and are investing to acquire computing resources to ensure that they provide their students with the necessary skills and competitive advantage. Modern information and communication technology and digital tools have been adapted in the architectural education and practice since the 1990's. Computer Aided Design (CAD) has been adapted into architecture and became the major working environment. CAD and digital media have also been adapted by many architectural schools around the world. The

rapid developments in information and communication technology and its applications in architecture have introduced a new opportunity to architectural teaching most especially the design studio. There have been various ways to integrate computation and digital media into design teaching that led to alternative models for digital design studio including computer augmented design studio, CAD-plus studio, virtual and web design studio, cyberspace design studio, intelligent building studio, and toys and tools studio (Do, Gross, and Do 1999).

The applications of ICTS as an assistive technology in architectural education

Information and communication technologies can be defined, for the purpose of this paper, as a diverse set of technological tools and resources used to communicate, and to create, disseminate, store, and manage information (Blurton 1999).

These technologies include computers, the internet, broadcasting technologies (radio and television), telephony etc. In recent years there has been a giant stride in the application of these technologies in architectural education to improve its efficiency and effectiveness at all levels. Some of the applications are briefly considered as follows:

(1) Video conferencing

Video conferencing allows the exchange not just of voice and graphics but also of moving images. Video conferencing technology does not use telephone lines but either a satellite link or television network (broadcast/cable). Video conferences have broadened the nature of computer-mediated human and inter-organisation communication patterns. As an interactive communication medium, two-way video stands out in a number of ways. A videoconference can improve retention and appeal to a variety of learning styles by including diverse media such as video or audio clips, graphics, animations, computer applications. In the Virtual Design Studio, video conferencing sessions are scheduled regularly. The early sessions are planning sessions in which tutors discuss the studio's organisation and the brief. The later sessions are used entirely by the students to get to know each other and to discuss problems in getting information from one site to another. The final video conferencing sessions are used for work on particular portions of the design.

(2) E-mail

The students use email to communicate with each other and with the client, studio tutors, and studio teachers. To promote interpersonal communication, the virtual design studio provides an e-mail tool to allow messages to be delivered to an electronic mailbox which can be read by the recipient at any time. This allows e-mail messages to be archived centrally and be available.

(3) Internet

According to (Diane M. Bender and Vredevoogd 2006), the technology with the greatest potential for impact on architectural education is the Internet. By the year 2006, it is estimated there will be 900 million computers and other web-based appliances in use, providing universal access, multimedia resources, and interactive medium (Diane M. Bender and Vredevoogd 2006; Charp 2000). In architectural practice, the internet has revolutionized the design process by allowing architects and designers to research new products, download specifications, access code information, transfer drawings, and even synchronously collaborate with colleagues from around the world. A popular format for teaching both in the classroom and online is blended learning (Diane M. Bender and Vredevoogd 2006). Blended learning involves both traditional face-to-face instructions, where both students and lecturers are present at the same time and place, supplemented with asynchronous and/or synchronous communication via the internet. In comparison to courses that are completely online, courses with a combination of online and face-to-face interaction produce the same or better success rates, plus dropout rates are lower (Dziuban and Moskal 2001). There are many benefits of using online technologies, such as the accuracy and consistency of data. All students are guaranteed to receive the same presentation material and get the same view of the professor and material, unlike the front row advantage in the traditional classroom. Students appreciate online classes, for it allows them flexibility in viewing course information at their convenience and as many times as they wish. This information may include course syllabus and outline, staff profiles and contact information, examples of projects, and other useful items typically provided to students in a traditional course (Diane M. Bender and Vredevoogd 2006). Furthermore, information technologies are predominantly visual rather than relying primarily

on audio and text as in the traditional classroom. Because of this, complex content can be conveyed more effectively due to the integration of multiple representations of material through computer animations with audio and video. These technologies applications can provide an additional degree of motivation, allowing students to express themselves in new and creative ways (Dias 1999).

(4) Virtual design studio

The School of Architecture at Columbia started a paperless design studio during the early 1990s, in collaboration with other schools of architecture such as Harvard, MIT, Washington University, Cornell University, and Hong Kong University (Wojtowicz 1994) to eliminate conventional design methods. It used high-end software, originally designed for the movie industry to produce animation and special effects. The software ability to create special effects was used to produce studies of building circulation, mobility, and program variations (Antably 2004). In conventional design studios, instructors normally rely on discussions and rationalisations to inform the student about what is not portrayed in his drawings or models. The learning process grounds on the tutor's expertise and credibility. This hypothesis is shaken by the paperless architecture paradigm, as visualisations can be tested immediately and decisions are made spontaneously. The Virtual Design Studios (VDS) explores the asynchronous and synchronous techniques in remote design collaboration. By using technologies, such as video conferencing, Internet publishing, e-mail, Web3D, and digital modeling, students gain an increasing understanding of the new modes of collaboration and media integration in design practices. The VDS also enriches the architectural experience by exposing studios to different design cultures and to a larger context of design feedback. The design collaboration may be single-task, in which each participant has his own view over the whole design problem, and the shared conception is developed by the superposition of the views of all participants, or multiple-task, in which the design problem is divided among the participants in a way that each person is responsible for a particular portion of the design.

The relevance of ICTs in architectural education

One of the most commonly cited reasons for using ICTs in the classroom has been to better prepare the current generation of students for a workplace where ICTs, particularly computers, the Internet and related technologies, are becoming more and more ubiquitous. Technological literacy, or the ability to use ICTs effectively and efficiently, is thus seen as representing a competitive edge in an increasingly globalizing job market. Technological literacy, however, is not the only skill well-paying job in the new global economy will require. EnGauge of the North Central Regional Educational Laboratory (2002) has identified what it calls 21st Century Skills, which includes digital age literacy (consisting of functional literacy, visual literacy, scientific literacy, technological literacy, information literacy, cultural literacy, and global awareness), inventive thinking, higher-order thinking and sound reasoning, effective communication, and high productivity (North Central Regional Education Laboratory 1999).

The potential of ICTs to promote the acquisition of these skills is tied to its use as a tool for raising educational quality. ICTs can enhance the quality of education in several ways: by increasing learner motivation and engagement, by facilitating the acquisition of basic skills, and by enhancing teacher training (Haddad and Jurich 2001). Versatility in the early application of ICTs for architectural training will empower architect graduate of the 21st century to possess the following skills needed in the workplace of the future as outlined by EnGauge North Central Regional Education Laboratory (1999): (1) Digital age literacy; (2) Functional literacy; (3) Ability to decipher meaning and express ideas in a range of media (This includes the use of images, graphics, video, charts and graphs or visual literacy); (4) Scientific literacy (Understanding of both the theoretical and applied aspects of science and mathematics); (5) Technological literacy (Competence in the use of information and communication technologies); (6) Information literacy (Ability to find, evaluate and make appropriate use of information, including via the use of ICTs); (7) Cultural literacy (Appreciation of the diversity of cultures); (8) Global awareness (Understanding of how nations, corporations, and communities all over the world are interrelated); (9) Inventive thinking; (10) Adaptability (Ability to adapt and manage in a complex, interdependent world); (11)

Curiosity (Desire to know); (12) Creativity (Ability to use imagination to create new things); (13) Risk-taking (Ability to take risks); (14) Higher-Order Thinking (Creative problem-solving and logical thinking that result in sound judgments); (15) Effective communication; (16) Teaming (Ability to work in a team); (17) Collaboration and ability to interact smoothly and work effectively with others; (18) Interpersonal skills; (19) Personal and social skills (Be accountable for the way they use ICTs and to learn to use ICTs and responsibility for the public good); (20) Interactive communication (Competence in conveying, transmitting, accessing and understanding information) (21) High Productivity (Ability to prioritize, plan, and manage programs and projects to achieve the desired results. This also includes the ability to apply what they learn in the classroom to real-life contexts in order to create relevant, high-quality products).

The Nigeria situation and the way forward

The status of Nigeria architectural education still remains traditional in most schools of architecture. There is a lack of collaboration and communication between the schools via ICT that could facilitate teaching and learning among lecturers and students. This is due to the fact that most schools of architecture do not have a strategy for developing communication and team-working skills in teaching especially design studio. These are problems to developing lifelong education and the learning climate in schools of architecture and this does not enhance students' learning.

This paper posits that, unless there is a radical change to see the use of ICTs in architectural education as a tool for creative and explorative learning in architecture; both architectural educators and their students will be incompetent in the global world. Hence, one of the ways forward is the importance for architectural educators to develop expertise in the application of these technologies, so as to carry out and provide creative direction in teaching and learning of architecture in Nigeria. This will bring about improving students' motivation for active, creative and explorative learning.

Another way forward is the preparation and the determination to move towards a paperless studio from a traditional based studio. The question of how to physically place computers into the studio is not the issue; that is a financial dilemma on the part of the university. The larger

issue is a pedagogical one of integration. How to infuse the computer into a design and teaching process becomes the greater question. The computer is a tool for inquiry and as educators our curriculum should provide the tools from the lower level classes so that the students could focus their effort to understand and become knowledgeable in its application to learning. The success of a paperless studio will rely on the ability of the students and lecturers to implement these new technological tools and change the culture of the studio environment.

Though in many cases, students want to incorporate new technology into their studio work, but the schools do an inadequate job of providing the needed knowledge base. If students are not adequately taught the use of these technologies and its applications to learning at the appropriate level in their education, digital media will not become part of a process of design and upper-level studios will be degraded to instructional labs for software training. In many cases upper-level students are forced to teach themselves software at the detriment to their studio investigation. Through technology initiatives such as workshops, seminars on how to use these technologies for both students and lecturers, and most importantly curricular changes and review, the ability to build a knowledge base becomes a viable opportunity for the digital exploration of architecture (Norman 2001).

Conclusion

The advances in ICTs over the last five years have been phenomenal and what the next five years will bring can only be imagined. Therefore, there is need for architectural educators in Nigeria to acquaint themselves with the methods and techniques of application of ICTs to teaching and learning of architecture in order to become relevant in this age of globalization.

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Author(s) contribution

- Oluropo Stephen Ilesanmi** contributed to the research concepts preparation, methodologies, investigations, data analysis, visualization, articles drafting and revisions.
- S. C. Folorunso** contribute to the research concepts preparation and literature reviews, data analysis, of article drafts preparation and validation.
- O. O. Kolade** contribute to methodology, supervision, and validation.