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ICT Integration in Nigeria and the Quest for Indigenous Contents: Prospects of the i-CLAP Model Design Initiative

Dr. Azi, J. I.[1]; Dr. Nkom, A. A.[2] & Professor Schweppe, M.[1]

[1] Rochester Institute of Technology, Rochester (RIT), New York, USA; [2]Ahmadu Bello University (ABU), Zaria, Nigeria.
Email: azijoe86a2000@yahoo.com; jia7050@g.rit.edu; Marla.Schweppe@rit.edu

ABSTRACT

Advances in Information and Communication Technology (ICT) is transforming the 21st century learning environment, from its traditional face-to-face, structured curriculum, fixed location and teacher-centered nature, into a more flexible and self-directed process. For instance, variously designed and developed instructional multimedia contents and interfaces in forms of (i) productivity, (ii) educational or (iii) gaming software, enable active learning access as mobile or classroom technologies, interactive tutorials, online discussions, internet conferencing and online databases. However, while this article considers these recent developments such as Intellimedia, NEPAD e-School, OLPC and Intel Classmate projects and so on as trendy and groundbreaking. It observes with discontent that the design of their contents and interfaces seem to be targeted at cross-cultural audiences, with very little or no consideration for minorities like Africa. The authors opine therefore that if the challenge of ICT integration towards bridging the digital divides in Africa must be taken very serious, the task transcends merely supplying networked computer hardware to local schools. Digital contents are required that reflect the beauty and riches of Africa's culture and heritage like music, fashion, architecture, arts and crafts. Against which backdrop, the Interactive Child Learning Aid Project (i-CLAP) model was initiated as a potential indigenous resource, for enhancing pre-primary education in Nigeria adapting the ADDIE model structure. The researchers observe that while 'customization' of ICT applications targeted at local audience is commendable, integrating relevant indigenous contents has the potential to enhance efficacy and consequently raise the motivational level of local learners.

Keywords: ICT, Computer Assisted-Instruction (CAI), Cultural Socialization, Instructional Multimedia

1 Concept of ICT

It is noteworthy that information and communication technology (ICT) is the general phrase used to describe a broad range of multimedia technologies relevant for gathering, storing, retrieving, processing, analyzing and transmitting information. Spanning from the creation of digital images for information visualization to the manipulation of moving images and sound as multimedia platforms for edutainment or business persuasion. Kimberley's ePortfolio [1] affirms that ICT is a term that covers all forms of computer and communications equipment and software used to create, store, transmit, interpret, and manipulate information in its various formats (e.g., business data, voice conversations, still images, motion pictures and multimedia presentations).

In fact, ICT can be considered as the convergence of telecommunications, information technology and a range of data networking technologies into a single platform. It means everything that is new and relevant to communications, this includes the Internet, mobile telephony, satellite communications and digital television over cable or aerials [2]. In fact, this technology has become an essential tool for the enrichment of human mental and physical performance, hence indispensable in almost all facets of today's knowledge economy.

According to Hall [3] every aspect of life is largely dependent on technology, demonstrated on its importance on business, schools, health and other aspects. Menanya [4] affirms that ICT has proven to be a key precondition for enhanced competitiveness in economic and societal modernization, as well as an important instrument for bridging economic and social divides and poverty reduction. Oketola [5] quotes Ms. Funke Opeke the *Chief Executive Officer of Main One Cable Company, Nigeria*, who argues that "if we are going to build our economy and create wealth for our people…as in India, in China, in Malaysia, in Philippines, IT has been one of the key enablers of jobs." She adds further "IT has been the largest driver of job creation anywhere in the world."

Research reveals that in education, three main approaches may be distinguished as pedestals for ICT application; it may be taught either as a subject in its own right, used as a tool for carrying out projects or a pool for sourcing relevant research materials. As a tool and a pool, in forms of a virtual instructor and a learning facilitator using the online search engines (e.g. Google, Yahoo!, AOL, eBay, Ask), email, on-line discussion groups, interactive conferences or tutorials and on-line databases (e.g. Britannica, Encarta, Wikipedia, Merriam-Webster, Academic Kids Online, Digital Universe). In fact, the term ICT is used to describe exciting and innovative ways to provide lifelong learners with global access to information, learning and support. According to Menanya [4] in the world today, the need for improved ICT networks has created new grounds

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as well as new business opportunities in Nigeria. Resulting in the use of ICT to increase communications services, online information gathering and research, e-learning, e-commerce, e-banking, e-medicine and other related services. Interestingly, these services are expanding access to the digital environment and globalization.

Today, ICT applications are adapted to a cross-section of fields that include business data, voice conversations, still images, motion pictures, multimedia presentations to name a few. Such services are relayed via electronic devices like radio, television, mobile phones, computer and networked and satellite systems. They are also via several peripheral applications associated with them, such as videoconferencing and distance learning. Fundamentally, studies in ICT combine many disciplines, with underlying principles based in mathematics, logic, physics and psychology [6], [7]. The emphasis of this article is on the educational application of ICT, the significance of locally designed and developed contents and their potential capacity to transform the Nigerian educational environment in the 21st century. Especially, from its traditional face-to-face, structured curriculum, fixed location and teacher-centered characteristics, into a more flexible and self-directed environment.

According to the Digital Education Revolution [8] research undertaken by Charles Darwin University has found that ICT and innovative learning technologies could help improve literacy and numeracy outcomes for Indigenous students who are educationally disadvantaged. Vanscoter, Ellis and Railback [9] posit that computers are powerful tools that are most beneficial when used as a natural part of the learning experience, which includes:

1. Integrating computers into the classroom environment
2. Using them as a part of the ongoing curriculum
3. Applying their use to real problems for a real purpose

Such advances, being improvements over earlier technologies like: radio, telephone, grammaphone, audio-visual devices etc., have brought about new varieties of interventions enabling multi-sensory learning capabilities. Research reveals that diverse categories of such educational software packages can be identified, these include: (i) *Productivity Software* like: Microsoft (Word, PowerPoint, Access), database management, Graphic Design (e.g. Adobe Photoshop/Illustrator/InDesign), Spreadsheets; (ii) *Educational Software* such as: Blue's Clues ABC, Disney Interactive, Sesame Street Workshop, ABC Kid's Workshop, Scholastic (developed in America), Mixy's Toybox (in Australia), Meena (in Asia) and *Gaming Software* this is a competitive category that includes role-playing software, auto and flight simulation, adventure, sports, animal planet and strategy games such as chess, and children's games [10]. Key players in this category are like: Electronic Arts, Activision and Take-Two to mention a few.

It is doubtless that the challenges of globalization have brought about an intense search for proven means of applying ICT-based pedagogical approaches to learning uncertainties within different cultures, learning styles and social norms. Azi [11] laments that Africa's multifaceted predicaments like diseases, starvation, political instability, crime and corruption, exert negative influences not only on Africa's educational development, but also on the processes of cultural socialization. Such conditions, it is supposed have the capacity to adversely distort the child's perception of life. The consequences include among others declining school enrolment, high drop-out rate and fallen cognitive performance levels. It is therefore a fact that if the challenge of ICT integration must be taken serious towards bridging the digital divide, the task on the shoulders of Africans transcends merely supplying computer hardware to schools. The question of developing 'relevant' software contents that reflect the beauty and riches of our culture and language cannot be ignored.

Moreover, the goal of such techno-cultural pedagogies is to improve learning experiences among local children, for lifelong application and global competitiveness. This article therefore explores recent developments in ICT application aimed at the Nigeria audience and reviews the appropriateness of the contents to local situation. The essence is to arouse the quest for local content development, through advocting the integration of culturally sensitive contents into the ICT applications meant for local consumption. Central to this advocacy therefore is an appraisal of the design and development of the Interactive Child Learning Aid Project (i-CLAP) model, proposed as a potential indigenous instructional multimedia resource for Nigeria. The article further highlights: the project's initiation as a Ph.D. research in 2002 at the Ahmadu Bello University (ABU), Zaria; through the production of the digital component at the Rochester Institute of Technology (RIT), Rochester, New York in 2005 and finally to the pilot implementation in Zaria, Nigeria carried out in 2007.

2 Graphic User Interface Design

Graphic User Interface (GUI) design tasks strive between the confines of time and space; ideation and vision and to a large extent funds, towards expanding the intuitive and cognitive capacity of the human mind assisted by technology resources; the outcome is an escalation in digital software and hardware innovation. Britannica [12] notes that GUI is a computer program that enables a person to communicate with a computer through the use of symbols, visual metaphors and pointing devices. According to FitzGerald [13] the overarching goal of any interface is elegance and great ones are simple and well crafted. In the past effective computer usage relied on the specialized ability of humans to memorize and recall sequences of highly abstract syntaxes in a very specific order to guarantee interaction with the computer. Other command interpreters integrated into some operating systems are text oriented, requiring commands to be typed in or to be selected via function-keys on a keyboard.

Graphics that include shapes (icons), text and colours are also

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used that assist the user to easily communicate (i.e. interact) with the computer. This is achieved by pointing and clicking to an on-screen icon, picture or shape that represents a specific command. Weiss [14] asserts that although experienced computer users prefer the text-oriented command interpreters, and beginners generally find graphically oriented interpreters easier to use. Cutting edge inter-disciplinary researches, representing the beginning of a concerted efforts to integrate powerful new technologies namely: Animated Agents; 3D Real-time Environment, Natural Language Processing (and an area of Artificial Intelligence), are advancing the next generation of user-friendly learning tools [15].

Against which backdrop, the challenge therefore is to develop contextualized interfaces that integrate recognizable African imagery and symbols, embedded with the capacity to enhance user-friendliness by enabling the user to communicate more freely with the computer. Researches assessing the influence of technology-mediated educational environment on learners, reveal that they can get directly involved with the learning task much more than within the traditional environment or using non-intuitive interfaces.

3 Recent Developments in ICT Applications

Today, thousands of educational software contents and interfaces have been developed towards enhancing cognitive maturation among learners. Although the list of these interventions is quite inexhaustive, however, some of the significant software packages that have potentials to be integral part of learning technologies of the future, which can help students understand complex phenomena include the following:

3.1 Intellimedia

Intellimedia has five projects currently underway namely: *(i) Design-A-Plant*, a learning environment centered on learning plant physiology, offering customized advice and support to students as they construct plants; The *(ii) Internet Advisor* which helps to explain fundamental internet (TCP/IP) protocol through an interactive packet-matching game; Also, are the *(iii) 3-D SEE (Self-Explaining Environment)* and *(iv) EyeCue System* projects which promises a significant leap by combining an animated intelligent agent technology and 3-D real-time environment to produce highly interactive learning situation. The *(v) PhysViz* is also an intelligent, real-time, 3-D application in the domain of physics [15], [16].

3.2 Virtual Instruction Pilot Research Group (VIPRG)

The IEEE's VIPRG project is a voluntary international research group sponsored by the IEEE Computer Society Technical Committee on Learning Technology. The purpose of VIPRG is to facilitate multidisciplinary research leveraging cognitive science, computer science, engineering, information technology, learning science, education technology, psychology, and mobile communications. The essence is towards investigating, building and using pedagogically effective and culturally competent virtual instructors that deliver measurably effective instruction anytime, anywhere, and for any pace [17].

3.3 Zoo Atlanta

Visitors to Zoo Atlanta learn about gorilla behavior by watching the animals in their enclosure, and then, donning a VR helmet, by stepping "through the glass" into the enclosure and becoming a juvenile gorilla. Scientists at Georgia Institute of Technology have programmed the virtual gorillas to react appropriately to a sassy youngster! The creatures in the new exhibit, exist only in a virtual electronic world, a user walks among the apes, becoming an adolescent gorilla [18].

3.4 Global Warming

In Seattle, the Human Interface Technology Lab has used a virtual world to help students understand what will happen in Seattle if global warming goes unchecked. Wearing a head-mounted display and holding a joystick-like wand, students entered a computer-generated model of Seattle to accomplish the task of ending global warming [19].

It is noteworthy, that the contents of the aforementioned initiatives had been commended on the basis of their design and their applicability to education globally. There educational significance manifested some of numerous advantages of ICT in education as enumerated by McNutt [20], including:

1. Reduction in instructional time
2. Stimulation in learners a more positive attitude towards the learning process
3. Cost effective in some circumstances
4. Supports self-paced/individual learning
5. Offers variety of presentation options to developers
6. Proffers interactivity (response-producing stimuli) of courseware and
7. Facilitates student's intellectual management abilities.

4 Customized ICT Applications for Africa

It is interesting to note that ICT's robust presence and profound influence in almost all sectors of Africa's life is undeniable. The development has consequently giving birth to a crop of technology-mediated applications visible in the fields of banking, education, governance, administration, health, entertainment to name but a few. Fundamental to this article is the impact of key custom technology applications on Africa's educational system. Butcher [21] had recognized the need to explore various issues relating to education in sub-Saharan Africa, of particular interest is how education, [including distance education and open learning (DEOL)] can be supported by ICT. This is such that the objectives of education might become achievable for the majority of people in Africa. Many of whom are now excluded from educational opportunities of any form.

Digital literacy refers to the most basic skills in ICT applications. Eurostat [22] adds that digital literacy refers to the skills

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required to achieve digital competence, the confident and critical use of ICT for work, leisure, learning and communication. It is however appalling to note that a very marginal percentage of Nigerian young children are digitally literate, yet it has been assumed that the digital economy has the potential to enhance global access and socio-economic power to the youths. According to Awe [23] literacy means much more than acquiring or improving new technology skills. It means utilizing such skills for accessing information, problem solving, analyzing information, searching for answers, networking and collaboration, developing creative solutions, contributing to knowledge, communicating and learning. This point of view is further reinforced by an upshot of ICT-based initiative aimed at Africa's young audiences, significant among which include the following:

4.1 NEPAD e-School Initiative

This project was initiated by the New Partnership for Africa's Development (NEPAD), publicly launched in Durban at the Africa Summit of the World Economic Forum in 2003. The NEPAD e-Schools Initiative has been adopted as a priority continental undertaking, aimed at ensuring that African youth graduate from African schools with the skills that will enable them to participate effectively in the global information society [24]. The aim of the initiative is to impart ICT skills to young Africans in primary and secondary schools as well as harness ICT technology to improve, enrich and expand education in African countries. Towards entrenching ICT in all social sectors, developing e-services and enhance Africa's digitally competitiveness [25]. According to Soul Beat Africa [26] this is a multi-country, multi-stakeholder, continental initiative, intends to enable African teachers to use ICTs to improve the provision of education in schools.

The project targets at 600,000 schools across the continent. It recommends the need to equip African primary and secondary schools with ICT apparatus like computers, radio and television sets, phones and fax machines, communication equipment, scanners, digital cameras, photocopiers and also to connect them to the internet [27]. The program also advocates the equipping of schools with a "health point", additionally are: (i) ICT training for teachers; (ii) Content and curriculum development and (iii) Efforts towards community buy-in, involvement and ownership of the process.

4.2 African Initiatives (School Connectivity)

The African Initiative mobile rural infobanks pilot project for community-based Computer-Assisted Learning system at the basic level of education in the Volta Region of Ghana. The project believes that global knowledge can be converged within a target rural African community, as brain power, to decode and integrate indigenous African knowledge into modern knowledge as a synthesized or enhanced local knowledge for resolving local crises, leading to human capacity enhancement, rural poverty alleviation and environmental rejuvenation for peaceful coexistence in human-human and human-environmental system sustainability [28].

4.3 One Laptop Per Child (OLPC) Laptops

The One Laptop Per Child (OLPC) children's Machine XO, developed by Massachusetts Institute of Technology (MIT) Media Lab co-founder Nicholas Negroponte. According to Sanders [29] the Linux-powered OLPC laptops project, aims to provide children in developing economies internet connection in schools using a central server and at home through a mesh network. The OLPC resource provides a squeak-based 'electronic' or 'educational' simulation, model, story or game created a learner. The new resource is presently being implemented at the LEA Primary School, Galadima Village, Gwarimpa II Estate, Abuja, Nigeria.

4.4 Intel Classmate PC

Nigeria's students welcome Intel's e-classroom, an educational notebooks project aimed at making ICT available at all times for pupils in schools. Intel's design is a fully-functional electronic classroom and is now ready for pilot trial towards meeting the needs of Nigerian school-children to profit from both a collaborative and an affordable e-learning environment. Classroom PC is part of a global dream, the World Ahead Programme (WAP) which promises ICT as a permanent instrument available for teachers and pupils alike [30].

5 Discussion on Customization

In technologically advanced societies, earlier trainings in information technology offered students skills in software programming. However, this high-end professional position is changing to include the use of creative and pedagogical theories for developing instructional multimedia contents and interfaces. In fact, today, designing contents using software packages like Adobe Flash, Illustrator, InDesign, Dreamweaver and Catalyst to name a few, would require minimal coding skills, adopting inbuilt predesigned templates which rather require high creative competence. The outcome of which is thousands of dynamic instructional multimedia software contents and interfaces for that address diverse aspects of classroom application requirements.

Means and Olson [31] allude to this assertion stating that in the past, computer laboratories were associated with classes teaching computer literacy or programming at the secondary level and with integrated learning systems (ILS) providing drill-and-practice on basic skills at the elementary school level. Adding that this situation is changing, wherefrom more schools are finding a place for general-purpose computer laboratories where students can go to work independently on their own projects. Hence, for optimal results ICT contents should guarantee students self-directional caoacity.

Fundamentally, it took the combined workforce of hardware and software specialists in the programming, pedagogical and creative disciplines, to design, develop and implement customized packages for Africa likes of the e-School and OLPC

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initiatives. Buchele and Owusu-Aning [32] observe for instance that:

> "The One Laptop Per Child (OLPC) project is an initiative that seeks to expand the use of computer technology to under-privileged children of the world, with a view to narrowing the *digital divide*." Also, "to improve educational opportunities for the children, by providing resources to enhance the children's engagement in their own learning using internet-connected laptop."

It is worthy of mention that CAI packages offers a bridge through which local learners' plunge into the World Wide Web (WWW) to secure versatile research data as well as carryout collaborative projects with international peers and mentors. Complementing the traditional chalk-and-talk method, technology-mediation empowers local learners with the capacity for new knowledge construction. Interestingly, this IT revolution has triggered the urge by creative industry's practitioners in the developing world (including Africa), to clamor for customized digital contents and interfaces.

Azi [33] refers to these artforms as *'Afrimation'* (a word he coined in 2006, from Africa animation), characterized by African art and design techniques. He identifies the following as very good examples of innovative homegrown contemporary digital projects: Kabongo; Tinga Tinga Tales; Zambezia; The Lion of Judah; Magic Cellar and Interactive Child Learning Aid Project (i-CLAP) Model. It is exciting to know that some of these projects have secured foreign broadcast deals with companies in the US, Canada and France. Hence, are seen to possess the potentials to promote the African Rennaissance agenda in the global digital technology arena. The goal of addressing this challenge through this procedure in addition to providing locally developed custom ICT contents is to become active partners in developing contents sensitive to local needs and preferences. Especially, ones capable of serving not only as educational resources, but also artifacts for globally projecting Africa's rich cultural heritage.

6 JUSTIFICATION FOR LOCAL CONTENTS

According to Azi [33] local (digital) contents constitutes any creative industry's output that integrates relevant components of Africa's cultural heritage, packaged as: computer software, film, animation, cinema, CD/DVD, video or computer games and mobile phone apps. Also, the concept should be directly or indirectly predisposed to Africa's socio-eco-cultural development. Azi [27] highlights the following among factors liable to constitute communication barriers when non-contextualized ICT-based contents are adapted, they include differences in:

1. Culture (language, lifestyle, beliefs, values)
2. Learning and teaching styles
3. Social standards
4. National philosophy

McLoughlin and Oliver [34] affirm that one of the limitations in current instructional design models is that they do not fully contextualize the learning experience and are themselves the products of particular cultures. Adepetun [35] quotes the Minister of Communications Technology, Mrs. Omobola Johnson, **f**or the Nigerian brand to soar in the global Information and Communications Technology (ICT) market, local equipment manufacturers (OEMs) and assemblers of indigenous computers need to improve on their respective brands, to boost local content development in the country. Against which backdrop, the i-CLAP model initiative is designed and developed as a 'contextualized' instructional resource that integrates two key features, that is: culture and multimedia technology components. Culture simply refers to the behavioral customs, the manners, the interests and values of a society. Moreover, since children all over the world are born into a culture not with one, a solid foundation to their education cannot be laid outside their culture.

Azi [11], as quoted from Michael Howe's book *"Learning in Infants and Young Children"*, states that the term "experience" is synonymous with exposure to the environment. It is usually inferred that learning has taken place when changes in behavior occur as a result of experience, practical and training. Furness, Winn and Yu [36] affirm that intrinsic motivation is increased if the learner has "ownership" of experience and control over or personal involvement in the experience. Adding that students who can construct their own ideas directly from experience are more interested and excited in what they learn, consequently motivation becomes largely intrinsic, interest higher and retention longer.

Therefore, as potential members of the society, it is one of the tasks of education to prepare its children for that full membership bringing forth every available resource. Moreover, Garcia and Pence [37] and Marito Garcia in Azi [38] declare that early child development (ECD) programs possess positive long-time benefits on children's future learning potentials, educational attainment and productivity. Vanscoter, Ellis and Railback [9] noted that children from birth to age eight learning rapidly, using all of their senses and their entire bodies to take in sensations and experience the world around them. Adding that during this period of their lives they learn through their play and exploration across five essential developmental dimensions that include:

1. Social and Emotional Development
2. Language Development
3. Physical Well-Being and Motor Development
4. Cognition and General Knowledge

According to McLoughlin and Oliver [34] recent theories argue for the need to provide a culturally sensitive learning en-

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vironment. The "Vygotsky and Social Cognition" and "Communities of Practice" models postulate that culture is a prime determinant of individual's development. However, in addition to culture designers should know that 90% of communication is non-verbal, conveyed through visual means such as gestures and images especially in the early stage of mental growth [39]. The British Film Institute [40] also adds that critical and creative moving image skills will be a key element of literacy development in the 21st century. Today's advances in technology avails digital applications for designing, producing and delivering visual images through interactivity allowing for the selection, controlling and self-pacing of learning.

The "Learning Style Theory" emphasizes the introduction of a wide variety of experiential elements to the educational process such as plays, rhymes, arts/crafts, games and storytelling activities, interestingly such elements have been a heritage of the Africa society. The i-CLAP model therefore, proposes an all-inclusive educational resource that harmonizes these artistic and cultural experiences to contemporary multimedia technology devices. That is aimed at appealing to all the intelligences towards enriching learning, as stipulated by Gardner's "Multiple Intelligences Theory" [41]. The i-CLAP initiative postulates that learning should not only be a means to a vocation, but a medium for the articulation of socio-cultural values. While it is true that action is required on many fronts, cutting across all these challenges and central to the achievement of the MDGs is the monumental task of achieving "Education for All" (EFA). By estimates of the Nigerian government itself, over 7 million children remain out of school, when examining the scale and nature of the problem, what we must always ask of every initiative is how it contributes to the overall reduction of those numbers in a sustained manner [11].

7 Design Architecture for the i-CLAP Model

Design architecture describes the structural procedure adapted in achieving a software design outcome. According to Taylor and van der Hoek [42] there is no doubt that design is the central focus of software engineering. Considering what software engineering is, namely a practice directed at the production of software systems, then design is seen at its heart, as it is in any other productive enterprise, whether the creation of skyscrapers, automobiles, toasters, or urban regions. The i-CLAP model design was carried out using the ADDIE model structure, which proffers 5 steps to instructional design namely: Analysis, Design, Develop, Implement and Evaluate. Against which backdrop, the processes of the i-CLAP model development were broken down into 3 milestones:

A (i) Need Analysis (i.e. identifying and evaluating needs)
(ii) Design (i.e. structuring necessary parameters)
B (iii) Develop (i.e. producing the practical component of the model)
C (iv) Implementation (i.e. testing the effect of the model on the target audience) and
(v) Evaluation (i.e. analysing results of test on audience).

While fieldwork provided primary data required for this research, available secondary sources aided the project's realization. Most of which data was acquired through online databases and other information finders like the Britannica and Encarta encyclopaedias. This exceptional opportunity made it possible for the researcher to develop the theoretical framework of the i-CLAP model. Of course, while 2002 was a period utilized strictly for the research coursework, which is a prerequisite for all Graduate and Postgraduate students at the Department of Industrial Design, ABU Zaria. The analysis and design phases for the research were carried out mainly between 2003 and 2005.

Furthermore, state-of-the-arts Computer Graphics and Animation facilities at the School of Design, College of Imaging Arts and Sciences (CIAS), Rochester Institute of Technology (RIT), Rochester, New York, served as the research centre where the development of the practical component of the model was carried out. The photograph on *Plate 1* (below) shows the front-view of the School of Design, *Plate 2* (below) shows Dr. Joseph Azi at RIT using the WACOM Tablet at the graduate design studio in 2005. This opportunity was made possible when in 2005 the researcher was awarded the Fulbright Junior Staff Development (JSD) Grant (No. 15054524), administrated by the Institute of International Education (IIE), New York. Wherefrom, hands-on training in relevant areas of Computer Graphics and Animation were acquired towards, the goal being to empower the initiator of the i-CLAP model with skills for developing the prototype project. Of course, the developed model served as a key component of research instruments during the pilot test. These hands-on experiences complemented the researcher's initial skill level in traditional animation.

Plate 1: The School of Design, College of Imaging Arts and Sciences (RIT), Rochester, New York. *Source: Original i-CLAP Model Clips [36]. Photographed by: J. I. Azi*

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It is noteworthy that some of the courses audited by the researcher within the period of two (2) academic Quarters, spanning between September 2005 and May 2006 included: *(i) First Quarter (September - November):* 2D Computer Animation; Vector-based; Special Effects; Graphic User Interface; 3D Computer Graphics; Curriculum and Instruction (CI) and *(ii) Second Quarter (March - May):* Instructional Multimedia; 2D Computer Animation II; Programming for Designers and Fundamentals of Instructional Technology. Note that theoretical Courses taken outside the College of Imaging Arts and Sciences (CIAS) included: (i) Curriculum and Instruction (CI) at the Portland State University (PSU), Portland and (ii) Instructional Technology at the College of Information Technology, RIT. Major software experiences during these courses included: Adobe Illustrator, Adobe Photoshop, Adobe After Effects, Macromedia Flash, Adobe Dreamweaver, HTML, XML, 3D Maya, Poser, Cinema 4D.

The rationale for equipping with technical skills and sourcing relevant data in the research was to be able not only to compose an indigenous computer-assisted instructional (CAI) resource capable of enriching the learning environment of the local child, but to justify the need for such a project. This information helped the researcher to be able to define the structural parameters and proffer a discrete scope for the i-CLAP model. Analyzing learning needs and goals for the i-CLAP model design was done towards appraising the human performance requirements in Nigeria, with a view to developing a 'contextualized' model befitting the local learning style and preferences. Especially, given that the western packages were seen to be inadequate in providing culturally inclusive experiences.

8 Observations

It is noted that technology integration entails availabling technology resources to almost every sector of a society, like education, medicine, government, agriculture and so on. With regard to educational software contents and interfaces, thousands of varieties have been developed for different subject areas, towards enhancing cognitive maturation among learners. Most of which have shown the potential to significantly enhance learning motivation and interest, hence are considered as an integral part of learning technologies of the 21st century classroom environment. However, it has been observed that western software contents are developed with cross-cultural audiences in mind, neglecting the interest of minority societies (i.e. developing countries). Against which backdrop this research argues that for optimal effectiveness, there is the need to customize the contents and interfaces of technology resources, especially the ones targeted at developing societies.

Against which backdrop, the researchers observed that the i-CLAP model is capable of simulating greater engagement among local learners, thereby enhancing their participation in the learning process. The project's local content characteristic also offered an exceptional sense of local reality, in that participants were able to connect with the unique concept offered by the *"Afrimation"* techniques through the use folkloric tales, music, architecture etc. This outcome revealed i-CLAP model's capacity to establish among learners a mood different from that which is induced by similar technology learning resources imported into Nigeria.

9 Conclusion

Although, the development and application of computer-assisted instructional (CAI) resources for classroom application are considered to be in a state of infancy, evidence abounds of their significance as indispensability to the 21st century classroom environment. Significant examples include Intellimedia, VIPRG, Zoo Atlanta, OLPC and Intel Classmate. It is no doubt however that technology when developed with contextual components meaningful to the learners experience and used appropriately by skilled teachers, can enhance learning motivation among local children in valuable ways. What is worrisome however is the dearth in local contents with concepts that integrate indigenous components of Africa's unique cultural experiences. There is therefore the need to riseup to the challenge of developing an indigenous model pertinent to Africa's socio-cultural peculiarities. Valuable lessons have emerged from the i-CLAP model design and implementation in Samaru - Zaria, which adapted the results of written tests, drawing assignments and assessments in using Computer-Assisted Instruction to evaluate the learning performance of pre-primary school children.

The evaluation revealed that the technology-mediated learning was a flexible learning tool, capable of enhancing motivation and simulating greater learning engagement in children by attracting and holding their attention and interest. This is required especially in Nigeria where multifaceted predicaments militate against developmental goals like war, starvation, HIV/AIDS, crime and corruption etc. Thereby, causing

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school low school enrollment, high dropout and low learning achievement levels to characterize the educational system. The i-CLAP model demonstrates the efficacy of cultural integration in instructional multimedia resources and the promise content customization holds for advancing the UBE and MDGs agendas.

10 Recommnedations

The following recommendations are drawn:

- Current standards in instructional multimedia design theory and practice should integrate cultural concepts like relevant components of the African Indigenous Knowledge (AIK);
- Government and stakeholders in Nigeria's development should boost local content development initiatives by offering project sponsorships, mentorship/partnership assistance and other incentives;
- Periodic evaluation of current ICT integration programmes in Africa should be carried out (e.g. School Connectivity, OLPC Laptops etc.), so as to ascertain the efficacy or orderwise of technology integration and possibly guide future policy decisions;
- Further research should be carried out towards standardizing the structure and contents of local digital content initiatives like the i-CLAP model design as a potential indigenous model for Nigeria.

12 Autors' Biography

Dr. Joseph Izang Azi is a Senior Lecturer with the Department of Industrial Design (Graphics), Ahmadu Bello University, Zaria, Nigeria. He is currently a Master's Degree student of Computer Graphic Design at the College of Imaging Arts and Sciences, Rochester Institute of Technology, Rochester, New York, where he was both a Fulbright and MacArthur Fellows in 2006 and 2008 respectively. He initiated the Interactive Child Learning Aid Project (i-CLAP), which he defended as a Ph.D. dissertation in 2007. Assessing the impact of digital technology in child development in Nigeria has been his major area research interest.

Dr. A. A. Nkom is a specialist in Educational Technology an area which he has relentlessly published articles in elite journals and has authored several books on instructional communication for effective teaching. Dr. Nkom has also consulted for the states and federal government of Nigeria in diverse areas of technology integration in education in addition to carrying his teaching and research endeavors at the Institute of Education, Ahmadu Bello University, Zaria.

Professor Marla Schweppe is the Chair of 3D Digital Graphics in the School of Design, Rochester Institute of Technology (RIT). She has taught Computer Graphics and Animation for more than 25 years at Ohio State, the School of the Art Institute of Chicago, and Northwestern University as the Director of the Learning Technologies Program, before joining RIT. At RIT she is currently building a BFA in three-dimensional digital design. Her creative work includes the incorporation of her extensive international theatrical background into performances on the virtual stage, animatronics, physical computing and tangible media.

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