

The Twenty First Century E- Learning Education Management & Implication for Media Technology Adoption in the Period of Pandemic

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Abstract

INTRODUCTION: The relevance of multimedia electronic learning(e-learning) education in the ongoing COVID-19 pandemic in the developing nations are justifiable on the pedagogical connections between the twenty first century digital automation and education itself. Multimedia is a creative combination of computer hardware , software and lifeware that allows for integration of video, animation, audio, graphical information and text resources in an interactive engagement , in which information are accessed interactively with any information processing devices.

OBJECTIVES: To enable personalizable and autonomous learning accomplishments when multimedia educational tools are merged , which allows for diversity in curriculum presentation.

METHODS: The current research investigated 400 postgraduate students of faculty of computer science and information technology who adopted the multimedia e-learning education approach to ensure that the expected date of graduation was not extended during the recent institution lock .

RESULTS :The research observed that out of six multimedia e-learning education tools used, e-mail functionalities, chat apps, audio/video computing application and discussion forum were mostly used to provide meaningful interactive engagement while blogs and webcast were less utilized.

CONCLUSION: The research proposed an enhanced level electronic participation, electronic readiness and e-learning education framework that matched the standards for the smartest educational reform that will enable regular and consistent educational accomplishment without disruptions of academic workflow in the global educational business ,notwithstanding the severity of any future pandemic similar to ongoing COVID-19.

Keywords: Multimedia, Data Mining, E-Learning Education, Internet of Things, Cloud Computing, ICT, Artificial Intelligence Robots, Information, Sustainable Development.

Received on 10 September 2020, accepted on 19 July 2022, published on 03 August 2022

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doi: 10.4108/eetel.v8i1.2342

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1. Introduction

The twenty first century electronic participation or e-participation is the term used to describe processes of engaging the government, academic institution administrative protocol, and populace (citizens or students) in a well-defined social arrangement[2],[3]. The procedures could be related to administration, service delivery, decision-making and the cycles of policy formation[4]. Thus, e-participation is directly tied to electronic government, administration, and governance participation in well-coordinated social interaction that has necessitated the twenty first century excessive digitization[5]. Digitalization of the classroom teaching in schools have recently attained prominence and have assumed the fundamental aspect of the educational development[6]. When done appropriately, it empowers advancement, structures learner behavioral adaptation, promotes accountability and stimulate pedagogical effectiveness within the educational system[7]. However, the institutions closure triggered by the emergence of COVID-19 pandemic have exposed the shortcomings of the educational systems in Nigeria and other part of the global world. At present, there exist several opportunities for private and public sector administrators to refocus the various tiers of education (primary, secondary, tertiary) and fashion approaches to content delivery that supervises citizen's requirements for the future academic development[8]. The novel approaches in Industry 4.0 , the fourth Industrial Revolution and Education 4.0 initiative was to groom the next generation of students through technology transformation and automation of educational learning in accordance with the global education reform[9]. The notion of Industry 4.0 describes how technology, industries, and societal patterns and processes will change quickly in the twenty-first century as a result of growing interconnectedness and intelligent automation. Increased automation, better communication and self-monitoring, and the deployment of intelligent technologies that can evaluate and diagnose problems without human involvement are all outcomes of this integration. The disruptive technologies improvements and globalization policy are advancing the tertiary education institution towards a workable future[10].

The fundamental objective of global education and training are to energize the citizens towards successful accomplishment in contributing to the knowledge sustainability, development of environmental ecosystem and charting parts for the world economic reforms[11]. The Education 4.0 symbolizes the transformations in Industry 4.0, the global occupational environment that is expected to prepare workforce with employable skills to grantee maximum returns on the educational investment[12]. The Industry 4.0 and Education 4.0 initiatives have engineered further developments through techno-innovative interventions to enable implementation of novel technology enhanced Education 4.0 learning experiences that empowers country-level workforce standards as priorities[13]. The twenty first century

students need to absorb the body of knowledge that have life time sustainability, capable of assimilating changes brought by the disruptive technologies that underpins Industry 4.0 and Education 4.0 with its effects on the global workplace environment.

From the technology point of view, the twenty first century digital students are immersed in the varieties of innovations from a very young age[14]. According to Prensky (2001a) , he rightly called the present generation students that grew up in a society immersed in technology “digital natives”, the generation that had spoken the language of technology from birth[15]. Students are immersed in technology in nearly all aspects of their daily lives such that boundaries between formal, semi-formal and informal education is partially differentiable. With the availability of social networking sites , multimedia devices , smartphones , smart television, computers , e-contents (compact disc read only memory CD-ROMs, digital versatile disc-DVD-ROMs), memory card storage devices, digital story books(e-books) , electronic downloadable, internet and more specifically the world wide web (w3), 3-D world , computer educational games, scientific simulation and of course channel programmes had made access to education , knowledge and information to be very easy[16].

However, the increase in access to digital knowledge, education and information with respect to unguided media such as internet, social media networking sites and world wide web could bring problem to the present digital society on the premise that most of the sites that the current digital society are exposed to are naturally infected[17]. The new internet control protocol that infused normative terrain to provide surveillance and censorship in an attempt to filter the web content and digital channels through online surveillance are expanding rapidly with potential innovations around the global world as part of civility in the democratic leadership which prohibits activities that constituted public nuisance in an online medium[18]. Educationally, social media sites are fundamental aspect of the current society culture for adolescent individuals, which are essentially significant in educating them to utilize those resources carefully and realistically as means of knowledge formation , intelligence gathering and educational pedagogy [19]. Numerous adolescents obtained classroom tutelage on digital literacy requirements but have insufficient opportunities to consolidate the honest competences. The social media interactive pedagogy saturates the divergence in digital literacy education through amalgamation of empirical instructions in a convincing and undamaging social cooperative classroom teaching[20]. The right to moral probity, ethical norms and social values, have increasingly diluted such that the society moral and religious uprightness is greatly questionable[21]. The progressive access to digital media and digital devices had introduced a set of social dynamics which had further induced the society with

superlative consciousness of mundane experiences of disillusionment[22].

The digital revolution that had occurred provided certain novel educational accomplishment which are progressively considerable on the side of the students to continuously effect learning at all moment in an online medium , offline, in the classrooms, as well as after schools , at home, libraries ,community centres, religious centres -churches organizing special retreats , seminars, conferences , career talk shows and museums[23]. With an array of knowledge and resources available at the touch of screen of student's portable device, students can truly learn at any time regardless of geographical boundaries, social and ethnic divide , any place and any pace[24]. Everyone is exposed to varieties of media technologies in form of computers, the Internet, instant messaging, social networking sites, and cell phones which provide instant communication locally and globally. The availability of broadband internet connectivity and digital convergence had created another dimension of social interconnectedness for education and for intellectual exchanges. Not surprisingly, research showed that today's digital students learn more when engaged in meaningfully relevant and intellectually stimulating coursework, pointing that technology can increase the frequency for this type of learning[25]. Ironically, with all such familiarity and comforts, technologies present challenges for educators who struggle to keep up with an ever-changing technology context and students who no longer process information primarily in a sequential manner. Using technologies, teachers can tap into the knowledge of experts; visualize and analyse data with their students, link learning to authentic contexts and take advantage of opportunities for electronic shared reflections[26]. The Educational policymakers, planners, reformers and investors should first understand the educational requirements of the present day digital natives and plan how best to cultivate ,target and harvest them. These broad goals should guide the choice of technologies to be used and their modalities for adoption. The potentials of the present day digital technologies varies considerably according to how they are used within the educational needs, requirements and objectives[27]. According to [28] ,they identified five levels of technology potentials in education which include (i.) Presentation (ii.)Demonstration (iii.) Drill and Practice (iv.) Interaction and (v.) Collaboration.

Interestingly, the information communication technology (ICT) tools or multimedia information communication technology for development (ICT4D) are represented in print media, audio/video cassettes, radio and TV broadcasts in the practical reality[29] . Computers and internet may be used for presentation and demonstration which are the most basic of the five levels of technologies for education. Except for the video technologies, drill and practice may likewise be performed using the whole range of technologies for assimilation. On the other hand, networked computers and the internet are the ICT's that enable interactive and

collaborative learning best practice while their full potential as educational tools will remain unrealized if they are used merely for presentation or demonstration. The Information Communication Technologies (ICTs) as used interchangeably with multimedia information technologies , defined as the miscellaneous set of technological tools and resources used to communicate, create, disseminate, store, and manage information,[30]. These technologies include computers, the internet, electronic broadcasting media technologies (radio and television), telephony, satellites communication, software innovations, Internet of Things (IoT), cloud infrastructures and platform technologies as services[31].The same also applies to multimedia communication technologies , the creative combination of computer hardware and software that allows for integration of video, animation, audio, graphics and text resources in such a way that information can be accessed interactively with any information processing devices[32].

Multimedia merges multiple levels of learning into an educational tool that allows for diversity in curricula presentation,[23]. The capability of technology to transform the modern classroom, creating some fashionable experiences in the perspective of active classroom engagement that had been established in some diversities of ways. Basically, teachers, tutors, instructors and lecturers will adopt technology as classroom management tool for expository learning. While the adoption of integrated classroom systems via customized Tablets or Hand held digital device for monitoring student performances will offer a set of leverage to the classroom management, projecting students for better experiences in the overall academic performances[33] . Many more schools have implemented online enterprise data warehouses for student monitoring and evaluation and also making information very flexible to share across computing platforms. The innovative technology paradigm will afford the students the opportunities to remain engaged with eyes on course even without unequivocal attentiveness with their lecturers and teacher in the course management. With the multimedia contextualized study approach, students will develop the abilities to surpass roadblocks with learning through the assistance from the technology itself[34]. Effective classroom management are the techniques for the teachers to certify that school children, undergraduates, apprentices, learners, scholars and pupils are: (i.) organized (ii.)orderly (iii.) focused (iv) attentive (v) on task (vi) academically productive. The assurance of a successful teaching accomplishment is on the effective classroom management to fully realize all educational objective of comprehensive human capital development.

However, the effect of the ongoing global pandemic had abruptly distressed the educational systems from the global perspective, steering a near absolute shutdown of schools, universities, polytechnics and colleges of education[35]. The Government of several countries have momentarily locked down all the educational institutions in effort to control the wide escalation of

COVID-19 within the nation space. An approximate value of 1.725 billion students are at present not attending school on the account of lockdowns in reaction to the COVID-19 global pandemic[36]. The United Nations International Children's Emergency Fund (UNICEF) had examined 106 countries of the world and released a report indicating that those countries are presently affected by lockdown and 55 are applying regional closures of academic institutions which had affected 98.6% of the global students populace[37]. The current research proposed an enhanced level educational engagement and e-learning education framework that matched the standards for the smartest educational reform that will enable regular and consistent educational accomplishment without disruptions of academic workflow in the global educational business, notwithstanding the severity of any future pandemic similar to ongoing COVID-19. The paper is structured into introduction, statement of problem, research aims and objectives, research questions, literature review, research methodology, research finding and analysis, summary and discussion of findings, research limitations, future research focus, recommendation and conclusion.

2. Statement of Problem

The current research identified two critical issues with the contemporary educational investment in the ongoing COVID-19 from global perspective and narrowed discussion to Nigeria and tried to proffer solution to the identified problems. The problems that the current research was formulated to solve include:

- (i.) The identification of ongoing COVID-19 obstructive interferences on the academic workflow of the global educational investment with particular reference to Nigeria educational system.
- (ii.) Sustainability in the educational investment and knowledge ecosystem. While analysing the situation of education investment and knowledge management from the global perspective and what motivated the researchers to carry out the current research. From all indications, sustainable millennium development goal on education with respect to SDG4 targeted three essential aspects of didactic accomplishment, bordering on: (i.) educational admission (ii.) educational accomplishment and (iii.) educational results.

In the current paper, effort was made to synthesize technology solution to COVID-19 pandemic as it is radically intensifying the pre-existing vulnerabilities most susceptible students already faced in accessing quality, safe and comprehensive educational development. While the outbreak of the COVID-19 pandemic fundamentally jeopardizes the collective progresses toward achieving the Sustainable Development Goal #4 (SDG4), the current paper seek approaches to counteract the COVID-19

disruptions and formulate methodology for inclusive access to education for all[38].

3. Research Aims and Objectives

The scope of the current research is limited to the contemporary Nigeria with the expectation of extending to the developing countries of Sub-Saharan Africa. The direct and indirect value of the investment highlights how valuable research and innovation in enterprise software environment and education automation are important and why policymakers should strive to continue the incremental growth support. The current research identified essential areas of applicability in the twenty first century educational management and academic workflow to include:

- i. Improved knowledge sharing through synchronous and asynchronous instruction delivery
- ii. Ubiquitous data mining
- iii. Time management and tailored learning
- iv. Autonomous learning and study guide
- v. Interactive pedagogy and comprehensive information processing and knowledge interworking
- vi. Access to cloud infrastructures and e-learning courseware management
- vii. Implementation of pervasive and ubiquitous study habits with self-concept and value clarification
- viii. Integrate ICT framework and e-learning education activities into the mainstream academic business of the students in the selected case study

4. Research Questions

The research is structured to provide answers to the following questions:

- i. To what degree do professors/ lecturers/ schoolteachers provide online lessons, presenting innovative learning approaches, delivering task differentiation, making available feedback, organising online assessments through enterprise e-learning education environments in the ongoing COVID-19 pandemic?
- ii. Does the adoption of multimedia instructional tools and e-learning education platforms implementable for teaching and learning in all higher educational institutions in Nigeria during the period of the ongoing COVID-19?
- iii. How do school teachers' professional competence, pedagogical knowledge and opportunities for developing digital adjustment which they were exposed during the COVID-19 impacted their successful mastery of the subject matter?
- iv. Do lecturers and students embrace these disruptive technologies and are able to use them effectively for knowledge cultivation and educational management in the ongoing COVID-19 and in the next global pandemic?

- v. What factors limit the e-learning education platform adoption and utilization for teaching and learning in Nigeria tertiary institution in the ongoing COVID-19 pandemic?

5. Literature Review

The twenty first century digital world is constantly transforming, revolutionizing and ubiquitously evolving to potentially prepare the current digital natives for the opportunities in the new world educational management in the ongoing COVID-19 global pandemic and in the next global bubonic plague[39].The educators (professors, lecturers, instructors and teachers) need to adjust the manners in which educational training are administered in what can be regarded as the Education 4.0 paradigm shift. The ongoing COVID-19 pandemic is an eye opener that the current educational technology and innovation in Nigeria and Africa are far behind the reality of the twenty first century education model. In the 21st century education system , robots are part of modern classroom teaching , mobile computing technology and augmented reality technologies are essential tools for interactive educational pedagogies, e-learning education , distance education, smart learning, blended learning and digital libraries all are adapted to provide access to the curriculum of education which motivation will enable students associate and comprehend issues that the current digital society experiences[40]. In attendance to the ongoing global educational disruptions, there exist scores of diverse solutions to enable students to be educated and unambiguously accomplished. Those approaches take account of classroom pontification with physical textbooks, computer assisted presentations via zoom multimedia live streaming platform, smart android computing device, handheld digital devices, electronic domestic device and interactive educational robots [41]. According to [42],the diversities in understanding modernism is determined by an individualized perceptions and opportunities to innumerable technologies and the infrastructural environment of the student geographic location.

The speedily transformation of the enterprise educational environment and society, where there are existence of unquantifiable intelligence and knowledge for adoption is the frightful connotation for academic engagement and information application in the most appropriate order required for universities and professional applicability[43]. The augmented reality environment (ARE) unarguably became appropriate educational innovation in the twenty first century, which histrionically modified the situation and schedules of educational training and digital participation. The current literature review portrays the twenty first century digital media technology and how they rub on educational teachings and physical learning activity and the prospective impressions they have on the future of education[44]. On the other hand, the twenty first century

digital media technologies have a few questions on emerging and implementation on the authentic and scholastic backgrounds which focused on the undisputable presentation and implementation across platform and across divides. These concerns are how the twenty first century digital media technologies in education can succeed in the actual classroom adoption and how twenty first century digital media technology systems applications can advance the usefulness and effectiveness of educational teachings within the academics, professional and corporate engagement. The wide adoption of zoom technology for online conference attendances, distance education, corporate meeting, government and administrative engagement in the ongoing COVID-19 proved the capacities for the technology configuration in the twenty first century digital extreme automation which characterized the Industry 4.0 and Education 4.0 ascendency[45].

The academic institutions in the 21st century will become a central connecting hubs, a center for educators and students to connect with those around them and their communities[46]. The educators in the emerging new environment will assume less instructorship roles and more of information designers, providing students with the capacity to transform knowledge into wisdom and creative ideas into commodity products. With respect to **Figure 1**, the Telepresence robotic systems are empowered to provide audio and augmented reality video communication experiences, becoming more prevalent with the rise of video-capability for consumer electronics and affordable internet access for ubiquitous interactivity. The telepresence robots have great potential for deployment in the school environment as a means of addressing issues stemming from COVID-19 pandemic and effect it had produced on educational system and beyond[47]. Uncountable explanations can prevent students from attending physical school, such as chronic health conditions, short term illness, COVID-19 global pandemic, anxiety and behavioral disorders or character tantrum. The innovative approach will require an updated pedagogical tools, competences, knowledge, skills and values that should be inherent in the technology schemes of the modern teachers for the twenty first century all-inclusive academic business[48]. Such technology schemes can be multicomponent and flexible for teachers' adoption with automatic pedagogical competence as the teaching and learning aids.



Figure 1: Telepresence Robots for 21st century educational augmented reality pedagogy [1].

The 21st century educational training requires providing students with the skills needed to succeed in the evolving digital new world and assisting them develop the confidence to customize their skills for opportunities for creativity and investment[49]. With the availability of limitless digital information to the current digital natives, the 21st century skills focused essentially on making information sharing and knowledge networking available and ensuring that ideals, skills and knowledge are used in a smartest way. The education systems should assist the society to model a superlative order of intellectual capabilities, proficiencies, competences, skills, powers and aptitudes to further consolidate processes of inquiry, permitting collaborative problem solving community of practitioners and essentially preparing people for complete local and global markets competition and for global citizenship[50]. The nations of the world who understood the social dynamics of the modern education will essentially leverage the opportunities in creating investment in building a strong and healthy economy with good people living happily within the environmental ecosystem, prospering in all human social economic endeavours. Availing the citizens with the opportunities for quality and affordable education is strategically imperative with the globalization of information, knowledge, digital technologies and digital economy [51].

However, a disparity is arising between those who have access and means to acquire and use the modern information and communication technology (ICT) devices and those who lack the requisite knowledge and proficiency to contribute meaningfully in the internet of things (IoT) age, information age and digital electronic society[23]. The direct consequences of the digital divide and knowledge divide is in the access and contribution of people to the activities that characterized the twenty first century digital space and in response to global economic policies and governance. The ICTs which stand for information communication technologies are set of technological innovations, tools and resources used to communicate, create, disseminate, store and

manage information,[23]. The ICT's technologies and tools may include computers, the internet, the world wide web (W3), smart phones, personal digital assistance, broadcasting technologies (radio and television), satellites communication systems, telecommunication system, 4G/5G broadband internet connectivity, software innovations as service, platform infrastructures as service, telephony system and more advancedly the twenty first century robotic technologies[52]. The ICT's essentially had enhanced communication and device networking across the geographical boundaries, scientific platforms and digital manipulations. The same is applicable to multimedia communication technologies, a creative combination of computer hardware and software that allows for integration of video, animation, audio, graphics and text resources with logic and creativity in such a way that information can be accessed interactively with any information processing devices[23]. The e-learning education could be interpreted as electronic learning activities that involves the Internet from a distance via a customized coursework through the internet world wide web platform in conjunction with other electronic gadgets,[53]. The research on multimedia pedagogy and e-learning education categorization established that multimedia applies to the methodology of teaching and learning for effective classroom management with the aim of improving the quality of learning outcomes through the use of media elements such as text, audio, video, animations, computer simulation and 3-D model[54].

Moreover, within the context of e-learning education, multimedia through its dynamic characterization, helps to present facts, occurrences, events and scientific scenarios in its raw factual representation and evidential interpretations without suppression and distortion of evidential ingredients. Facts with evidential prove of graphical illustrations, audio narrations, video display and 3-Dimensional Simulations methodology will remove distortive narratives which will undoubtedly authenticate the information and knowledge source and the scenarios upon which it is applied. The educational challenges in Nigeria with respect to comprehensive sustainability to some extent does not have a straight line panacea rather a hybrid and collage of technological ideas which unarguably followed systematic pattern. A hybrid methodology is suggested based on the understanding of the contemporary Nigeria geopolitical space and its complex social configurations. While the southern Nigeria have more educational privileges, infrastructures and western civilization advantage, the northern Nigeria are yet to advance in rank to meet up with the southern region. Therefore, the multimedia pedagogy will require a technological configurations that creatively combines computer hardware, software, media tools that will totally and comprehensively blend the digital courseware and allows for integration of videos, animation, audio, graphics, text resources, creative effects and logic in such a manner that information, knowledge and transformative ingredients can be situated and accessed interactively with any information processing devices[23].

Fundamentally, multimedia systems combines several learning activities into an educational content that enabled structural diversities in curriculum accessibility, assimilation, presentation, understanding and digestion of the digital courseware[55]. To adequately deploy the multimedia in the e-learning environment for effective and interactive pedagogy , the learners, facilitators and instructors can use communication tools such as electronic mails, discussion fora , chats option, application sharing specification, polls, whiteboards requirement, audio cast and video conferencing to communicate , collaborate , cooperate and work as team[56]. Authorities in multimedia e-learning such as, Richard Mayer who is a professional in the multimedia learning education practice. According to Mayer’s multimedia e-learning theory which was based on the Paivio’s Dual code theory (1990), Sweller’s Cognitive Load theory (1994) and Bruner’s Constructivist theory[57]. Mayer and his co-researcher Mareno (2000), carried out several researches on the multimedia use in delivering instructional design principles from cognitive theory in multimedia e-Learning education. The main observation noted was that very active participatory academic learning occurs whenever learner engaged the three cognitive sequence which include, Selection, Organization and Integration[58].

5.1. Selection

On Mayer’s assumptions, students will always be able to assimilate certain amount of information when they are systematically and coherently aligned within the study expectations. Under this structural arrangement, certain verbally represented expressions (words) and visually presented images are permanently processed and stored in the human brain (hippocampus). The Mayer’s multimedia theory perfectly established that during learning process, the human brain will selects relevant audibly expressed words for verbal processing while all the relevant images are visually processing simultaneously. On this account, the verbally expressed information and visually aligned ideas are coherently processed within the memory circuit. This approach will enable the memory to process and retain information and students can be able to overcome the problem of memory loss and frequent forgetfulness. .

5.2. Organization

The Mayer’s multimedia e-learning theory further revealed that, the learners, students, audiences will usually organize audibly expressed information into coherent verbal models while the visually represented information are processed into coherently visual models for active learning. The theory established that, the more often the students think about an organized information in a meaningful context, the greater the chances of repeating the information in their working memory, and the more likely they remember everything that was learnt.

5.3. Integration

The Mayer’s multimedia e-learning theory was able to establish the learning phenomenon involving students in the activities of information processing and education activities. Students will always learn perfectly well whenever corresponding verbal information and visual information are logically linked together in a meaningful context because it will fundamentally make learning more engaging, meaningful and reinforce able for interactive pedagogy. The researchers were of the opinion that, verbally represented information and visually represented information when combined intelligently will always complement each other, therefore, when accessing verbal information and visually represented information jointly, it will enable students process different models of information simultaneously and collaboratively.

The line of thought proposed that the theory will assist the subject tutors to produce visual learning aids to improve students’ academic roles , performances, mental agility and self-awareness[59]. In a similar development[53], also analyzed multimedia e-learning education to include all resources utilization for educational instruction management involving one or more media such as textual information, graphic information , video information , animated information , imagery and audio-sound system managed sensibly to provide access to the educational of curriculum. Mayor’s theory identified four key fundamental characteristics of multimedia information system as followed:

- i. The multimedia e-learning information systems are basically controlled by computer
- ii. The multimedia learning systems are highly integrated and fundamentally interactive
- iii. The multimedia information system content are digitally characterized with software embodiment
- iv. The human computer interface for the final presentation of media should be expressive with maximum interactive flexibility.

The multimedia e-learning education had been extremely result oriented in teaching individuals, students, audiences in a wide range of subject areas. Interactive multimedia e-learning education is essentially changing the manner and ways through which we effect communication on individual and group participation. Academic lectures can be extremely transformative, effective and informative when lectures are integrated with pictures, video, audio, images and graphics and all the media are coherently held together[32]. The application of interactive media such as compact disc read only memory (CD-ROMs) and web based multimedia content can be wonderfully engaging for effective academic business in teaching students a wide varieties of subject areas, disciplines, and cultures[23]. Fundamentally, certain multi-sensory engagement, observations and experiences are initiated for the students, learners and audiences, which usually elicits positive appraisal in the adoption of the multimedia e-learning application[60].

6. Research Methodology

In attending to the fundamental research purposes, this investigation combined qualitative and quantitative methodology and amalgamated the primary and secondary sources of data in consolidation with the research findings. Empirically, the analysis of the data and interpretation of the result were supported by quantitative and qualitative explanations. Research instruments utilized in the current findings were structured Survey/Questionnaires, Personal Observation, Interview/Discussion. Those procedures were intended to be used to obtain information on the availability and use of multimedia e-learning education for teaching and learning among lecturers and students in the faculty of Computer Science and Information Technology which comprised of four departments; Computer Science[CS], Information Technology [IT], Computer Science Economics [CE] and Software Engineering[SE] of the selected case study in the ongoing COVID-19 global pandemic who were currently undergoing categorized post graduate diploma studies(PGD, MSC & PhD). The research instrumentation were divided into two sections. Section A sought to obtain information pertaining the demographic details of the correspondents (**Table1 and Table2**) while Section B contained structured questions directed to the study objective (**Table3 & Table4**). The survey was conducted in 2020 within the period of the global lock down. In the beginning, a comprehensive questionnaire based on the objectives of the study was administered to the postgraduate students in the faculty of Computer Science and Information Technology in the select tertiary institution comprising of male and female gender, who were at present undergoing study in the department of Computer Science & Information Technology correspondingly. A stratified random sample of 250 female students and 200 male post graduate students participated in the data collection exercise. The sample took into account the heterogeneous nature of the student's population and diverse digital experiences of the composition. A total of 180 (male) and 220(female) reusable questionnaires were returned by the students for the response rate of 90% and 88% respectively. The data were analysed using descriptive statistics tools.

7. Sample of the Population

The research study utilized the population sample which consist of the male and female Post graduate students from the designated Federal Tertiary Institution in the North Western Nigeria at the commencement of the nationwide lock down. Proportionate stratified random sampling was used to select the required sample size of 250 female and 200 male postgraduate students in relation to the research expectations. The researchers used questionnaire and personal interview where appropriate to collect data and descriptive statistics were used in analysing the data that relates to the study. While two

hundred and fifty (250) questionnaire pertaining to the female Post Graduate students and another two hundred twenty (200) questionnaire were delivered to the male Postgraduate students. Two hundred and twenty (220) questionnaires from the female postgraduate students and another (180) questionnaires from the male post graduate students were appropriately concluded, returned and realized compatible for computational consideration, signifying 88% and 90% rejoinder proportion correspondingly.

8. Data Collection Methods

The data collection techniques were concentrated on the perspective of the fundamental performances of the twenty first century e-learning education goals. Those methodology comprise of primary and secondary data collections bringing together the quantitative and qualitative data analysis already mentioned previously. Already, data collection instruments are formulated and organized through appropriate techniques to respond correspondingly to the research specific objectives. Inspection and cross-Examination are also an essential characteristics of data collection and there are different sources for this: interviews, documentation, direct observations, participant observations and archival records. However, observational discoveries are contemplated strong in validity for the reason that the researcher is capable of accumulating a depth of information regarding a specific events [61]. An Interview could be well-thought-out qualitative when people who are studied to be outstandingly well-informed about the topic of interest are rightly engaged. While semi-structured interviews are typically accomplished in a face-to-face appointment that enables the researcher to obtain comprehensive perceptiveness of the subject of interest, ask questions and weigh occurrences in distinctive evaluations. The principal instrument for achieving the primary evidence in a level-headed enquiry is questionnaires, on the account that the investigator could freely choose on the sample and the categories of interrogations to issue. Research data could also be extracted from the professional point of views associated with the divergence of understanding, organization, relationship and knowledge exploitation together with sub-factors. Data acquired in this manner will be prioritized and utilized for decision-making purposes. Therefore, responses with respect to the data sources was satisfactory and reliable, focusing on the questionnaires and Interview/discussion which resulted in the response rate 90% and 88% respectively. For this reason, the data collection quality level and its composition have not been negotiated. The responses rate are contemplated to represent the research composition and organizations. Therefore, the response rate of the current research is satisfactory and fall within the acceptable limits for the purposefulness of the research demand.

9. Research Finding And Analysis

The result of the current research showed that the twenty first century digital students are familiar and impacted with digital media tools and e-learning education functionalities. The multimedia tools and ICT gadgets are useful for learning activities with inclination for sustainable growth and development. Therefore, educators, professors, lecturers and teachers ought to exploit their digital capabilities, lecturing competences and knowledgeable advantages for the upcoming generation in the business of knowledge management available on e-learning education environment, digital media and electronic media. In a most perfect arrangement , multimedia technology education are parts of student’s recent motivations that are essential aspect of digital natives electronically empowered lives loudly changing their psychological nomenclatures and positively impacting the ways they are thinking ,learn and respond to digital scenarios[62]. With multimedia tools, ICT tools and e-learning education functionalities, the hope for information growth and survival is on the positive side. Moreover, multimedia courseware are interesting to view and hear with sound, visual effects makes lectures much emphatic and reinforce able. Computer technologies will be helpful and useful in educational business and investment of the present generation and the next generation of digital learners which implies that learning will be less boring when computer is involved together with journalistic requirements as information source will be readily available and viewable as the dynamic media . The utilization of computer resources within schools will impact additionally in technological advancements and in methodology of teaching and learning due to its ability for addressing diversities for learning outcomes. At moment, computer technology had witnessed advancements in all facets of human managerial responsibilities as it incorporates all aspect of media for its interactive pedagogy. The circumstances of COVID-19 global pandemic had compelled us to ask fundamental questions and to re-examine the sort of skills and competencies the digital society is expecting from the ongoing educational automation. The susceptibility is arising on the premise that substantial proportions of the public tertiary institutions may perhaps be overwhelmed by technical skills challenges, curricular modularity and the numerical manageability shortfall of the e-learning development to the best standard global benchmarks, which incidentally are instinctive components of the digital society educational transformation and philosophical definition of the modernistic civilization.

In the ongoing COVID-19 pandemic, educators (professors, lecturers, instructors and teachers) were challenged with the necessity to be accustomed with the online teaching. Consequent upon the adoption of the online teaching methodology, social media became highly essential and invaluable means of distributing information to the students in addition to the e-learning education

customized platforms. In the perspective of the Nigeria peculiarities, the media acted as a double-edged sword as it permits students to be aware of information void of obstructions and in another development used to coordinator a huge protest in Nigeria called #END SARS# protest following the COVID-19 pandemic lockdown. The current paper investigated the social media leverages for digital pedagogy such as Email Messaging Apps, Zoom platform, YouTube, Facebook, Twitter, WhatsApp, online blogs and online newspapers as the mainstream medium adopted by the academia and institutions to interact with their respective students[63]. While the paper communicates the results of the investigation of immediate career educationalists performed in April 2020 to October 2020, the findings from the current paper demonstrated that ICTs tools and media adoption particularly for educational opportunities are instrumental in adapting to online teaching during the COVID-19 pandemic.

10. The Demographic Information Distribution

Table 1: Gender Distribution of the Respondents

Gender	Frequency	Percentage
Female	220	55%
Male	180	45%
Total	400	100

Source: Field Survey 2020

The Information in Table 1, Figure 2 demonstrated that 220 (55%) of the respondents are Female gender while 180 (45%) of the respondents are Male who sincerely participated in the research.

FIGURE2: GENDER DISTRIBUTION OF THE RESPONDENTS

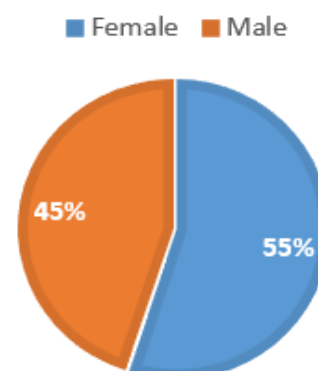


Table 2: Educational Programme Distribution of the Respondents

Educational Programme	Frequency	Percentage
PHD	20	5%
MSC	150	37.5%
PGD	230	57.5%
Total	400	100

Source: Field Survey 2020

The Information in Table 2 Figure 3 shows that 230(57.5%) of the respondents are undergoing PGD Programme, 150(37.5%) are pursuing MSc Degree Programme. While 20 (5%) respondents are pursuing PhD Programme.

Figure 3: Educational Programme Distribution of the Respondents

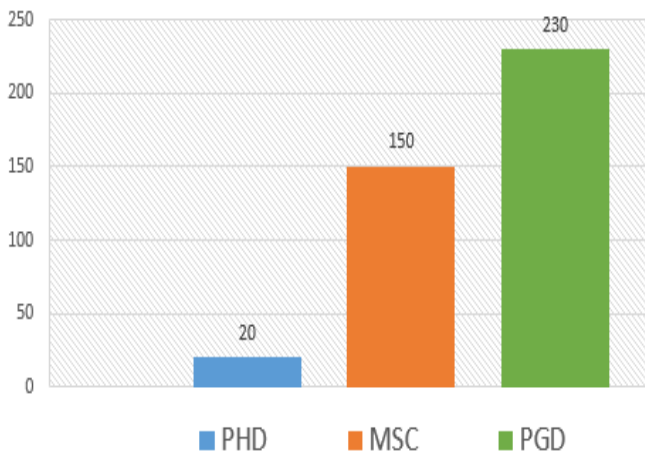


Table 3: Distribution of the ICT Computing Devices Utilization by the Respondents on the E-Learning Education Activities

E-Learning Computing Device	Frequency	Percentage %
Desktop	34	7.5
Laptops	230	50.7
Tablets	150	33.0
Smart Phones	40	8.8
Total	700	100

Source: Field Survey 2020

The information contained in Table 3, Figure 4 indicated that 40 (8.8%) of the respondents used Smart

phones, 50(7.1%) , 150(33.0%) used Tablets, 230 (50.7%) used Laptops, while 340(7.5%) used Desktop computers to join in in E-learning education and ICT digital computing in managing the coursework in the ongoing COVID-19.

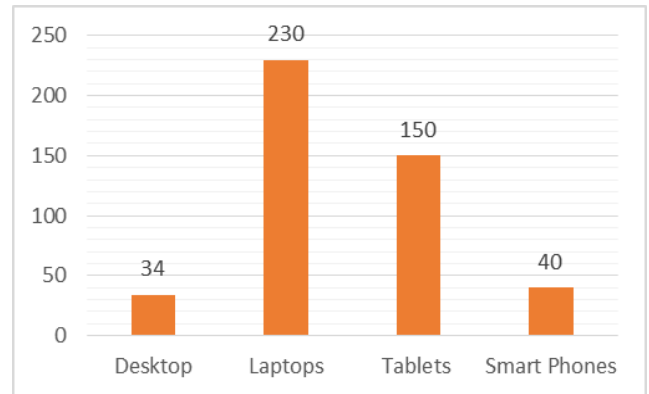


Figure 4: Distribution of the E-Learning Computing Devices

Table 4: The Impact Multimedia E-Learning Education Technology on the Academics Performances of the Respondents?

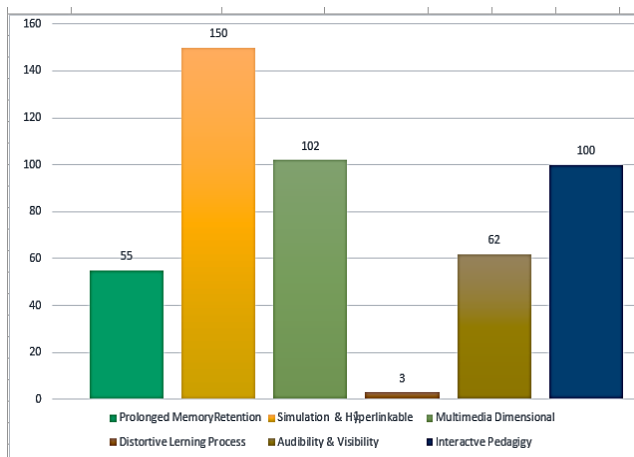
Multimedia E-learning Functionality	Frequency	Percentage
Prolonged Memory Retention	55	11.7%
Simulation & Hyper-linkable	150	31.8%
Multi-dimensional Access to Digital electronic contents	102	21.6%
Distortion of Learning Process	3	0.6%
Audibility & Visibility	62	13.1%
Interactive Pedagogy	100	21.2%
Total	472	100

Source: Field Survey 2020

The information provided in Table 4, Figure 5 indicated that 55 Respondents characterizing (11.7%) of the distribution acknowledged that Multimedia E-learning education functionalities helped them in prolonged memory retention, 102(21.6%) respondents acknowledged that Multimedia E-learning education technology assisted them in Multi-dimensional access to digital electronic content with respect to instruction and learning, 150(31.8%) acknowledged that multimedia e-learning education functionalities, helped them for simulative & hyper linkable exploration , 3 (0.6%) acknowledged that multimedia e-learning education

technologies distort learning processes, 62 (13.1%) acknowledged that multimedia technology e-learning education increases the chances of audibility and visibility, while 100 (21.2%) acknowledged that multimedia enhances interactivity.

Figure 5: The Impact Multimedia E-Learning Education Technology on the Academics Performances of the Respondents



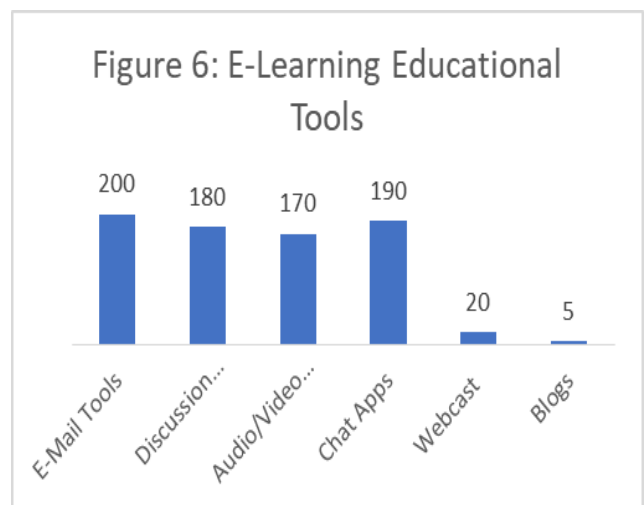
Source: Field Survey 2020

11. Summary/Discussion of Findings

In analysing the result of the current research, attention must be given to the electronic digital media tools and multimedia elements of the present time which had impacted education and created a new digital paradigm which had further distinguished the present digital society into four distinct natives; (i.) The super digital natives (Q1) (ii.) The advanced digital natives (Q2) (iii.) The average digital natives (Q3) and (iv) Mere digital natives (Q4). The Q1 digital natives have superlative knowledge and understanding of the digital world and all that characterized digital society. They specify the direction of the digital society and lead in the innovative thinking involving computer ideas, information and smart technologies. Majority of this class of natives are students of computer science and those with strong computer background like electrical electronics, mathematics, information technology and information science like library. The Q2 digital natives have digital knowledge but required more advancement and special training to fully upgrade to the next higher ranking (Q1). The individuals in Q2 ranking have very good knowledge of digital world but incomparable with Q1 digital natives. The Q3 digital natives are simply on the average scale of digital knowledge performance. Majority of students might end up as average digital natives without advancing to the next higher ranking due to age, economic factors and job commitment and family life. The mere digital natives (Q4) naturally inhabit the digital space without significant impact in the digital ecosystem. They use the

digital devices to make and receive calls, send message but does not demand further use and exploration of the digital component and facilities of the smart multimedia tools. They also use computers for minor computing assignments with no much expedition of any advanced exploration of the 21st century digital learning apparatus.

The result of the findings shows that with the current distribution of the digital society, especially academic environment, all students does not have equal level of digital participation and knowledge rank. While we openly admit technology leverage, attention also must be paid to digital frustration and economic pressure in keeping abreast with the 21st century digital technologies for e-learning education expeditions.



Further investigation shows that majority of the respondents do have access to the multimedia resources on campus but not always. The multimedia utilities in this faculty and departments are being viewed by respondents as being inadequate with respect to demand and digital realization of the 21st century e-learning education environment. The study further revealed that the Internet and its facilities as well as the computers storage distributable (CD-ROMs, DVD and External Hard drive) were the mostly used of the multimedia resources while the television and few others were the least used. Lack of supportive infrastructures, lack of time to spend on technology, inadequate training, inadequate fund on the part of individual lecturers and high cost of technology were the major constraint limiting the use of multimedia in real life experience with respect to teaching and learning activities. While reference is made to **Figure 6**, the current research revealed that among all the e-learning education media tools available in the 21st century digital space, the email tools is mostly used. The research further revealed the implications of several discussion fora. The essentiality of the chat groups, Apps sharing, audio/video computing apps the general purpose streaming Zoom electronic platform, webcasting and blogs use for interactive pedagogy and digital collaboration are very essential for digital realization and classroom

management[64]. The research posit that continuous adoption and sustenance of the multimedia tools and e-learning education will boost knowledge application, information sharing and intelligence gathering in the new classroom management.

12. Research Limitations

Notwithstanding the prospects of the ongoing twenty first century educational automation and what Nigeria , sub-Saharan Africa and entire global world anticipated to achieve through the adoption of e-learning paradigm, this research had acknowledged certain fundamental issues of ultimate concern and also proffer solution. Remarkably, the current research had identified the following limitations;

12.1. Digital Activation and Media Literacy

From the current research , the distribution of the digital natives into Q1(super digital natives), Q2(advanced digital natives),Q3(average digital natives) and Q4(mere digital natives) have considerable consequences on their individual responses to digital world which will influence the delivery and adoption of the new twenty first century technology projected in the current research. The learners and individuals from the inaccessible communities with little knowledge of computer, sophisticated digital gadgets and personal digital assistance might be confronted with unimaginable frustrations in the adoption of the new technological innovation in the ongoing digital society extreme automation.

12.2. Digital Knowledge Divide

The knowledge divide is generally the gap between those with requisite knowledge to operate the new modern technologies and those without the ability and skills to perform such task. With the current distribution of the society, all learners do not have equal knowledge level. Moreover, the rich people will always have access to knowledge and skills than the poor. The rich will always have advantage over the poor due to economic inequality. Notwithstanding, the increasingly support in the global ICT projects and digital activation, with the new paradigm, such gaps will be bridged perfectly.

12.3. Universal Internet Access

This design will demand internet support and digital grid connection. Connectivity will be optimized to accommodate every logistics and to enable students study at all times. Commitment is highly expected by the government to provide internet connectivity but if internet connectivity is lacking, the entire workflow may be hindered and that will impact negatively on the learning

outcome of the students. Providing high internet connectivity (5G/4G) will be of great benefit in delivering the E-Learning functionalities.

12.4. Issues with curriculum harmonization and design adjustment

The twenty first century educational automation will impact significantly on the current curriculum of education. Incorporating artificial intelligence, machine coding, augmented reality and simulation will go a long way to support the access to education through autonomous learning approach and interactive pedagogy. Therefore, finding the perfect blend and absolutely synchronization, linking concept to authentic context will be a very challenging task.

12.5. Power/electricity Supply consideration

The new design will require electricity distribution or its alternative such as solar grid for constant operation. The Government will have the responsibility to provide the basic infrastructure, otherwise the entire system will collapse.

13 Future Research Focus

Technology advancement will provide the basis for Industry 4.0 to remodel the educational business and economic topologies in the coming years. In quantifying the effects of the twenty first century digital automation on the industrial workforce, we also looked at the influence of technology on the advancement of research and education. The application of internet of things, artificial intelligence, machine learning, cloud technology and big data in the knowledge engineering will diminish the figure of employees engaged in quality control manic operation, thereby intensifying the exigency for the scientific evolution[31]. The robotic assisted inventions will significantly advance the automation of several industrial and educational processes while condensing the volume of labour-intensive formations[65]. Every single classroom teacher and lecturer are anticipated to utilize educational technologies to advance student learning opportunities and performances in every subject area. The future research will consolidate on adoption of augmented reality (AR) innovation and application of such technologies in developing educational research such as AR in computer science , engineering , mathematics , quantum physic , biology , chemistry, anatomy and history in the tertiary education system. Augmented reality technology should be adopted into educational programme for career professionals and students with offer of computer generated 3-D environments, together with augmented reality games

and simulations regarding hazardous materials operation, military defence tactic, concept awareness, control process and extreme automation.

14. Recommendations

In addressing issues in the digital age, the future strategic objectives must be geared in perspective of institutionalizing modern technologies into educational curriculum through early adoption of e-learning education design in the grassroots education programme. The event of 2020 global pandemic (COVID-19) that led to total shutdown of all institutions across the world with consequential impact in the global knowledge ecosystem with respect to SDG4. The Sustainable Development Goal on education (SDG4) targeted three fundamental aspects of educational investment, which include, access to education, completion of education and learning outcomes. The ongoing COVID-19 global pandemic had obstructively interfered on the academic workflow in Nigeria tertiary education, and had furthered impeded the sustainable knowledge and infrastructure management, becoming a critical issues in the contemporary educational investment around the world. With the current development, future educational policy direction will bring about streamlined programmes with the central objective of preparing the academic community with opportunities for self-development, self-empowerment, innovative technology enrichment opportunities to increase economic growth and sustainable development in the knowledge ecosystem. To bring about this desirable trend, the following strategies have been recommended for action at various levels of interactions within the vocational and technical education around the world and most specifically Nigeria and sub-Saharan Africa.

- i. Development of robust e-learning autonomous environment more powerful than the current e-learning education platform such as zoom technology platform. The anticipated enterprise e-learning platform should allow synchronous and autonomous detection of participants through artificial intelligence and machine learning coding.
- ii. The federal government should formulate a national policy on multimedia technology education aimed at incorporating multimedia development programmes in the system of education and vocational training with potential of designing e-tutoring courseware across discipline to facilitate the process of autonomous e-learning requirements.
- iii. A national curriculum project on multimedia development should be established by the federal ministry of education in conjunction with Universities, Polytechnics and Colleges of education to harmonize the modalities for e-learning adoption following the circumstances of COVID-19. The setup should capture the fundamental requirements, generate modalities, sensitization and advance curricula components for different levels of

educational interaction that is capable of addressing the present day educational requirements through technological approaches.

- iv. Increased automation of educational infrastructure through artificial intelligence robotic inducement to creating opportunities for autonomous learning adaptation.
- v. Teachers should be empowered with skill development to keep abreast with current disruptive technology growth.

15. Conclusion

The current research captured the tertiary institutions ostensible involvement in utilizing electronic media and platforms to increase assistance for student's educational pursuits, highlighting the personal supervisor when a student is disconnected from actual coursework activities. The wide adoption of zoom technology for online conference attendances, distance education, corporate meeting, government and administrative engagement in the ongoing COVID-19 proved the capacities for the technology configuration in the twenty first century digital extreme automation which characterized the digital technology ascendancy. With the current development, future educational capitalization will produce restructured programmes with the fundamental intention of preparing the academic community with opportunities for self-development, self-empowerment, innovative technology enrichment, opportunities to increase economic growth and sustainable development in the knowledge ecosystem. The current research had established that while most institutions completely enforced locked down, several institutions adopted e-learning education methodology to ensure that the duration of the postgraduate programmes in several faculties and departments do not exceed.

The survey of 400 post graduate students during the ongoing COVID-19 showed that technology in education has the potentials for self-governance, self-regulation and self-sustenance necessary for educational automation, digital synchronization and self-democracy. The research had established also that among the e-learning education tools adopted to achieve milestone during the institutional lock down include e-mail tools, discussion forum, audio/video computing software particularly zoom technology, YouTube, Facebook, blogs, webcast, and chat apps. Finally, the current research had established that in future global pandemic that could impact physical face-to-face contacts, e-learning education could be adopted to ensure that academic activities proceeded without disruptions.

Conflict Of Interest

There is no conflict of interest regarding this piece of research work.

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