An Exploration of the Potentials and Potencies of Information & Communication technologies for Educational Development

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ABSTRACT

Interactive Computer Technologies (ICT) have crept into education industry, thus dramatically causing a tremor of transformation as it is continually integrated into the instructional process. The world moving rapidly into digital media and information, the role of ICT in education is becoming more and more important and this importance will continue to grow and develop in the 21st century. This paper highlights the various impacts of ICT in education and explores potential future developments. Education is a very socially oriented activity and quality education has traditionally been associated with strong teachers having high degrees of personal contact with learners. Information communication technologies (ICT) at present are influencing every aspect of human life and a potent force to bring educational reforms. They are playing salient roles in work places, business, education, and entertainment. Moreover, many people recognize ICTs as catalysts for change; change in working conditions, handling and exchanging information, teaching methods, learning approaches, scientific research, and in accessing information. Therefore, this review article discusses the roles of ICTs, the promises, limitations and key challenges of integration to education systems. The article attempts in answering the following questions: (1) What are the benefits of ICTs in education? (2) What are the existing promises of ICT use in education systems of some developing countries? (3) What are the limitations and key challenges of ICTs integration to education systems? The review concludes that regardless of all the limitations characterizing it, ICT benefits education systems to provide quality education in alignment with constructivism, which is a contemporary paradigm of learning. The successful integration of any technology, thus ICT, into the classroom warrants careful planning and depends largely on how well policy makers understand and appreciate the dynamics of such integration. Given the size and pace of development of this topic area it would be impossible to claim comprehensiveness of coverage in this resource guide. It does however provide a detailed pointer to the main resources which can be used to further develop expertise in this area.

Keywords: Technology integration, Pre-service teacher training, Constructivism, Behaviorism Enhancing learning; Educational improvement; Teacher Education

African Journal of Computing & ICT Reference Format:

1. INTRODUCTION

ICT is a generic term referring to technologies which are being used for collecting, storing, editing and passing on information in various forms [1]. A personal computer is the best known example of the use of ICT in education, but the term multimedia is also frequently used. Multimedia can be interpreted as a combination of data carriers, for example video, CD-ROM, floppy disc and Internet and software in which the possibility for an interactive approach is offered [2]. Is technology driving teaching, or teaching driving technology? Since the beginning of this century, education has faced a variety of social, cultural, economical, and technical challenges.

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.”(1) The emergence of this new global economy has serious implications for the nature and purpose of educational institutions. As the half-life of information continues to shrink and access to information continues to grow exponentially, schools cannot remain mere venues for the transmission of a prescribed set of information from teacher to student over a fixed period of time. Rather, schools must promote “learning to learn.”: i.e., the acquisition of knowledge and skills that make possible continuous learning over the lifetime.(2)
“The illiterate of the 21st century,” according to futurist Alvin Toffler, “will not be those who cannot read and write, but those who cannot learn, unlearn, and relearn.” Integration of ICT in education has been a contentious issue. There are considerable differences of ‘e-maturity’ within and between countries, and between schools within countries. In some countries schools have embedded ICT into the curriculum, and demonstrate high levels of effective and appropriate ICT use to support teaching and learning across a wide range of subject areas. In other countries however, schools are in the early phase of ICT adoption, characterised by important enhancements of the learning process, some developments of e-learning (ICT enabled learning), but no profound improvements in learning and teaching. At one extreme, there are some who are not convinced that ICT will bring the pedagogical benefits that have been so much touted about. At the other extreme, technology advocates like Edison (cited in [3]) claim that technology will change the educational landscape forever and in ways that will engender a dramatic increase in the performance of learners. In between these two extremes, there are others who adopt a balanced approach.

They are convinced that ICT, if properly integrated, has the potential to enhance the teaching and learning process. If properly integrated, ICT-enabled education has the potential to promote the development of students’ decision-making and problem solving skills, data processing skills, and communication capabilities. If designed and implemented properly, ICT-supported education can promote the acquisition of the knowledge and skills that will empower students for lifelong learning [4]. The 21st Century will see nations increasingly relying on technology to address growing concerns about diminishing resources and ensuring sustainable development. The economic crisis of 2008-2009 has heightened the importance of having competent human resources to assist the recovery of losses resulting from the crisis. Concerns over educational relevance and quality coexist with the imperative of expanding educational opportunities to those made most vulnerable by globalization—developing countries in general; low-income groups, girls and women, and low-skilled workers in particular. Global changes also put pressure on all groups to constantly acquire and apply new skills.

The International Labour Organization 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’. The most pronounced finding of empirical studies on ICT impact is that there is no consistent relationship between the mere availability or use of ICT and student learning. Two major studies in the U.S. found a positive relationship between availability of computers in schools and test scores. [5] [5]. A study in Australia [6] found no relationship between computer availability in schools and test scores.

Two large studies, an international study by Fuchs and Woessmann involving [7] developed and 31 emerging countries, and another by Wenglinsky surveying U.S. schools [8], found a negative relationship between the availability of computers in the home and achievement scores. Research has also shown that success of ICT in education depends largely on teachers and their level of skill in integrating ICT into the teaching process and in utilizing ICT to provide learner-centred, interactive education. The effective integration of ICTs into the educational system is irrefutably a complex, multifaceted process that involves not just technology—indeed, given enough initial capital, getting the technology is the easiest part!—but also curriculum and pedagogy, institutional readiness, teacher competencies, and long-term financing, among others. Unfortunately, many teachers tend to ‘keep off’ or avoid using them either because they find it too sophisticated or because they find it expensive. Therefore, training teachers to be able to use ICT and to integrate ICT into teaching is crucial for achieving improved educational outcomes with ICT.

For developing countries ICTs have the potential for increasing access to and improving the relevance and quality of education. It thus represents a potentially equalizing strategy for developing countries. Furthermore, the rapid rate with which new technologies change and develop implies that education programs must keep pace with advancements in knowledge and skills and also the demands and requirements of employees to stay relevant. The kind of skills needed and how universities can help to foster these skills are issues yet to be fully addressed. It is crucial that universities equip their students with appropriate knowledge, skills and aptitudes to be more competitive in a shrinking and increasing global and competitive labor market. In addition, the trend towards a knowledge-based economy has emphasized the importance of universities being repositories of valuable human capital to help secure shares in the global market. The shift to high-technology and information technologies economies requires sustained human resource development and training. Thus, driven by globalization and pressures to teach and train knowledgeable, skilled and competitive professionals, universities has a huge challenge to enhance access to higher education and also improve the quality of higher education against the reality of decreasing resources. Universities need to be innovative and leverage on the rapid developments in ICTs and lead by example in using these cutting edge technology to meet these expectations.

ICT education is a diverse field encompassing a range of disciplines; both those traditionally classified as IT (e.g., information systems, computer system engineering and computer science) and newer disciplines which cross over a number of educational domains (e.g., business systems, web development and design, e-commerce). Broadly, three major types of ICT induced studies can be identified—measure ICT integration into education in terms of infrastructure and access, identify and measure the use of ICT in educational settings and last but not least the impact of investment of ICT on learning and teaching.
To respond to these problems, policymakers need to make fundamental changes. They need to replace the information-based, teacher-directed learning provided within a formal education system governed by directives with a new type of interactive learning that emphasizes creating, applying, analyzing, and synthesizing knowledge and engaging in collaborative learning throughout the lifespan. As more and more higher education institutions are using ICT to develop course materials, deliver and share course content, lectures and presentations, facilitate communication among lecturers and students, encourage pedagogical innovation, increase cooperation and collaboration, conduct research, enhance professional development, and provide administrative and management services. ICTs are a potentially powerful tool for extending educational opportunities, both formal and non-formal, to previously underserved constituencies—scattered and rural populations, groups traditionally excluded from education due to cultural or social reasons such as ethnic minorities, girls and women, persons with disabilities, and the elderly, as well as all others who for reasons of cost or because of time constraints are unable to enroll on campus. ICTs provide a window of opportunity for educational institutions and other organizations to harness and use technology to complement and support the teaching and learning process. E-learning is an example of the use of these ICT-supported teaching and learning methods whose use in educational institutions is gaining momentum with the passage of time [9].

Can a better world be achieved via better communication? This is a perpetual question concerning communication researchers and practitioners for centuries. It is our vision that free and balanced communication between communities, nations and civilizations is the path to a peaceful and prosperous globe. Communication is closely related with the development of each individual. It is also interrelated with community and global contexts. As information communication technology brings people around the world closer, the need for human to understand and share meaning between each other becomes more urgent than ever. The existing global communication order is still far from satisfying this requirement. There are problems of dominance of the elite-clubs, digital divide, intercultural stereotyping and discrimination, the dilemma of regulation versus liberty, etc.

According to [10] ICTs have become within a very short time, one of the basic building blocks of modern society. Many countries now regard understanding ICT and mastering the basic skills and concepts of ICT as part of the core of education, alongside reading, writing and numeracy. However, there appears to be a misconception that ICTs generally refers to ‘computers and computing related activities’. This is fortunately not the case, although computers and their application play a significant role in modern information management, other technologies and/or systems also comprise of the phenomenon that is commonly regarded as ICTs.

According to [11] information and communication technology (ICT) may be regarded as the combination of ‘Informatics technology’ with other related technology, specifically communication technology. Informatics refers to the science dealing with the design, realization, evaluation, use and maintenance of information processing systems, including hardware, software, organizational and human aspects, and the industrial, commercial, governmental and political implications of these. Informatics Technology on the other hand is defined as the technological applications (artifacts) of informatics in society. From a less technical viewpoint the term information and communication technology (ICT) refers to the range of technologies that are applied in the process of collecting, storing, editing, retrieving and transfer of information in various forms. The foregoing definition implies that a broad range of technological equipment such as computers, mobile telephones, MP3/MP4/WMA storage devices, file transfer protocols, listservs, satellites, world wide web etc are used for information exchange among people for different purposes.

These devices are capable of both synchronous and asynchronous communication formats, and the most advanced of these technological applications is the concept of multimedia, which refers to teaching and learning devices that include a combination of data manipulators e.g. video, CD ROMs, floppy disks etc which facilitates interactive communication between and among individuals. Given these descriptions of the components of ICTs, it should be clear why ICTs are considered a more robust and all encompassing phenomenon than the popular narrowly held conception of mere application of computers in human activities. According to [12] information and communication technologies are the backbone of the knowledge economy and in recent years have been recognized as an effective tool for promoting economic growth and sustainable development.

The use of ICT in education can be seen to reflect a shifting pedagogical paradigm that has its roots in the educational theory of John Dewey and Paulo Freire. For both Dewey and Freire, education, and commensurate with this the role of the teacher, is concerned not with the dissemination of knowledge or with preparing students for a world of work, but in imbuing them with the skills that they need to become rounded individuals and better human beings. This is more because we are living in a world of rapid change where technologies play a multitude of roles. We cannot remain indifferent to this societal metamorphosis. As researchers and educators, we have a responsibility to embrace and shape the processes of change that ICTs bring to teaching, life, learning, work, and livelihoods. The role of education in society is in flux, as a result of the progression of the forces of globalization, the pace of technological change, the ever-increasing centrality of information and knowledge, and the importance of skills to access and use both new technologies and information more effectively. The result is that the aim of education has shifted and we need to better align technology with pedagogy.
A paradigm shift in understanding how technology can be embedded in teaching practices is necessary to ensure that education can move into a new era of learner-centric education. Countries have been investing considerably in terms of money, expertise, resources and research to integrate technology in education as smoothly as possible so that the classroom environment is made more conducive for enhanced teaching and learning. Nations have recognised not only the positive effects of technology in education, but also the pivotal roles that it plays in securing jobs in the competitive job market of the 21st century. Prospective job applicants increasingly need to be computer-literate in order to qualify for job positions. Moreover, for countries to compete with each other in the global information-based and knowledge-based economy, they need a workforce that is skilled in the use of technology to gain the necessary competitive edge over one another. Hence, it is no longer a question of if technology should be integrated in the school setting, but a question of when and how to integrate technology so that it benefits all the parties concerned – students, teachers, administrators, parents and the community. Countries that fail to recognise and act according to the trends in new content and new methodologies in education and training may find it very hard to compete in the global economy [13].

A predetermined process is important for the integration of ICTs in the classroom, curriculum, school management, library, and any educational setting. Integration of ICTs enhances the quality of education by helping teachers to do their job and by helping students to learn more effectively. In these contexts, teachers’ shifting role in the 21st century involves an essential mission, which is to be the frontier for applying technological innovations to the teaching and learning process. At this point, necessary skills and the level of future teachers’ readiness are key factors in implementing new ICTs. Consequently, schools of teacher education play a crucial role in preparing future teachers to become proficient in the integration of ICTs into the curriculum. They need to help prospective teachers understand how ICTs can be used to teach content in rich and meaningful ways [14] [14] [14].

We are experiencing the dawn of the new millennium, one that is built on information and increasing technological advancements. The millennium brings with it a world of greater interconnectivity and an accelerated flow of data, whilst decreasing time and international boundaries. The force driving this rapid revolution in communication, transforming the world from isolated islands to interconnected superhighways is ICT. In the future these networks, in conjunction with future and emerging ICT technologies, will serve as a global area network that connects Intranets of companies, the home systems of families, possibly the personal computers of individual people and the microprocessors of all types of equipment. To summarise, ICT will have a consequential and ubiquitous effect in the world — especially in the area of education — now and particularly in the future.

ICT is an umbrella term that includes all technologies for the communication of information. Prevailing technologies of reproducing, storing and transmitting of information in today’s world have changed irrevocably. Information technologies have modified the nature of civilization and brought new ideas and ideals. 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. The emergence of this new global economy has serious implications for the nature and purpose of educational institutions. As the half-life of information continues to shrink and access to information continues to grow exponentially, schools cannot remain mere venues for the transmission of a prescribed set of information from teacher to student over a fixed period of time. Rather, schools must promote “learning to learn” i.e., the acquisition of knowledge and skills that make possible continuous learning over the lifetime. “The illiterate of the 21st century,” according to futurist Alvin Toffler, “will not be those who cannot read and write, but those who cannot learn, unlearn, and relearn.” The incorporation of technology into teaching and research is one of the most important challenges for education today.

Technology has always impacted education; the printing press allowed textbooks to be developed, and the replacement of slates and chalk by pencil and paper permitted a permanent record of one's writing to be preserved. It is time to move beyond the walls of our classrooms to join forces with other institutions and societies to revitalize education. Technology development in the beginning of 21st century has changed not only the way classrooms appear, but also necessitated a change in how students in the classrooms learn. The integration of educational technology into classroom instruction to enhance student learning is of increasing interest to stakeholders such as policymakers, administrators, educators, students, and parents [15]. Technology allows us to better serve the diverse learning styles of our students and educate them for a wider range of intelligence. Everybody has different learning styles for meaningful learning but teachers cannot represent all the styles in a traditional classroom environment. However, with the flexibility and help of the technologies, we can design learning environments in which students can manage and construct their own representations of knowledge in their minds.

It is generally believed that ICTs can empower teachers and learners, making significant contributions to learning and achievement. However, current research on the impacts of ICTs on student achievement yields few conclusive statements, pro or con, about the use of ICTs in education. Studies have shown that even in the most advanced schools in industrialized countries, ICTs are generally not considered central to the teaching and learning process. Moreover, there appears to be a mismatch between methods used to measure effects and the type of learning promoted. Standardized testing, for example, tends to measure the results of traditional teaching practices, rather than new knowledge and
skills related to the use of ICTs. It is clear that more research needs to be conducted to understand the complex links between ICTs, learning, and achievement. However, the experience of introducing different ICTs in the classroom and 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—indeed, given enough initial capital, getting the technology is the easiest part!—but also curriculum and pedagogy, institutional readiness, teacher competencies, and long-term financing, among others.

2. TECHNOLOGY INTEGRATION IN SCHOOLS

The findings indicate that teachers encounter many barriers like lack of confidence, lack of competence and lack of access to resources. Since confidence, competence and accessibility have been found to be the critical components of technology integration in schools, ICT resources including software and hardware, effective professional development, sufficient time and technical support are required. No one component is self-sufficient to provide good teaching. Promoting equity through ICT is one of the most important issues any educational government has to handle while developing computer culture in schools. In order to realize this objective, we need a model of the eLearner of the first decade of the new millennium. This “digital student” is similar and at the same time very different from those we encounter in the classrooms of today. Over the past decade, educators have been under pressure to reform school through technology. Public and political support for technology use has generated billions of dollars toward increasing its availability to schools and colleges [16] [16]. Information and Communication Technologies (ICT) can be an extremely powerful enabler in efforts to bring positive and sustainable development to countries around the globe. Today, almost a full decade into the 21st century, we live amidst an unprecedented revolution in the advancement of ICT.

A vibrant education sector is fundamental for developing human capital within countries. With an active and transformative education policy and a supportive infrastructure, the development of a knowledge-based population can apply itself to sustained and equitable growth. If there is one truism that has emerged in the relatively brief history of ICT use in education, it is this: It is not the technology but how you use it! Put another way: “How you use technology is more important than if you use it at all…[and] unless our thinking about schooling changes along with the continuing expansion of [ICTs] in the classroom then our technology investment will fail to live up to its potential.”85 Technology then should not drive education; rather, educational goals and needs, and careful economics, must drive technology use.

Only in this way can educational institutions in developing countries effectively and equitably address the key needs of the population, to help the population as a whole respond to new challenges and opportunities created by an increasingly global economy. ICTs, therefore, cannot by themselves resolve educational problems in the developing world; as such problems are rooted in well entrenched issues of poverty, social inequality, and uneven development. What ICTs as educational tools can do, if they are used prudently, is enable developing countries to expand access to and raise the quality of education. Prudence requires careful consideration of the interacting issues that underpin ICT use in the school—policy and politics, infrastructure development, human capacity, language and content, culture, equity, cost, and not least, curriculum and pedagogy.

ICT can play a vital role in increasing access to education as well as providing better quality education. While there is agreement that ICT can be a powerful tool for advancing education efforts going forward, the challenge we face today is turning the potential of Information and Communication Technologies for Education (ICTE) into reality with results. This is a tremendous challenge, compounded by the realistic fears that if not used properly, ICT can increase existing social and economic inequalities, particularly if access and use of ICTE is not equally available to everyone. Implementation of ICTE must be case specific and locally driven, or the development community may risk further isolating impoverished populations rather than promoting inclusion and social advancement. In addition to the dangers of further isolating already marginalized groups, evidence from ongoing projects around the world reveal that effective implementation of ICTE initiatives is extremely challenging. Imagine a remote village in India and some of the potential challenges to overcome when introducing ICTE to those living there. Is there adequate government support and funding for the projects? Is there infrastructure and connectivity for computers in the schools? Have the teachers ever used computers before and are they willing to adopt their teaching styles to do so? These are only a few of the many questions one would face when attempting to bring ICTE to areas that may not be as familiar with the concept.

Quite common today, teachers expect recipes for using technology. Simply stated, they want to be shown how to do something with computers without actually learning to use them. Teachers invariably seek to be given procedures to follow, packaged lesson plans to implement, imaginative and representative applications of technology that they can carry back to the classroom and put into practice in teaching. This is a popular notion among many teacher and technology educators and seems on the surface to make sense. This idea as a goal for empowering teachers with technology for the benefit of school children seems quite appropriate at first glance and is thought to withstand any criticism as noble and obviously beneficial for the target group.
As an analogy, consider hiring a chef for an important banquet. Your chef is known to have gone through schooling designed to prepare the chef with the latest in cooking the finest meals. Two hours before your guests arrive you look in on your chef only to find a total dependence on recipes, step-by-step charts and other such aids. When you inquire about the chef’s ability to intuitively manage the art of cooking with a flare of imagination, insight and mastery, your wizard for your evening of magic points to the recipe. The chef explains with confidence that their experience in school was state-of-the-art, equivalent to the finest schools around the world, and amounted to getting a recipe book and some classroom practice following the recipes. You of course reluctantly and apprehensively settle for the hope that the recipe will work out for your evening.

This scenario, as absurd as it is, is not unlike what today teachers expects from their study of technology. The intuition, problem-solving and critical thinking abilities consistent with learning and mastery are not commonly over dramatizing, becoming a competent user of technology involves a transformation as one acquires an education – a mastery. Teachers don’t want to change and prefer instead to merely pickup copies of their recipes and thus their mindset precludes being educated at all.

3. CHANGING MODE OF TEACHING

Information and Communication Technologies (ICT) that are becoming increasingly pervasive in societies around the world are also reaching schools. With numerous global advancements in ICT it is essential that educators have a thorough working knowledge of these media and their influence on the performance and engagement of their students. There is no firm agreement on the definition of ICT, as these technologies evolve almost daily. Here we assume that ICT includes, but is not limited to, personal computers, laptops, printers, LCD projectors, palm devices, iPods, fax machines, cell phones, Internet, and Intranet.

Conventional teaching has emphasised content. For many years courses have been written around textbooks. Teachers have taught through lectures and presentations interspersed with tutorials and learning activities designed to consolidate and rehearse the content. Contemporary settings are now favouring curricula that promote competency and performance. Curricula are starting to emphasise capabilities and to be concerned more with how the information will be used than with what the information is. As we move into the 21st century, many factors are bringing strong forces to bear on the adoption of ICTs in education and contemporary trends suggest we will soon see large scale changes in the way education is planned and delivered as a consequence of the opportunities and affordances of ICT. No longer do we have to rely on print media to obtain the information we need. Electronic and digital texts permeate our daily reading and have become a way of life for many adults and students.

An overwhelming amount of information is readily available for us to use just fingertips away. The immense amount of information demands that one has the ability to search, locate, analyze, and judge the usefulness of the information. Publishing software programs make it possible that everyone becomes a published author. New technologies have also blurred the line between authors and readers in cyberspace. Various modes of communication, both asynchronous and synchronous, are possible through networked computers and devices such as iPhones and iPads. Space and time are no longer hurdles for communication as they were before. These are just some examples of the changes brought by new ICTs that are connected to literacy-related competence.

Many research reports have demonstrated clearly that for effective use of ICT, teachers need to be confident and familiar with technology - they have to perceive a reason to use it and be convinced of the benefits. Computers have to be easily accessible, case studies of good practice need to be available, and teachers ought to facilitate the development of increased student autonomy and offer opportunities for authentic learning. There is considerable evidence that students’ learning is more robust and that their knowledge and understanding increases where ICT is used in ways that promote learners to work together and where the teacher is less didactic. However, for students’ learning to develop in this way, teachers’ views of learners have to change and their teaching has to move towards a social constructivist perspective in which they encourage knowledge sharing. ICT alone will not change teachers; it is a fundamental view of learners that needs to change, but ICT can be a catalyst.

While everybody is jumping into the ICT bandwagon, it may be more rewarding to take a step backward and adopt a thorough plan to ensure the meaningful implementation of ICT in schools as well as the high quality of education for the younger generation. The teacher is there to provide support and guidance. There is however a need to provide underlying support to teachers to help them accept the potential of technology for learning. The use of ICT can alter teachers’ views of learners but it takes time to match teaching to this new view. It is likely that some teachers will need more support than has been anticipated and provided for in the current initiatives for teacher training in the integration of ICT into subject teaching.

More student autonomy and encouragement for students to take more responsibility for their own learning is considered to be essential for students to engage in learning in a way that makes the skills they develop transferable to a range of situations and helps them become effective problem solvers. Teachers ‘telling’ students is no longer a sufficient strategy and has proved to be ineffective in knowledge processing and retention. Teachers need to re-evaluate their position in the classroom and ICT can be used in several ways to support this way of working. ICT can be a resource for teaching in the same ways as other resources such as books, videos, radio and audiocassettes.
Teaching can be through, with or about ICT and teachers’ workloads can be reduced with the use of learner management systems that will allow them to maintain records of students, support the preparation of reports and manage timetables, for example. Students can learn in classrooms or at a distance and as ICT becomes increasingly available inside and outside of educational institutions, there are far more choices about where, how and when to learn than ever before. The introduction of multimedia within computer-based environments has had a beneficial effect on student learning. The introduction of a full range of media to complement text and static images and to combine audio, video, and animation provides the learner with a richer learning environment that can provide greater support and develop deeper understanding. Additionally learners can select the medium by which they learn best, and they can demonstrate their understanding in more varied ways, thus providing opportunities for a greater number of students for whom traditional learning environments might have been prohibitive.

4. THE ROLE OF EMERGING TECHNOLOGIES

Technology is evolving at an astonishing rate. It is argued that the adoption of emerging ICT should be examined from a dynamic process perspective. Traditional adoption theories developed by previous researchers [17] [17] [17] have contributed to technology adoption studies in the past, but they have limitations in capturing constant technology advancements and the dynamic and evolutionary nature of technology adoption. Radical breakthroughs in ICT increasingly rely on deep synergies with other disciplines and with the arts and humanities. This requires new attitudes and novel collaborations between a broad diversity of actors in research. As we move into the 21st century, these factors and many others are bringing strong forces to bear on the adoption of ICTs in education and contemporary trends suggest we will soon see large scale changes in the way education is planned and delivered as a consequence of the opportunities and affordances of ICT. In this new Golden Age of technology there is widespread belief that thoughtful and pervasive applications of technology can help eliminate many educational inequities between inner city and suburban schools, between urban and rural districts, and those affecting minorities and people with physical and learning disabilities. Technology should be a tool to help educators meet the educational needs of all children.

As such, technologies cannot function as solutions in isolation, but must be thought of as key ingredients in making it possible for schools to address core educational challenges [18]. There seems to be universal agreement that a major criterion of technological implementation in the schools should be whether such applications actually do improve teaching and learning and increase student achievement. However, there also seems to be consensus about the complexity and challenge of reliably evaluating the effectiveness of technology.

It is a daunting task to separate the effects of technology from the effects of other factors that influence teaching and learning. Results and conclusions must be considered in the context of the interdependent set of variables in which the use of technology is embedded. These variables can include access, teacher preparation and experience, student background, curriculum content, instructional methods, and additional educational resources. Ascertaining technology’s context as well as its impact calls for comprehensive evaluations that consist of both formative and summative components. Formative evaluations (during the course of the program) track the implementation of the technology. Summative evaluations (at the end of the program) examine the impact of the technology application.

ICT is emerging in a new avatar, that may be different from the well known form of technology solely based on a PC connected to the Internet. Education is being partially transformed by new technologies. At one time students could learn a small, but fixed body of knowledge. However, today, the enormous amount of available information, coupled with the fact that the amount of knowledge in the world continues to double at an increasingly quick rate, requires a transformative approach to education. It is imperative that the student of today learns how to be an information manager, rather than in information regurgitator [19].

In a technology-rich environment one must remember that the educational focus is on learning and instructional goals instead of the technology itself, because technology is merely a tool or vehicle for delivering instruction [20]. It is not what equipment is used, but how the equipment is used which makes it relevant to a constructivist classroom [21]. Studies show that in technology rich classrooms there are many observable changes:

1. There is a shift from whole class to small group instruction.
2. Coaching occurs rather than lecture and recitation.
3. Teachers work with weaker students more often rather than focusing attention on brighter students as in traditional settings.
4. Students are more actively engaged.
5. Students become more cooperative and less competitive.
6. Students learn different things instead of all students learning the same thing.
7. There is an integration of both visual and verbal thinking instead of the primacy of verbal thinking [22].

As the technological age continues to render traditional classroom practices obsolete, many educators are still untrained and apprehensive when it comes to technology integration. Therefore, a paradigm shift is needed that requires more than just a quick-fix staff development solution. This leads to the expectation that teachers will create learning environments which challenge and broaden their students’ comprehensive use of technology.
Given the technology driven nature of our global, information based society, lack of technology integration among teachers in classrooms is a major concern in education today. Few would argue that the goal of technology-based professional development is technology integration, but a common definition of technology integration is hard to find. Until recently technology integration was equated with computing equipment in schools, and even today many school districts seem to be of a similar mind. However, the rapid escalation of technological advances, most especially the growth of the World Wide Web, has led educators to expand conventional notions of literacy to include “being able to use an array of technologies to gather information and communicate with others.” and to call for technology integration across the curriculum.

21st century is characterized with the emergence of knowledge based society wherein ICT plays a pivotal role. With this backdrop, major paradigm shift is imperative in education characterised by imparting instructions, collaborative learning, multidisciplinary problem-solving and promoting critical thinking skills. Government of India has announced 2010-2020 as the decade of innovation. Reasoning and Critical thinking skills are necessary for innovation. Foundation of these skills is laid at school level.

It is desirable that affordable ICT tools and techniques should be integrated into classroom instructions right form primary stage so as to enable students develop their requisite skills. Most of the tools, techniques and tutorials are available in Open domain and accessible on web.

Educators today need to separate themselves from the past and accept technology as an integral part of the education of students in the 21st century. Teachers need to recognize technology as an instrument in their tool chest for teaching and learning. But easy access to computers or labs does not always guarantee integration of technology into teachers’ lesson plans. So, it should come as no surprise that while many principals want to improve technology integration in their schools, they just do not know how or where to begin. They have to realize that to promote meaningful technological changes, their teachers must be given opportunities to acquire the skills needed to use technology and then apply them in the context of the curriculum. It’s also important to remember that change takes time, and a realistic Technology Integration Plan should span three to five years. During this time, administrators must be patient, diligent, and attentive. Through strong vision and leadership, the number of educators who can integrate technology effectively into their teaching practices will increase, which will ultimately lead to higher levels of student achievement.

How can technology be appropriately used, and how can it be misused? There are many software packages available which are little more than electronic worksheets focusing on skill and drill. [23] states, “To promote the wholesale use of technology-based systems for [the teaching of] mechanical skills, means that schools would settle for the lowest level of instruction to the exclusion or extinction of higher level skills. If the present system is failing to produce the type of educated students that the nation needs, then automating those same processes will not change the educational outcomes. Having students learn superficial information faster will not improve education” (p. 19). According to the Education experts, Technology is helping teachers tailor instruction toward student needs, making possible a student-centered learning environment, aligning standards, allowing for testing and diagnosis, allowing teachers to manage classes and administrative duties more efficiently and letting teachers pursue professional development opportunities more easily.

Technology is helping students, including students with special needs and those at-risk, acquire necessary skills, participate in mainstream classes, prevail over limitations, physical or learning, work on real-world problems, communicate with peers around the world, improve their tests and gain access to computers when it otherwise wasn’t available. With technology, average students would make substantial improvement and higher-level type students would have no limitations. Literacy would no longer be a concern and lower level and handicapped students would have new prospects [24] [24]. Technology is helping administrators show accountability for goals, use data to learn about effective practices, manage information more effectively, improve communications between parents, teachers and students and provide different opportunities for parental involvement.

What about the future of technology in education? There are many stories of successes when computers and technology are implemented in schools; there are also many stories of failures, technology that isn’t fulfilling its promise of improving our students’ education [24] [24] Most teachers understand the potential of integrating technology into curriculum and the changes it will make to the education field, but many know that technology’s full potential won’t be reached until it can be fully integrated in the classroom and not just used as a supplement to traditional teaching. Effective research based technology integration can enhance students’ learning in language arts, mathematics, science, social science, foreign language and technology literacy. Students can synthesize and present knowledge creativity through graphic presentation, audio and video files, online portfolios and Web page creation. Teachers can motivate students through project based collaborative programmes and can take them on virtual field trips and other curriculum – related websites. Perhaps the most useful pieces of available technology for students are hypertext and hypermedia which allow students to browse information in a nonlinear fashion.
These databases contain hyperlinks which give the decision-making power as to what to explore next. This type of interactive learning also allows the student to create his or her own nonlinear data bases! "Interactive learning in this context means learning in which inquiry, feedback and ongoing collaboration play important roles" [25]. As the 21st century continues to roll on, educators and administrators are faced with many issues. Budget concerns, insufficient funding, the over-regulation and micromanagement of schools, challenges of school leadership, the politics of education, teacher turnover, teacher quality, the No Child Left Behind Act [26] standardized test scores, and potential referendums are issues that all schools face. But perhaps one issue that gives school districts the biggest headache is technology. The concerns with technology and schools are many fold and a constant concern of administrators, educators and school boards. While there are numerous points to deal with when discussing implementation of technology in schools and into curriculum, the main roadblocks can be broken down into the following issues:

A large body of literature supports the idea that technology training is the major factor that could help teachers develop positive attitudes toward technology and integrating technology into curriculum [27] [27] [27] [27] [27] . Of course, technology training that simply focuses on teaching basic computer skills is unlikely to ensure the successful infusion of technology into the classroom. To effectively infuse technology into the curriculum, teachers need to participate in intensive curriculum-based technology training that move them beyond the attainment of basic computer skills to activities that teach them how to seamlessly integrate technology into the curriculum [28] [28] [28] [28] [28]. Research shows that while trained teachers did demonstrate positive attitudes toward using technology and used more technology than teachers who had no such training; they did not show significant changes in frequent classroom integration of technology with students and more student-centered learning [29]. One factor which may contribute to a lower than desirable rate of integration even after technology integration training, may be the lack of on-going technical and curriculum and technology integration idea support after the initial training. Although states are recognizing the need for technology integration training, training is usually short term with no to minimal follow up support after training classes.

5. TECHNOLOGY AND STUDENT ACHIEVEMENT

Effectiveness, cost, equity, and sustainability are four broad intertwined issues which must be addressed when considering the overall impact of the use of ICTs in education. One of the most critical problems in trying to assess the effectiveness of computers and the Internet as transformational tools is that standardized tests cannot capture the kinds of benefits that are expected to be gained in a learner-centered environment. Moreover, since technology use is fully integrated into the larger learning system, it is very difficult to isolate the technology variable and determine whether any observed gains are due to technology use or to some other factor or combination of factors. Therefore, one of the important concerns in using technology in teaching and learning has been whether or not its use contributes positively to student achievement. The need for an answer has become more urgent in recent years due to two key factors—an emphasis on standards-based accountability and the substantial financial, instructional, and organizational costs—involved in purchasing and implementing technology. Research does not allow us to unequivocally state that technology presents a cost-effective way to improve student achievement. The relationship between the two is complex, and problems with research methodology make it difficult to show more than a correlative relationship. It is also next to impossible to control all the variables in the imperfect research environment of schools [30]. A number of meta-analyses, however, have been summarized by [31] in a report to the Institute of Education Sciences (IES) and funded by the United States Department of Education. These authors examined meta-analysis studies from 1975 through 2002. Overall, these analyses indicated educational technology has positive effects on student achievement. According to the Center for Applied Research in Educational Technology [32], technology can improve student learning when it (a) supports curriculum objectives being assessed; (b) provides feedback about student performance to both the teacher and student; (c) allows for student collaboration, discussion, and reflection; (d) adjusts for diversity of learning styles and abilities of students; (e) extends curriculum content beyond the classroom; and (f) is supported by the school district and community.

In addition to examining the meta-analyses studies of others, [31] conducted a systematic search of the impact of technology on student outcomes. Their results indicated there was a “modest, positive effect of teaching and learning with technology on student outcomes” (p. 12). According to their findings, teaching and technology processes can directly or indirectly impact student outcomes. The analysis had several limitations, however, which are indicated below:

- Having few quantitative research studies in peer reviewed journals is a serious problem in this research and in the field.
- There were few randomized, experimental studies. Most were descriptive or exploratory and did not report specific findings.
- The studies lack specificity resulting in difficulty in coding and analysis
- The findings are correlational and do not result in strong causal inferences.
- Some of the studies were a decade old and technology has advanced greatly during this time frame.
- The authors of this study recommend additional, continuous, high quality research on the impact of technology on student achievement [31].
6. TEACHER ATTITUDES AND BELIEFS

Integrating technology into the curriculum in today’s schools should not mean finding ways that computers can help us teach the same old things in the same old ways. Instead, school leaders have the opportunity to combine technology with emerging models of teaching and learning to transform education. If technology is an appropriate vehicle for promoting meaningful learning, why is it difficult to incorporate technology within the classroom? There seems to be skepticism about technology use being “glitzy toys” and “bogus stuff” in the middle of an “educational catastrophe” where children cannot read or write. Proper training is necessary to remove the skepticism. Educators need to learn how to use technology as a device to support communication and collaboration. According to Franklin [33], relatively few teachers feel well prepared to integrate educational technology into classroom instruction. To prepare for this paradigm shift, teachers need to be trained and to think about why they do what they do. Acculturation in the schools must take place, but this is a slow process. Elementary teachers often use a constructivist approach, but most secondary teachers continue to teach in a didactic manner. Thus, even though students come to us from a technology-enriched environment where they control information flow, they are expected to fit into an educational institution unchanged by the technology which has swept through society [34].

In what ways can teacher education programs help preservice teachers become more proficient at integrating technology into their curricula, which in turn, will promote student learning? First, let’s define what is meant by “learning or thinking with technology.” According to [35], thinking with technology can be defined as “a state of mind when teachers use discriminating thinking to identify [and generate new examples of] activities using technology” (p. 351). It is not when a teacher uses technology to create a presentation, to prepare lesson plans or worksheets, or to record grades and student information. While these are other ways to use technology, they do not involve the students in the active learning process. The goal is to prepare future teachers who will use different technologies throughout the curriculum to help students expand their thinking and enhance their learning in the family and consumer sciences classroom.

Researchers’ found two areas that must be addressed in a teacher education program if preservice teachers were to develop a “thinking with technology” perspective: (a) to emphasize the value of integrating technology in the classroom through relevant examples and demonstrations [36] and (b) to build each candidate’s self-efficacy in using technology as a cognitive tool [35]. [36] found that the more content-specific the examples were in using technology, the more likely teachers saw the value in it and used it in the classroom. She stated “the farther the example is from the teacher’s content area, the lower the likelihood that the teacher would spend time developing other possibilities for the technology” (p. 296).

After taking a methods course in which technology was infused into the curriculum and used by participants, a group of preservice teachers’ changed their perceptions about using technology in the classroom from “a vehicle to deliver information” to a “mind tool with which students could learn” [36]. In addition to building their skill level of technology, preservice teachers need to build their self-efficacy of teaching with technology. According to [37], self-efficacy refers to one’s beliefs about their ability to perform an action. A person can have knowledge and skill of technology, but without self-efficacy, they may never attempt to use technology.[38] stated that teachers with higher levels of self-efficacy for using technology in the classroom are more likely to spend time and effort, and persist longer on technology-related tasks than teachers with lower levels of self-efficacy. Researchers [39] [39] described three areas that can influence an individual’s self-efficacy: (a) personal experiences and mastery of the material, (b) observation of material modeled by others, and (c) positive social persuasion from peers and mentors. As these areas build up for an individual in using technology, fear and anxiety diminish and they feel more confident in their ability to integrate technology into the classroom. In other words, the more positive experiences a preservice teacher has using technology in their content area, the more value they see in it and the more confident they become in using technology in the classroom.

Another area of concern in developing a “thinking with technology” perspective for preservice teachers is their student teaching placement. The role of the cooperating teacher can either enhance or inhibit a preservice teacher’s use of technology in the classroom. If a cooperating teacher does not regularly integrate technology into the curriculum, a preservice teacher’s ability to work with technology during their student teaching experience will be limited [36]. [40] characterizes beliefs as existential, affective, evaluative, and loosely bounded, and maintains that they are “very important determinants of how individuals organize the world into task environments and define tasks and problems.” (p. 322) Teacher attitudes and beliefs strongly affect both professional development and technology integration. Some attitudes and beliefs that have been shown to affect technology-based professional development include teacher self-efficacy [41] especially technology self-efficacy, [42] teacher epistemology and pedagogical beliefs [43], and teaching styles [44]. A great deal of the responsibility for successful integration of technology inevitably falls upon individual administrators and teachers. The most critical element in technology use is the preparedness and skill level of those who employ it. Teachers, for example, need high-quality professional development that leads to a professional community centered around the integration of technology into the curriculum.
Teachers' subject specific beliefs [43], in particular their beliefs about educational technology and technology integration [42], are obviously also critical. [42] For example, in an extensive, two-year study of 263 Canadian teachers, found that teachers' confidence in their ability to use computers was the strongest indicator of technology use at the classroom level. [45] studied the "thoughts, perceptions, beliefs, experiences, knowledge, and growth" (p. 187) of practicing teachers studying and attempting to integrate the use of computers in their classrooms. The overarching theme they found running throughout this research was teachers' strong assertion that they needed to change personally and take on new roles if technology was to be effectively integrated into their classrooms. Most of the teachers involved in this study saw themselves as the place where change efforts needed to begin.

Experiences with technology planning highlight the well-documented observation that teacher attitudes toward technology and technology integration seriously impact the success of professional development programs [42]. They thus need to be seriously considered. Positive attitudes toward technology integration enhance learning to use technologies in teaching and learning; negative attitudes constrain it. This does not necessarily mean that only teachers with positive attitudes should be included in technology training activities. It does mean that negative attitudes among participants need to be valued and addressed, and that positive attitudes should be encouraged and developed.

The vision and planning of administration is paramount to the successful integration of technology in schools. When district technology plans are being constructed, school improvement plans must be included. Besides incorporating the SIP, administrators must understand and consider other factors. It is vital that teachers have a reason to use the technology. Projects and assignments that have a real world application and that enhance the lesson and learning are critical. The curriculum should be the inspiration for the technology, not the other way around. Administrators and curriculum leaders need to visit other schools and see what has worked and what hasn’t. Districts need to get good equipment. In a time when money is tight, getting the proper hardware and software is important. Putting together systems with old, out dated material will cost the district more in the long run. As stated above, training for teachers needs to be ongoing and should be a high priority. Another aim for administrators is that technology planning never ends and needs to include trouble shooting, maintenance and networking. Integrating technology needs to involve everyone, including support staff, parents, and the community. Above all, administrators' support and involvement is a crucial factor in the successful implementation of technology in schools [46].

Many factors influence a district’s decision on integrating technology into their schools and into their curriculum. In order for the implementation and integration to be successful each group affected must contribute to the success. Teachers must become familiar with technology and overcome any negativity previously held. They must become educated about technology with professional development. They must develop strategies and lessons using technology. Administrators need to provide funding, encourage teachers and set forth a technology plan for the future. Students must use the technology as a tool for learning. Parents and community members must support the implementation, support the professional development it will require, participate in planning, help with the fund raising and provide business contacts to incorporate practical applications [47]. Only when all of these groups work together will the potential of total technology integration be met.

7. CHALLENGES OF ICT IN EDUCATION

English is the dominant language of the Internet. An estimated 80% of online content is in English. A large proportion of the educational software produced in the world market is in English. For developing countries in the Asia-Pacific where English language proficiency is not high, especially outside metropolitan areas, this represents a serious barrier to maximizing the educational benefits of the World Wide Web. Even in countries where English is a second language (such as Singapore, Malaysia, the Philippines, and India) it is imperative that teaching and learning materials that match national curriculum requirements and have locally meaningful content, preferably in the local languages, be developed. This would ensure that the Web is a genuinely multicultural space and that peoples of different cultures have an equal stake and voice in the global communities of learning and practice online. Particularly vulnerable to exclusion of this sort are isolated, rural populations, cultural minorities, and women in general. Thus attention must be paid to their special needs.

The strongest message from the research, concerned the need for teachers to receive appropriate training and concurrently, for the onsite provision of support for the use of ICT in subject teaching. The challenge confronting our educational systems is how to transform the curriculum and teaching-learning process to provide students with the skills to function effectively in this dynamic, information-rich, and continuously changing environment. ICTs provide an array of powerful tools that may help in transforming the present isolated, teacher-centred and text-bound classrooms into rich, student focused, interactive knowledge environments. To meet these challenges, learning institutions must embrace the new technologies and appropriate ICT tools for learning. They must also move towards the goal of transforming the traditional paradigm of learning.
The rapid diffusion of Information and Communication Technologies (ICT) has been accompanied by an increasing body of research exploring both the potential and challenges associated with the use of these tools, particularly in developing countries. As new technologies are continuously developed, different priorities emerge, traditional technologies merge with newer ones in development practice, and players and agendas at the local, national and international levels constantly transform. Today’s teachers face a variety of challenges when it comes to technology integration. Often, the pressure of using computers and digital media in the classroom is more intimidating than motivating. Countries everywhere are facing similar challenges in implementing ICT in their education systems. Unfortunately, many local, national and regional government bodies are still not giving ICTE the attention and priority it deserves despite the benefits it brings.

Providing basic access to ICT to young people living in either impoverished communities or rural locations often neglected by policy makers is one major challenge being faced. These areas offentimes lack basic infrastructure such as classrooms, let alone Internet connectivity. The availability of quality teachers to apply ICT to the existing education systems is also in short supply. Bringing long-term, sustainable ICTE reform will also be costly and will challenge policymakers handling national budget allocations to make difficult decisions in how to allocate national monetary resources and foreign aid. Finally, shifting the existing focus from the traditional educational models in place, depending on the specific country, to one that is ICT driven, will certainly not be easy.

Well, it’s really mind-boggling the magnitude of other administrative problems that we have to surmount if we are to be a competitive economy, and if Vision 20-2020 will not remain mere rhetoric. One keeps coming back to the issue of ICT in our educational system because we are talking about the future, and the future is about our youths — people who, demographically, are still in one level or the other of the educational system. If by now, eleven years into the 21st century, our educational system is not IT-driven, and the blackboard is not about to give way to the keyboard, how can we achieve Vision 20-2020?

Many of these buildings are just standing there, disasters waiting to happen, their structures having weakened through the ages of use. In other words, there are great infrastructural challenges we must overcome if we are to have an IT-driven educational system. Are our schoolrooms built to house the technology? Will those ones be wired for computer use? In other words, we will need to retrofit many buildings for ICT. Right now, many classrooms are not even wired, or if they are, just for overhead lighting. We have to see to proper wiring for the devices, cooling and ventilation, while we have to secure them as well. Assuming we overcome these problems in the nation’s schools, there still is the problem of electric power, as there’s no point installing computers and retrofitting buildings if electricity is not available.

Where we are now, the nation’s electricity demand, which cannot be met, is chiefly for industrial and domestic use; a scant percentage is used by the schools. An ICT-compliant educational system will need electricity — lots of megawatts; those trying to solve the power conundrum might as well factor in that demand right now. On the heels of that will be the issue of broadband for the educational system. It will be inevitable that schools should have broadband access so that online resources that will better facilitate the teaching-learning process be available. In the global village we are in, this has become a necessity, not a luxury.

Further, teachers may sometimes resist using technologies based on their feelings of discomfort, dislike and even fear of technology [48]. [49] reported several possible explanations for teacher resistance to using computers. These reasons included a) doubt that computers improve learning outcomes, b) resentment of the computer as a competitor for student's attention, c) unsupportive administrators, d) increased time and effort required of the teacher and e) fear of losing control of center stage, and fear of looking stupid in front of the class. For effective technology integration, they further stated that there needed to be a fundamental shift in the role of teacher in order to benefit from the interactive nature of the technology and its capacity to enable student centered exploration. The teacher can no longer be a dispenser of information to relatively passive learners. They stressed that technology-oriented teacher’s new role was described in the literature as manager of information, coach, guide, organizer, initiator and diagnostican. They put the role of traditional lecturer and impartor of knowledge at one end and the role of coach, observer, and facilitator at the other end of a continuum, and concluded that the traditional end of the continuum embraces behaviorist learning theory while the other end is likely to embrace constructivism.

[50] investigated pre-service and in-service teachers’ beliefs on knowledge acquisition by means of a survey touching on knowledge acquisition views from objectivism to constructivism. They found that experienced teachers had a tendency to embrace objectivist view of learning whereas pre-service teachers held a constructivist notion of learning. Based on the interview results, they also concluded that external sources of influence and classroom management issues might create an environment that favors implementation of objectivist-based computer software programs rather than those that are grounded in the constructivist perspective. Technology has also impacted pre-service teacher education programs at many universities. As an example, new initiatives for prospective teachers enable them to view best practices via streaming video over the web. When incorporated with online discussions and teacher/facilitator annotations, the support a teacher needs in implementing a vision or changing a practice is greatly enhanced [51]. According to the study conducted by [52], living-and-learning environments for the training can foster rapid changes in teachers’ epistemological beliefs.
Results indicated that teacher epistemology became significantly more constructivist on three of four measured epistemological dimensions, and the training program was very effective and that certain epistemological dimensions are subject to change. Teachers learned about constructivism by doing constructivism. Individually and collaboratively, teachers learned how to use the technologies by incorporating them into the design of lesson plans. In retrospect, trainers observed that one of the most powerful influences for epistemological change was the teacher-to-teacher encounter. Moreover, [53] concluded that electronic collaboration that was not constrained by time and space was an effective means of providing additional mentoring and support to beginning teachers in their first years of teaching.

The biggest challenge is the need for constant renewal in terms of content, which means expanding NAT-based curricular requirements to accommodate widespread applications that have emerged over the last 4-5 years (networking, e-mail, and multi-media). As technology develops and the environment becomes more user-friendly, there is less of a need for detailed knowledge of operational systems. In direct proportion, however, there is an even greater demand for practical experience in the use of software, the strengthening of network communication and skills in preparing documentation. The role of graphics software in the design of multimedia applications has increased along with the significance of handling audio, visual and music editing programs. Although the NAT structure is “durable” i.e. it does not suggest concrete tools and methodology, because of accelerated technical development local curricula must be modified on a continuous basis so that students can become familiar with the latest applications.

Providing opportunities for a seamless integration of technology into instruction requires teachers, school administration, technology coordinator, and parents to play an active role in determining the importance of technology integration in classroom. [54] suggests that in order to affect teacher beliefs, research needs to be conducted where teachers have first-hand experiences with technology, where teachers observe successful implementation, and where change occurs through professional learning communities. According to [55], components of professional development for effective technological integration includes: (1) connection to student learning; (2) hands-on technology use; (3) variety of learning experiences; (4) curriculum specific applications; (5) new role for teachers; (6) collegial learning; (7) active participation of teachers; (8) on-going process, (9) sufficient time; (10) technical assistance and support; (11) administrative support; (12) adequate resources, (13) continuous funding, and (14) built-in evaluations.

Studies have shown that one’s culture influences one’s perception and learning. Most ICT software materials produced overseas are end product of research findings geared to solve specific problem in their country of origin”. Thus a major criticism leveled against these software materials is the unrelatedness of the educational materials sold to the other countries’ environment. The bone of contention is that in most cases examples and illustrations used have no relevance to the experience of the children of these countries.

8. CONCLUSION

The role of and potential for ICTs in the education sector is not an issue separate from educational reform efforts, but rather inextricably intertwined. ICTs are important tools to meet Millennium Development Goals of access to and quality improvements of educational programming for all children. Having to use ICT in an innovative manner is an important bottleneck teachers have to cope with [56]. It can be interpreted as a ‘design-question’ and allow us to formulate the proposition that ‘educational designing’ skills form the core of the future teaching profession. Recent ICT literature focuses on the mismatch between the traditional, industrial model of public schooling and the new socio-informational configurations emerging from the information revolution. For example, [57] describes this dissonance as a systemic malfunction, suggesting that it is irresolvable within the current industrial framework of schooling. He feels that new theoretical configurations are needed to transform schooling in a manner that can realize the full potential of information technologies. [58] labels typical technology implementation in Australian schools in ways that support and supplement, rather than transform, existing classroom practice. This outlook is reinforced by [59], who laments the lack of inspiration among British primary schools in optimizing the nation-wide installation of high-speed Internet connectivity. Reminding us of Seymour Papert's warning a quarter of a century ago, [60] joins a chorus of colleagues in urging educators to abandon the industrial metaphor for school organization.

However,[61] discovered a positive correlation between teacher self-image and satisfaction with the ICT curriculum resulting from professional time regularly made available for collaboration and communication about ICT practice, suggesting that time committed to peer mentoring can create a positive influence on curricular efficacy. Many researchers have concluded that the use of technology as a learning tool can make a measurable difference in student achievement, attitudes, and interaction with teachers and other students. Interactive, self-directed learning and higher order thinking can be fostered by technology, and that technology can have the greatest benefit when the environment is conducive to such experiences. The evidence shows that technology integration representing learning from technology (behaviorist perspective) is not the most effective way to improve learning, although it helps learners to perform the lower level sub-skills automatically.
On the other hand, constructivist learning environments representing learning with technology, which encourages learners to actively process and organize information by making internal cognitive connections, can well provide the theoretical framework for the effective technology integration.

Consequently, the change required is a shift of responsibility from the teacher to the learners. The key to making this transition is, of course, the teacher. This is how [62] explain: Perhaps the time has come for the goal of education to change… The computer reinvented knowledge by giving us new ways to view the world and ourselves. Education must move from the statistic, mechanical view of the teacher as giver of knowledge to teacher/learner as integrator, guide, architect and facilitator. However, for this change to occur, educators must accept that the computer and its software are not replacements for the content of the discipline core of the curriculum, but are useful extensions that complement content. [http://www.thejournal.com/magazine/vault/A3638.cfm]

On the issue of technology integration in education, there are considerable disparities between developed and developing countries. Developed countries have more resources, knowledge, skills and experience than developing countries. However, developed nations suffer from many of the same challenges and concerns as developing nations, though to different extents. They suffer from the same concerns of teacher apprehension and motivation, and lack of appropriate educational software and technical support, and the same challenges of providing adequate teacher training, of taking care of infrastructural inadequacies, and implementing learner-centred instruction and proper assessment procedures in schools. Advocates frequently propose ICTs in the classroom, but often do so with little rigorous evidence to support their claims. Additionally, very few randomized controlled trials (RCTs) have been conducted and as a result, important questions remain unanswered, such as whether differential effects across subgroups exist, whether certain ICT interventions are more successful than others, and what factors mitigate and enhance the success of ICT interventions.

Much can be learned, however, from what developed countries have done to deal with their technology integration problems, and much can be applied to developing countries. Developing countries should establish a list of priorities based on their needs, specificities and capabilities, and then apply appropriate guidelines to execute and evaluate their plans. However, high in the priority list should be the conduct of needs-analysis and establishment of goals, the securing of funds, procurement of ICT infrastructure, the training of teachers, providing adequate support to schools and teachers, and involving major stakeholders in the decision making process. All this should be cemented by a firm commitment by the authorities and a constant evaluation and management of the implementation process.

Research indicates that the benefits of technology integration do not happen in some miraculous way simply because the technology has been provided, and technology cannot be effective in the classroom without teachers who are knowledgeable about both the technology itself and how to use it to meet educational goals. Therefore, in order to accomplish the profound changes associated with the integration of technology in the overall learning environment, there is a real need for training pre-service teachers. As [63] states, “Without appropriate leadership and training, educators will continue to use technology as a supplement to instruction rather than a tool to facilitate instruction” (p. 10). Pre-service teachers may not develop the necessary skills and application practices of technology integration unless they are presented with appropriate experiences [64]. Proper support and professional development activities should be incorporated into curriculum planning of colleges of education to enhance teaching and learning process.

Teachers’ attitudes toward technology appear to be in constant state of change, but the research indicates that in recent years more teachers are using technology to support learning contexts as a result of appropriate training. Teachers tend to continue to teach and use technologies within an objectivist model of teaching and learning, even though current educational reform movements are based on the constructivist paradigm of instruction [65]. Although most teachers seek ways of improving their practice, and express enthusiasm for constructivist and other reform-based approaches, their underlying, and often largely unconscious beliefs about teaching and learning tend to diffuse efforts to establish constructivist learning environments [66]. Therefore, pre-service teachers should also be trained to learn new skills for facilitating learning in a technology-rich constructivist learning environment.

Notes
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Author’s Short Biography

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Telecommunication Services Provision in Nigeria - Consumers’ Perspectives on Information Provision, Advertising and Representation of Services

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ABSTRACT

This study examined mobile telecommunication users’ perception of service providers, with regard to information provision as well as advertising and representation of services. The study was conducted in Ibadan – a Nigerian municipality. The objective was to determine whether information provision and advertising and representation of services will significantly impact the perception of the telecom users. Using convenience sampling technique, 626 respondents were selected among the consumers of four telecommunications service providers - MTN, GLO, AIRTÉL, and ETISALAT. Data was collected with a 5-point Likert scaled structured questionnaire developed from the Nigerian Communications Commission’s (NCC) consumer code of practice regulation for telecom operators in the country. Descriptive statistics was used to group the observations. Findings showed that subscribers of MTN and GLO perceived their respective providers negatively with regard to providing required information as well as the representation of their products in advertising. It was recommended that NCC should be more proactive in gathering primary data from the users in order to be able to understand the situation and level of compliance with their various regulatory documents. Service providers were also advised to ensure that consumers’ desires are met in order to continue to be in their good books.

Keywords: Advertising, Code of Practice, Consumer perception, Provision of Information, Telecom Service Providers

1. INTRODUCTION

The world’s current population is estimated at about 6.9 billion people [30]. Out of this figure, about 6.8 billion have been verified to own a mobile phone [10][19]. This is a staggering 98 percent of the human race. The mobile phone has been said to be the fastest diffusing innovation of all time, taking just a few years to reach the furthest part of the world [7][24]. Mobile phones have out-diffused virtually every prior technology including; bicycles, radios, television sets, wallets, and wristwatches, and has done so in twenty-five years [24][11]. At the moment, China, India, United States, Indonesia, Brazil, Russia, Japan, Pakistan, Germany and Nigeria are reported to be the top 10 countries in the world with over 100 million mobile subscriptions [19]. Out of the global 6.8 billion subscribers’ figure, the total corresponding to the developed world is estimated to be 1.6 billion while the remaining 5.2 billion plus, belong to the developing economy.

Of the figure corresponding to the developing world, subscribers on the African Continent are estimated to be 545 million. Nigeria with an estimated population of 162.5 million according to The World Bank [30], is reported to have an active mobile subscribers base estimated at about 106.9 million out of the total subscribers of 143 million people [21]. Nigerian active mobile subscribers hence represent about 65.8 percent of the entire population. Furthermore, Nigerian subscribers also constitute about 19 percent of the total mobile telecom subscribers on the African Continent, a feat that has earned the country the first on the African continent and the 10th place in the entire world. Mobile telecommunications service provision in Nigeria is currently shared among four companies that include; MTN, GLO, AIRTÉL, and ETISALAT.
Statistics showed that among the subscribers of mobile service in Nigeria, MTN subscribers top the list with over 47 million subscribers constituting about 43.3 percent of the total GSM subscribers in the country. GLO is the second with subscribers’ base of over 24 million which represent about 22 percent of the total market share and it is followed by Airtel with over 23 million constituting about 21.1 percent of the total market share. Etisalat currently has the least subscribers of about 14 million plus, representing about 13.6 percent of the total market share [21].

Despite the fact that mobile telecommunications consumers in Nigeria have been ranked among the top ten consumers of mobile services in the world according to mobileThinking [19], Nigerian mobile subscribers still groan under the poor performance in service delivery by the four telecommunications service providers in the country. For example with over US$ 5.750 billion investment recently ploughed into network expansion projects by operators in the market, Nigerians are yet to feel the impact in terms of improvements in network quality with drop calls, unsolicited text messages, sudden tariff deductions and incoherent voice transmission still prevalent in the industry [34]. In an article by Famutimi [5], it was reported that the Director of Public Affairs of the Nigerian Communications Commission; the regulatory authority overseeing the telecommunications sector, asserts that the service providers are seriously lagging in meeting the required performance index set by the commission and further encourage the consumers to take service providers to court on account of flouting required regulations. The advice given by the Director according to the article, came as a result of a poll it conducted on its consumer portal; www.consumer.ncc.gov.ng, which indicated that 81.52 percent of consumers it surveyed in February 2014 were dissatisfied with the services rendered by their operators. It should be of note that primary studies of this type that obtain the opinions of the consumers will provide effective views and hence help in the decision making processes of both operators and regulatory bodies.

Hence, the kernel of our study is to assess from the consumers’ perspectives, two variables from the regulatory framework provided by NCC which stipulated the general consumer code of practice that the telecommunications service providers must adhere to, and subsequently find any differences; based on these variables, in the assessment of the consumers of the four mobile service providers in Nigeria. The two variables are: provision of information to consumers and advertising and representation of services. Provision of information to consumers gives the minimum requirements for the telecom operators as far as service description, contracts information, pricing information and so on are concerned. Advertising and representation of services, on the other hand, stipulates the directives for product representation in adverts, unsolicited telemarketing and the likes. Therefore, our objective in this study is to examine:

1. Nigerian telecom consumers’ perception of service providers in terms of their provision of information to consumers
2. Nigerian telecom consumers’ perception of service providers in terms of their advertisement and representation of services.
3. The differences in the perception of MTN, GLO, Airtel and Etisalat consumers in terms of provision of information
4. The differences in the perception of MTN, GLO, Airtel and Etisalat consumers in terms of advertisement and representation of services

To provide answers to the stated objectives, the following research questions guided the study:

1. What is the perception of Nigerian telecom service consumers about service providers in terms of provision of information?
2. What is the perception of Nigerian telecom service consumers about service providers in terms of advertisement and representation of services?
With regard to creating incorrect belief, a few studies have also explored the way advertising messages are framed or presented and its effects on the consumers (Dunegan, 1996; McCuster and Carnevale, 1995; Shelley and Omer, 1996 as cited by [18]) . In their study, Martin and Marshall [18] while investigating the most appropriate message framing to present to consumers, established that consumers are often influenced by the framing of advert messages either negative framing or positive framing.

Chandy et al [2] examined the effects of advertising cues on consumer behaviour in new versus established markets. The conclusion from their study is that the same advertising cue can have different effects on consumer behaviour depending on whether the market is old or new. Cason and Gangadharan [1] documented the market failure that arises from incomplete information. To buttress the influence of product information on consumer behaviour, Kozup et al [15] while studying the influence of health claims and nutrition information on consumers’ evaluations of packaged food reported that when favorable nutrition information or health claims are presented, consumers have more favorable attitudes toward the product. A similar study was conducted by Drichoutis et al [4] which examined consumers’ use of nutritional labels and the authors stated that nutritional information affects purchasing behavior because it influences valuations and perceptions of the product. This makes it imperative for proper consideration of what type of product information is made available to consumers [3]. Garella and Petrakis [6] studied the deployment of policy supporting minimum quality standards for some products and concluded that it is appropriate to use minimum quality standards in industries where consumers cannot precisely ascertain the quality of goods giving example of the pharmaceuticals or products with chemical components.

Advertising messages have been reported to be conveyed through diverse media other than the traditionally known media and there is constant increase in these channels which has given rise to what is popularly known as mobile marketing. Apart from the content or the framing of the message being passed across, consumers are also reacting to the frequency and channels with which these adverts messages are conveyed. For example, Shannon [28] reported that the telephone; an example of a mobile device, has been called “a uniquely invasive technology” because it essentially allows solicitors to invade people’s privacy with little or no restrictions. Mobile marketing is now a veritable platform (Bamba and Barnes, 2007 cited by [25]).

It has been reported that for marketers, SMS advertising provides several advantages, such as cost effectiveness, ubiquity, immediacy, and targeted message delivery (Rettie and Brum, 2001 as cited by [25], Muk, (2007), Grant and O’Donohoe [8], and Xu, (2006/2007) as cited by Phau and Teh [25] were however reported to have said that 79% of online consumers find receiving mobile advertising through their phones irritating and intrusive. To curb this intrusion of privacy, some western countries already have in place what is referred to as a ‘national do not call list’ [29][33].

Despite the importance of information provision and advertising practices of service providers to the consumers of telecommunication services, specific studies on how telecommunication subscribers view information provision and advertising practices of the service providers are currently low as a number of studies in the sector have mainly focus on issues such as consumers’ satisfaction with mobile services, loyalty to brands, service quality, price or call rates, customer care centre service and a number of other factors [14][31][13][9][22][32][26].

3. METHOD

3.1 Research Design and Selection of Respondents
Survey design was adopted. The study was carried out among GSM consumers in Ibadan, a Nigerian municipality. The population of interest was the consumers of the four mobile telecommunications service providers (MTN, GLO, AIRTEL, ETISALAT) in the city. Convenience sampling, a non-probabilistic sampling technique was adopted in the selection of respondents because of the possibility of having access to a large number of mobile subscribers within the study location. In all, 626 respondents were sampled.

3.2 Operationalisation of Variables, Instrumentation and Data Analyses
Two main variables were measured in this study. These were: provision of information to consumers and advertisement and representation of services. These variables were measured using other sub-variables contained in the research instrument. The sub-variables in turn made up of items that elicited specific information from the respondents. These items were measured on the five-point Likert scale ranging from strongly disagree to strongly agree. A structured questionnaire, comprising all the constructs treated under each of the variables, was used in the collection of the required data. The questionnaire was divided into Parts A and B. Part A collected demographic information about the respondents as well as the telecommunication service providers used. Part B made up of two sections. Section 1 collected data on the first variable which was provision of information to consumers while section 2 collected data on the second variable which was advertising and representation of services. The content of the different parts of the questionnaire are described as follows:
a) **Part A:** Demographic profile of the respondents were collected and these include; sex, age, educational qualification, network service provider(s) used, and the primary network service provider used by respondents.

b) **Part B:** The part B of the instrument collected data using the 5-point likert scale format. This part is divided into two sections and each sections elicited different responses as discussed below.

i. **Section 1** - This section elicited data on one of the two variables in the study which is provision of information to consumers. The sub-categories of variables here include;
   - **Service contracts information:** A service contract according to the Nigerian Communications Commission is an agreement the consumer and the service provider enters into in the process of transaction.
   - **Description of services:** This has to do with instructions and guidelines provided by the Nigerian Communications Commission with regard to clear and unambiguous way service providers should make information about service provisioning available to the subscribers.
   - **Pricing information:** This is the assessment of the service providers based on the provision of clear and plain pricing information for customers.
   - **Product warranties and maintenance:** This measured whether service providers make product warranty information available to subscribers if such is available for a product or service purchased and also the clarity of the language used for such information.
   - **Fault repair and service interruption:** This is a measure of how service providers make available to consumers, avenue through which information regarding fault repairs and service interruption can be reported.
   - **Access to emergency services:** The Nigerian Communications Commission stipulated that service providers should make available avenues through which emergency reports can be made.

The items under each of the above sections were culled from the Nigerian Communications Commission’s consumer code of service regulation; a document on which this study is based. Each of the items in the different sections were directly taken from this document and phrased in ways that subscribers were able to relate with.

ii. **Section 2** - This section elicited data on the second variable in the study which is advertisement and representation of services. The items under each of the sections were also culled from the Nigerian Communications Commission’s regulatory document on which the study is based. Below is a brief discussion of the sub-categories of variables under this section:

- **Availability of services:** The Nigerian Communications Commission stipulated that in advertising a product or service offered, service providers must state if there is any technical or geographical limitations that may hinder the availability of such service.
- **Advertising of packaged services:** It is expected that if a service provider represents in advertising materials that a service is provided as part of a package, the provider must ensure that it supply all components of the service package.
- **Unsolicited telemarketing:** Unsolicited telemarketing has to do with direct-to-phone marketing used by the service providers as well as their partners.

The instrument comprised five items for the demographic variables, 20 items under the provision of information to subscribers and 10 items under the advertising and representation of services variable. In all, there were a total of 35 items.

The instrument passed content validation by three experts in social informatics research. After data collection, items reliability were tested using computed Cronbach’s alpha value (Cronbach’s alpha = 0.893). Data was collected within a period of two months between August and September 2013 by the researchers with the support of 4 research assistants. In all, the study earmarked a sample size of 700 out of which 626 (89.4 %) were certified to be valid for analysis. From the remaining 74 copies of the questionnaire, seven were not properly filled by the participants while the remaining 67 were not returned. The data used in the analysis was therefore based on the properly filled 626 copies (MTN=287; GLO=123; ETISALAT=119; and AIRTEL=97) of the questionnaire.

Using Statistical Package for the Social Sciences (SPSS) software, frequency distribution was ran on all variables while the variables used to measure provision of information to consumers and advertising and representation of services were re-coded as (1=strongly disagree + 2=disagree) = (1=disagree), (4= agree + 5= strongly agree) = (2=agree), and (3= undecided) = (3= Undecided) to provide a summarized perception of the respondents which were then presented in tables and charts.

4. **RESULTS**

4.1 **Demographic Characteristics of the Respondents**

a) **Participants’ Sex:** Figure 1 presents the distribution of the respondents based on their sex.