



Designing Smart and Innovative Learning Education System in Nigerian Tertiary Institutions

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Abstract: The global impact of education is gradually influencing the tertiary institutions in Nigeria. Developing an adaptable model or design that will enhance learning is imperative. The educational system in Nigeria is adjudged to static, conventional and obsolete, because it is operated in traditional teacher centre approach. This paradigm view cannot remain unattended because the world is moving towards robotic environment. Beside, education is becoming more smart and innovative; every single nation is peculiarizing their system to accommodate local operation. Thus, Nigeria cannot lag behind in this 21st century. Smart and innovative learning gadgets or system will afford students the privilege to learn fast, quick and from anywhere possible. Thus the paper focuses on designing smart and innovative learning education system in Nigerian tertiary institutions. Descriptive Narrative textual Case Study approach was adopted. Thus the paper based its qualitative secondary discourse. Institutional restructuring ranging from religious, academic, business and government were the attention and focus areas of many governments in the last two years due to the COVID-19 epidemic disease that has affected the entire global economy with specific challenges facing humanity at large. This paper discussed information on designs that can foster better educational institutions in a challenging era in Nigeria. Issues such as smart innovative learning and designs, smart learning system, smart education, students engagement strategies, online academic circles were discussed. The paper concluded that smart and innovative educational teaching and learning strategies are no easy feat, because it places institutions, government and the end user out of their comfort zone, especially in financial obligations. However, experimenting new methods and strategies improves students' engagement, motivation and attainment and is a win-win direction for both students and the system. The paper suggested among others that Government should show genuine concerns in developing the pedagogical practices and structures to meet the best global standard in the 21st century and that an academic smart and innovative master plan should be developed as a driven focus in the 21st.

Keywords: Designs Smart, Innovative, Learning, Education, System, Tertiary, Institutions

1. Introduction

The concepts of teaching and learning is becoming more and more interesting in recent times due to its strategic place of exposing students to new interventions, innovation and technologies. Thus, delivering pedagogical instructions and implementing curriculum has assumed global concerns. This is because the classrooms across the world are becoming more diverse due to global migration. This diversity is challenging teachers to adapt instruction to students at a wider range of instructional language proficiency levels, prior educational experiences, and even differing abilities to see, hear, speak, move, and learn. Gaps in students'

achievement are also growing because the global pandemic is leading to varying levels of access to schools. These changes therefore make it important for all institutions to understand how to adapt their learning environment to meet the needs of all students, especially in a challenging period. The COVID-19 pandemic raging around the globe has caused large-scale institutional and behavioural 'shock effects' in various areas of human activity including education [27]. The impact on learners is unprecedented: on 9 April 2020, there are over 1,500,000,000 students worldwide from primary to tertiary level who cannot attend school [56]. Due to massive and unexpected closures, affected countries and communities have been forced to seek quick fixes in different digital learning platforms [28]. These rapid moves from classroom

to online teaching and learning have set aside the more profound questions related to national educational policies and theoretical grounds and premises. According to Orcutt and Dringus (2017) instructors provide intellectual and scholarly leadership by sharing their knowledge, experience and insights as subject matter experts. The availability and supportive nature of the instructor presence, influences to a great extent the climate and positive online learning experience for students. The author stressed that the essence of "presence" is not one-dimensional in that the instructor merely follows a set of prescribed actions that demonstrate availability and supportiveness in the online development. Presence is also a mindset for extending activity between student, instructor and content beyond just being there. The presence mindset includes a strategic workflow of effective practices that lead to co-construction of the intellectual climate shared by the instructor and students in the online progression.

According to Teräs, Suoranta, Teräs, and Curcher (2020) current conditions of formal educational systems can be described using Philip Strong's model of epidemic psychology consisting of three consecutive and overlapping epidemics: those of fear, explanation, and action. Strong uses 'epidemic' as a metaphor representing collective psychological reactions to an epidemiological crisis [55]. The first aspect involves an epidemic of fear and opens up a question: How can the educational systems and individual learners cope with the exceptional situation? The second aspect is an epidemic of explanation and moralization: 'People may be unable to decide whether a new disease or a new outbreak is trivial or whether it is really something enormously important. They swing backwards and forwards from one state of mind to another'. The third aspect is an epidemic of action. It demonstrates how educational institutions and teachers across the world's educational systems transfer their work from classrooms and lecture halls to digital platforms almost overnight. This quick transition has also revealed gaps and shortcomings in how online learning has or has not been adopted in educational institutions. Efforts at covering these gaps have created an influx of various kinds of support such as drop-in sessions, free webinars and blog posts, emergency policy documents, and even lessons learned from earlier university lockdowns [10, 14]. Perhaps more importantly, the situation has become a new market opportunity for commercial digital learning platforms providers.

Nigeria in particular and Africa in general operates from the other side of digital divides, where information communication technology is striving to survive because of the challenges of massive digital illiteracy. Therefore, the effect of COVID-19 pandemic was enormous, and took time before the educational institutions were able to switch their teaching and learning platforms; even at that, so many institutions especially the colleges of education are yet to find a common digital learning environment to adhere to pedagogical practices and principles that can enhance teaching and learning in challenged era. Some forms of

emergency online learning are being criticized for failing to adhere to sound pedagogical principles, best practices, and earlier research [21].

2. Statement of Problem

There are relatively few positive innovations taking a more transformational, inclusive and empowering approach, challenging existing norms and practices, and rethinking the role of educational actors in Nigeria. Maintaining high-quality teaching and learning in the times of a pandemic poses a huge challenge to education systems in Nigeria. Thus, to scaffold adequate principles, practices and pedagogical structure in the educational systems during the pandemic or challenging era, more advanced and fine-grained learning designs are needed than providing the curriculum objectives and learning materials of the course and defining the deliverables. While access to learning and skills development will be maintained in some contexts through a rapid shift to distance learning in education and training, the pre-existing social and digital divides should not deprive the most marginalized groups of continued learning and put them at risk of falling further behind. With only a few exceptions, the increased adoption of distance learning solutions by educational institutions has not facilitated the acquisition of skills and work-based learning, which are essential components for the success of students.

On social media, prominent professionals have questioned reasons driving some individuals, organizations, and companies so eagerly towards providing guidance, pondering whether their motivation has been driven by market reasons [52]. Others have noted the potential negative outcomes of educational technology quick fixes are implemented without balancing their consequences [51, 53]. Quickly jumping on board with learning platforms and online learning has also raised concerns about privacy and surveillance and the impact on students' lives and human dignity [19]. In the moment of crisis, educational organizations should think carefully about their choices regarding online learning and education technology. These choices can potentially echo in the future as new relations of power and control, new forms of student inequity and inequality, and other unpredictable effects [51]. In other words, educational institutions, especially in Nigeria should think of peculiar platforms adaptable within the culture and pedagogical practices within the Nigeria and African system. It is on this backdrop the paper focused on designing smart and innovative learning education system in Nigerian tertiary institutions.

3. Objective of the Paper

The paper objective is to identify smart and innovative learning designs applicable in Nigeria during epidemiological and challenging era. Attention is paid to smart and innovative designs that can enhance pedagogical practices to promote educational intentions and focus in Nigeria tertiary institutions.

4. Method

This paper adopted Descriptive Narrative Textual Case Study approach. DNTCS is a method that allows and encourages researcher to develop and organize research paper using secondary materials adopted from existing literature either from the internet or local libraries, especially in an opinion related studies, with interrogative attention paid to individualize contributions.

5. Theoretical Base of the Paper

5.1. Theories of Social Innovation [13]

As such, the more dominant and current understandings of social innovation have viewed the phenomenon through associating social innovation with product innovation processes and the conceptualization of the ‘hero’ and lone operating entrepreneur. Social innovation as a concept has been rapidly embraced across business and management literature and is often associated with broader processes of innovation and entrepreneurship.

A related concept to social innovation is the notion of inclusive innovation. Linked to inclusive growth, inclusive innovation refers to innovations that create or enhance opportunities to improve wellbeing for those at the ‘bottom of the pyramid’ (BoP). It can include any form of innovation – product, service, business model – and can represent the recombining of existing resources in new ways, or be completely new to a context [16]. Inclusive growth is about improvements in the social and economic prosperity of those members of society who have been ‘structurally denied access to resources, capabilities and opportunities’.

This model favours education at all levels as the policy mothership that increasingly guides a new cultural, ecological and ‘sharing economics’. On this model education is regarded as a means of fostering international understanding and of developing social platforms for enhancing collective intelligence and creativity. This new model of open and social innovation is a very different notion to the standard economic view, bringing to the fore the ethics of collaboration in the service of co-creation, peer- and co-production that is more suited to the digital age of social media. It is a model that has the power to radically transform education as institutions become less like factories in the industrial age and more like a Google workplace in the knowledge age [55]. Social innovation can co-create public goods and services by utilizing forms of collective intelligence (CI) and CI internet-based platforms. There is now a huge literature on collective intelligence and new forms and ways of delivering public goods and services through forms of co-creation and co-production. This constitutes a political theory of social innovation which centrally involves educational Innovation for social democracy [47]. In a nutshell, education and pedagogy are increasingly technology-led activities and the changes are heralded as innovation [41]. In this study therefore, Social Innovation theory is a construct that underpins smart and

innovative designs that encourages social inclusion and innovative growth, which is the premise of this concern.

5.2. C-K Design Theory [20]

C-K theory is a unified Design theory and was first introduced in 2003 [20]. The name “C-K theory” reflects the assumption that Design can be modelled as the interplay between two interdependent spaces with different structures and logics: the space of concepts (C) and the space of knowledge (K). C-K theory describes and explains the reasoning of a designer as he thinks of and designs a new object – a new product, service, or process. In addition to its explanatory power, this theoretical framework provides powerful generative mechanisms to overcome cognitive obstacles, thus improving our ability to innovate. C-K Design Theory provides a comprehensive understanding of design mechanisms. Numerous tools and methods aimed at better structuring and optimizing the innovation processes, in particular those dedicated to breakthrough innovation were derived from this theory. This theory is a perfect fit for this paper as it clearly demonstrates the power of designing concepts and knowledge, which is the driving force of this research.

6. Conceptual Discourse

6.1. Designing Smart and Innovative Learning System in a Challenged Era

Digital technology availability has made it possible to rethink all activities, especially in a challenging period, like the COVID-19 pandemic [1]. Likewise, in the higher education landscape, tertiary institutions have been delivering blended and online learning for more than two decades [6]. However, the changing paradigm is geared towards innovative learning designs, especially localizing global best practices and approaches. Innovative learning is defined as a sort of learning similar with creative learning, by which the learners elicit the change, renewal, reorganization, and a series of new questions [26]. It is the process of gaining knowledge through the integration of technology to support and promote students' learning experience. According to [57] innovative learning is the process of creating an atmosphere where students learn about new things regularly, question them, and think of new ideas on their own. It can involve using technology like-Augmented reality, Deep Learning, or something as common and necessary as the Internet to let students explore and understand things. It could be inclusive of more practical and Do-It-Yourself (DIY) projects to let learners take risks and learn by doing. It can also facilitate group explorations that can help in developing skills like learning from others, growing, and developing harmony amongst them, which will later help them in the future while managing a huge team as a Creative Leader. Primarily, the idea of educational innovations revolves around one fundamental question – What do you mean by education? If it's the art of learning things, then the curriculum should be

flexible and should involve the encouragement of the use of technology and to learn by exploring [57].

The concept of flexibility is considered paramount in pandemic learning design. According to Pelayo, and Pelayo, (2020) learning is a process where the transfer of knowledge takes place. Different types of learning designs were introduced for the purpose of providing aid in the learning process and one of these is flexible learning [46]. Lundin in Zhi-Ting, Ming-Hua, and Peter (2016) defines flexible learning as an idealized state where there is a mixture of education philosophy, pedagogical strategies, delivery modalities, and administrative structures which allows students to choose according to their learning needs, styles and circumstances [58]. In principle, flexible learning approaches may be applied to any subject; still, accurate analysis of the demands of the learner and of the practicality of this approach is highly recommended. Flexible learning approaches are often designed using a full range of teaching and learning theories, philosophies, and methods to provide students with opportunities to access information and expertise, contribute ideas and opinions, and correspond with other learners and mentors [46].

Learning design refers to a framework that supports learning experiences. It pertains to deliberate choices about what, when, where, and how to teach. To support learning, decisions about the content, structure, timing, pedagogical strategies, sequences of learning activities, and the type and frequency of assessment in the course, as well as the nature of technology to be use is very important. Recently the concept of "Learning Design" has gained momentum in the education space, mostly through discussions at conferences, webinars, ebooks, and more [46]. The COVID-19 pandemic has caused global social and economic disruption, causing the largest global recession since the great depression and global famines affecting millions of people. It has led to either the postponement or outright cancellation of events such as sporting, religious, political, and cultural activities, shortages in supplies as a result of exacerbated panic actions and reactions. Also, schools, universities, and colleges are affected due to closure either on a nationwide or local basis in so many countries, affecting approximately more than half of the world's student population. In this regards, alternative learning approaches requires absolute attention, especially in a world where epidemics are becoming regular occurrences. The flexibility discourse centres on students engagement designs to promote individualistic or group learning in a time of challenge. Thus, the following ideas are adopted in this paper.

6.1.1. Institutional Engagement for Students' Partnership Design

Students are the pivot of knowledge driving and career focused educational institutions. Consequently, designing real-world learning processes to inspire self and group culture is only but ideal in a time when conventional teaching space is becoming challenged by environmental indices and elements beyond human comprehension. According to

Matthews, Cook-Sather, Acai, and Dvorakova (2019) there is a new tendency in higher education to empower students as partners in the learning process [36]. Becker (2019) stressed that this approach enables students to be part of the learning design and promotes engagement, motivation, and agency [5]. Gravett, Kinchin, and Winstone, (2019) reinforced that research has shown that the strategy of making students partners increases their confidence and self-efficacy [18]. Therefore Involving students as partners will increase educators' understanding of how new generations learn and could potentially enhance student-educator relationships, in a 'mutualism' as Boucher puts it [48]. According to the author, the strategy can be mutually beneficial to both parties. Another advantage of this approach is that it could increase students' awareness of metacognitive learning, self-evaluation, and reflection and increase their sense of belonging to the institution or discipline [9]. In a challenging period, inviting students to webinars are great learning design engagements that allow students to muster in focus groups and discuss difficulties or interpolate with each other and the teacher without meeting in a conventional classroom. According to Reyna (2020) knowing the difficulties students encounter could lead to the redesign of a lecture into a webinar which 'flips' the troublesome content [48]. This way students can engage with the content as many times as required before coming to the webinar, ready to engage in higher-order thinking via discussion and consideration of ideas.

Students differ in motivations, and attending to these motivations can improve overall motivation and achievement. For example, some students may be working towards a professional degree in a specific field, while others may be enrolled to fulfill a requirement and course merely their first introduction to a topic. Therefore, students with different backgrounds and goals require different approaches to communicate the importance of what they are learning and understand how it applies to their learning goals. To improve engagement, one must be flexible with the modes and modalities you use to present information to students. There is not one means of engagement that will be optimal for all learners in all contexts; providing multiple options for engagement is essential. Thus, to create students partnership and improve on learning ability and capability of students, institutions are encouraged to design engagement approaches that will facilitate students' involvement in the educational system. The approached is geared toward C-K theory, which favours concept and knowledge driven engagements by students.

6.1.2. Innovative Academic Online Circles Design Strategy

Learning during pandemic or challenging period is difficulty because of the deserting or regulation prohibiting 'physio-environmental' engagement. Therefore, online academic circles design strategy is a connection and nexus that improve and encourage continuous learning from individual safe zone. This method encourages the application of motion and non-motion contents to enhance learning

experiences among students. The use of media and multimedia methods becomes highly rewarding and is encouraged. The multimedia principle suggests that students learn better when the learning materials contain words and images [37]. The ‘personalization principle’ means engaging the learner by delivering content in a conversational tone to enhance learning [48]. Through the design of online subjects, facilitation of discourse, and direct instruction, educators can establish an online teaching presence [46]. A robust online teaching presence makes for a robust online learning experience and a sense of community for students [4]. According to Reyna, (2020), a video is an excellent tool to create online teacher presence with medical students [48]. By creating weekly introductory videos on the subject being taught, educators can create a strong teacher presence. The videos should be one or two minute’s maximum to engage students effectively. Video scripting is essential to avoid redundant words [54]. One minute of video is about 130-150 words, so scripting is essential to avoid overly long videos [8]. Thus, innovative online academic circles designs focuses on technological tolls that help in shaping the learning platform to accommodate circles of teaching and learning groups and enhancing safe-self learning environment. Thus both students and their tutors can operate form the confine of their home. In consonant with social innovation model, the strategy is focused on medias that will enhance inclusive and intelligent growth among students. According to Daniela, (2018) in general, education is considered to be a cyclic process, where the learning process provides the inclusion of new innovations, modifying the content of teaching, changing teaching strategies, developing new teaching

materials, planning what competencies will be needed in the future, which occupations will be required in the labour market, and so on [12]. However, the author stated that technological progress, which is becoming more rapid with the possibilities provided by digitization, pose a risk of centrifugal effects in the educational process, making it fragmented, where actors of educational processes operate independently, and the role of pedagogy is diminishing, which also affects the quality of education.

The author further asserted that the centrifugal effect is due to several possible causes and one of them that the possibilities which are provided by technology are interesting and exciting and can redirect students’ attention away from the educational process, where these interesting and exciting technologies are not included. The reason why they are often excluded is because quite often technology is considered useless for promoting students’ cognitive development, since there must be taken into account the regularities of student development and the need to support the development of the attention span. It is undoubtable that it is necessary to let students acquire the needed knowledge to analyze information, make informed decisions, and promote the development of higher-level cognitive processes in order to create new innovations. The fact that the learning process should be interesting and exciting is not new for educators. However, the fascination of technology makes it necessary to analyze the risks which can be caused by the concept ‘interesting’, as students are constantly shifting their attention to interesting technologies. Thus, academic innovative cycle strategy will serve as a monitor to ensure there is focus, commitment, interest and development in the process.

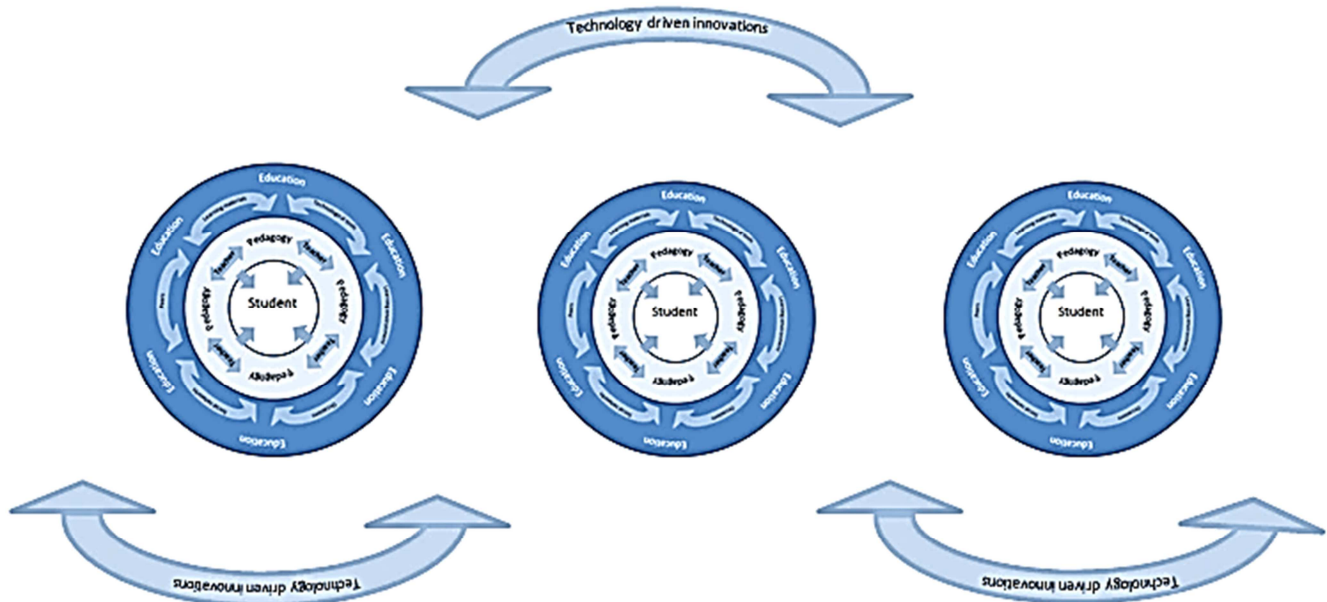


Figure 1. Cycle of the educational process [12].

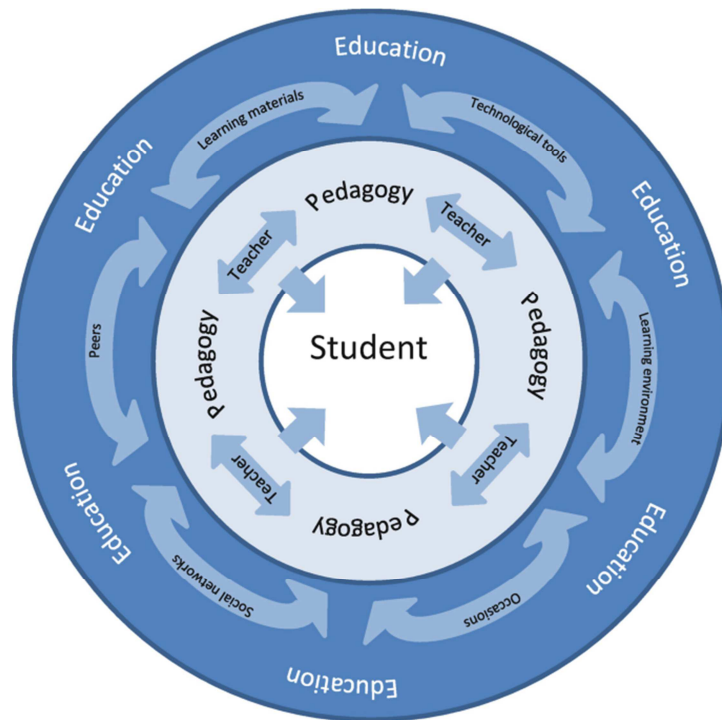


Figure 2. Smart Pedagogy for Technological Enhanced Learning [12].

6.1.3. Smart Learning Education Initiative Design

Smart learning education is one of the best approaches whereby contents and assessment are developed to allow students free access on smart platforms or devices for education on-the-go. With the exponential technological advances, anything could be instrumented, interconnected, and infused with intelligent design, so is education. Smart education has gained significance attention in recent years [58]. In 1997, Malaysia first carried out a smart education project. The idea behind the smart learning education is environmental technology designs that accommodate 'Safe-Self Learning Education' (SSLE), where both the students and teachers are free to attend classes without the fear of contacting any communicable diseases. As a new educational paradigm, smart learning bases its foundations on smart devices and intelligent technologies [34; 30]. As identified and heavily studied over the last decennia, technology can be implemented and utilized in helping learners learn. This is described as Technology-Enhanced Learning (TEL). TEL is used to provide flexibility in the mode of learning. Technologies can be as media or tools for accessing learning content, inquiry, communication and collaboration, construction, expression, and evaluation in TEL [7, 11, 17, 40]. With the development of mobile, connected and personal technologies, mobile learning has become a major TEL paradigm. Mobile learning emphasizes the utilizing of mobile devices and focuses on the mobility of the learner, in contrast to the static traditional education system which is prevalence in the third world nations. In addition to this, the supporting of ubiquitous technology has caused further changes that is moving learning style away from the mobile learning toward to the ubiquitous learning which emphasizes learning can

take place anytime and anywhere without the limitations of time, locations, or environments [24].

According to Zhi-Ting, Ming-Hua, and Peter (2016) globally many countries have participated in projects focused on smart education, e.g. Malaysian Smart School Implementation Plan (Chan cited in [58]. Smart schools, which are supported by government, aim to improve the educational system in order to achieve the National Philosophy of Education and to prepare work force that meets the challenges of the 21st century. Malaysian smart schools aim to help the country to foster the workforce of 21st century by utilizing and enabling the leading-edge technologies into schools. And the smart schools not only focus on stimulating thinking, creativity, and caring for the students, but also considering the individual differences and learning styles among the learners.

Singapore implemented the Intelligent Nation Master Plan since 2006, in which technology supported education is an important part [22, 58]. The smart education in Singapore also emphasizes the role of technology. The goal is to foster engaging learning experience to meet the diverse needs of learners, through the innovative use of information and communications technology [15]. In order to realize this, Singapore created an enriching and personalized learner-centric environment, and additionally created a nation-wide education and learning architecture for educational institutions and life-long learning.

Korea carried out the smart education project to provide the customized and adaptive learning for students to foster self-directed learning ability and have fun to use various resources and technology. Individualized instruction and creativity-centered education is considered as the main keyword of smart education. Australia aimed to build a smart,

multi-disciplinary student-centric education system using the following strategies: adaptive learning programs and learning portfolios for students, collaborative technologies and digital learning resources for teachers and students, computerized administration, monitoring and reporting, and online learning resources. New York proposed the keys for achieving Smart School as following: embracing and expanding online learning, utilizing transformative technologies, connecting every school using high-speed network, extending connectivity between inside and outside of the classroom, providing high-quality, continuous professional development, and focusing on fostering 21st century skills [43]. Finnish smart education aims at using user-driven and motivational learning solutions to promote 21st century learning [29]. They proposed a pedagogical network of educational institutions called “Value Network” that is the central of the program. It has five categories as following: to understand user experience and usability, to receive expert feedback, to indicate learning outcomes, effects and quality of learning, to develop skills and expertise [35]. United Arab Emirates (UAE) aims to advance their education system to student-centric through the application of world-class teaching science and latest technology. They encourage learners to develop creativity, analytic thinking and innovation. Their approach encompasses learning both inside and outside the classroom. The students can control an active participant into their own learning process in interactive, engaging and enabling learning environments. The various experiences and ideation by the above nations has shown that an individual country tends towards adaptive technologies and innovative appliances applicable to their educational peculiarity.

According Noh, K. S. Ju, S. H. Jung, J. T. (2011) smart learning is an alternative solution for the continuous growth of e-learning in the smart computing age. Nigeria is not an exception in technological adaptiveness. Thus the educational institutions are encouraged to develop adaptive technologies capable of delivering teaching and learning in a smart dimension in the 21st century, using the C-K theory or Social Innovation Model to design a concept of smart innovative learning school with idiosyncrasy to the Nigerian educational system.

6.2. Framework for Smart and Innovative Learning System Design

Smart Education is now a typical feature in education, emerging from Information Communications Technologies and the constant introduction of new technologies into institutional learning. The aim of the Smart Classroom is that users develop skills, adapt and use technologies in a learning context that produces elevated learning outcomes. Technologies, such as cloud computing, learning analytics, big data, Internet of things (IoT), wearable technology etc., promote the emergence of Smart Education. The IoT is a new paradigm in which objects equipped with sensors, activators, and processors that communicate with each other to serve a meaningful purpose. IoT influences education in many ways that enable institutions to make decisions that are more informed in an effort to improve student learning experiences, operational efficiency and campus security and many more [33].

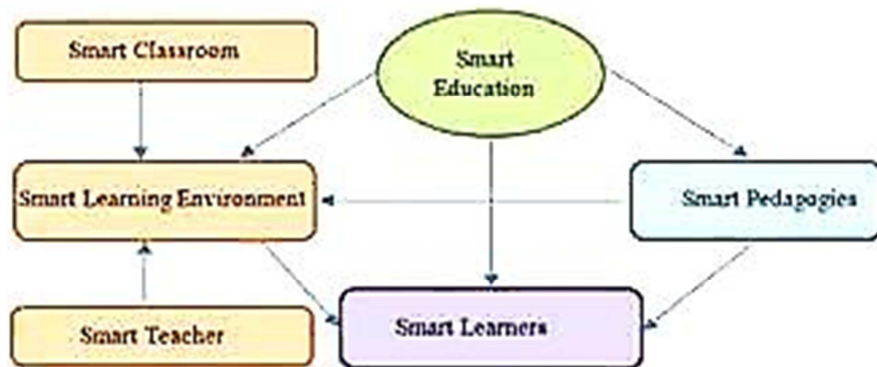


Figure 3. A framework of smart education.

This model is only adopted, adapted and expanded in this study. The framework is expanded and discoursed below:

Based on the generalities of different countries' smart education and smart learning innovation is the concept of discourse within the global education stage. Zhu and He (2012) stated that “the essence of smart education is to create intelligent environments by using smart technologies, so that smart pedagogies can be facilitated as to provide personalized learning services and empower learners, and thus talents of wisdom who have better value orientation, higher thinking quality, and stronger conduct ability could be fostered”[59]. Thus, based on this definition of smart

education, a learning framework initiative can be considered. This framework describes three essential elements in smart education: smart environments, smart pedagogy, and smart learner. Smart education emphasizes the ideology for pursuing better education and thus had better to be renamed as smarter education, which address the needs for smart pedagogies as a methodological issue and smart learning environments as technological issue, and advances the educational goals to cultivate smart learners as results. Smart environments could be significantly influenced by smart pedagogy. Smart pedagogies and smart environments support the development of smart learners [58]. There is a nexus

between smart education ideology, smart environment, smart pedagogy and smart learner.

6.2.1. Smart Learning System (SLS)

Learning is conventionally defined as the process of acquiring competence and understanding. It results in a new ability to do something, and an understanding of something that was previously not understood. Competence is sometimes described in terms of possessing specific skills, understanding in terms of possessing specific knowledge. The 21st century demand skills and competence from people in order to function and live effectively at work and leisure time. Education needs to prepare workforce for the demand. So the goal of smart education is to foster smart learners to meet the needs of the work and life in the 21st century [57]. Smart Learners are learners with unique ability to master quickly applicable devices and technologies in the learning process. They are digital enhanced learners, who uses technology in achieving their learning objectives. Smart learning system incorporates sensing technologies to achieve learning outcome. Sensing technologies based smart learning system significantly affects the learning and teaching process. Sensing technologies increased the interaction between learners and teachers comparing to conventional learning system. The smart learning system provides an appropriate information to individual students in the right way. The smart learning system also facilitates deaf, blind and aged learners which will definitely reduce the extra expenditures for constructing separates schools and colleges. Ultimately learners' ratio will be increased if smart learning strategy is deployed for learning process. Furthermore the proposed system can be easily deployed in learning environment [42]. The implementation of sensing technologies in teaching learning activities to achieve the objectives of teaching and learning effectiveness is what tagged smart learning system is. Through smart sensing technologies the collaboration between teachers and learners will be more beneficial than the conventional learning environment. Smart learning strategy defiantly required for smart environment in which interaction of the participant is convenient. To analyse the differences in smart learning systems and conventional learning environment, learning tools, resources, teaching and learning communities, and ways of teaching and learning are integrated to design effective learning and teaching system [42].

6.2.2. Smart Pedagogy System (SPS)

Pedagogy as a science is constantly evolving and looking for ways to better teach and to scaffold students in the process of knowledge building. An important milestone in the development of pedagogy can be seen from the year 1949, when a group of scientists in the fields of pedagogy and psychology worked out the development of an educational taxonomy, which was published in 1956, more widely known as Bloom's taxonomy [12]. In Webster's Dictionary, *pedagogy* is defined as the art, science, or profession of teaching [38]. Žogla, (2017) has analyzed the interdependence between pedagogy and the educational

sciences, presenting the development of pedagogical science, which has changed direction from external influences on the learning process to the understanding of the complex nature of learning, which, from the perspective of the students, takes into account the individual needs of each student and looks for solutions with which to support the students by emphasizing and strengthening their abilities [60].

With the rapid development of technologies, increasingly flexible and efficient learning methods for students are developed. Research in cognitive science has indicated that knowledge and skills are closely intertwined [49]. It needs mixing content knowledge and process skills to produce understanding which learners need. Then learners execute their understanding in practice to produce their performances. The critical thinking and learning skills are very important, but these skills cannot be taught independently and some appropriate factual knowledge need to be taught in particular domain and context [2]. Using the deliberate instructional or learning strategies can be related to cultivate the knowledge and skills for learners. Students usually accept basic knowledge and core skills in the classroom. Learning goal and process always are the same for each student in traditional classroom. But students with different backgrounds have different needs [58]. Every student deserves a strict education matched with content and performance standards that promote the understanding for a global interest and focus, which is what smart and innovative system offers. The classroom should be differentiated and responsive to vary learners' readiness levels, interests and learning profiles [58]. Differentiated instruction emphasizes the different needs of each individual student and cultivates the basic knowledge and core skills for students. Whether learning happens in the classroom or online, students who have different performances often need to learn together in-group or team to fulfill common task or achieve common goal. In collaborative process, learners can foster comprehensive abilities including critical thinking and solve problem ability [58]. Students in cooperative teams can keep knowledge longer through sharing information and engage in discussion at higher levels of thought to take responsibility for their own learning [58]. Learning processes should be tailored according to the students' learning needs that include requirements, background, interests, preferences, etc [58]. In particular, personal interest is more important than external motivation because it is driven by students' own passion [58]. Interest-driven personalized learning emphasizes the interests of students and can fosters intrinsic motivations, and then promote the personalized expertise for students [3]. Smart Pedagogy therefore emphasizes usage of smart platforms with individual students focus and ability consideration to encourage group or individual learning.

6.2.3. Smart Learning Environments System (SLES)

Generally, smart learning environment is effective, efficient and engaging [39]. The learner is always considered as the heart of smart learning environment. And the goal of smart learning environment is to provide self-learning, self-

motivated and personalized services which learners can attend courses at their own pace and are able to access the personalized learning content according to their personal difference [31]. Koper (2014) proposed that smart learning environments are defined as physical environments that are enriched with digital, context-aware and adaptive devices, to promote better and faster learning [32]. Hwang, (2014) specified that the potential criteria of a smart learning environment include context-aware, able to offer instant and adaptive support to learners, and able to adapt the learner interface and subject contents [25]. Smart learning environment not only enables learners to access ubiquitous resources and interact with learning systems anytime and anywhere, but also provides the necessary learning guidance, suggestions or supportive tools to them in the right form, at the right time and in the right places. Learning can take place anytime and anywhere via the utilization of smart devices. The context-aware aspect plays an important role in smart learning environments that can support to provide proper learning service to learners. Kim, Song and Yoon, (2011) designed a smart learning environment based on cloud computing. The smart learning service provides context-awareness supporting push smart learning content to learners through collecting and analyzing their behaviors. It aims to provide personalized and customized learning services to learners [30]. According to Scott and Benlamri (2010) built a smart learning environment, which is learner-centric and service-based, based on semantic web and ubiquitous computing [50]. The learning environment is composed by ubiquitous collaborative learning spaces, which transform traditional learning spaces into intelligent ambient learning environments through context awareness and real-time learning services. Huang, Yang and Hu (2012) Considered a smart learning environment is high-level digital environment that realizes learning context awareness, recognizes learner's characteristic, provides adaptive learning resources and convenient interactive tools, records learning process automatically and evaluates learning outcomes. Its goal is to support easy, engaged and effective learning for learners, through effective environmental friendly learning conditions [23].

7. Conclusion

As the great scientist Thomas Edison once said, "The value of an idea lies in the use of it." Hence, our education system must stay efficient as well as relevant to the progress we are making and the challenges our world is facing now. It is time we promote smart and innovative teaching and learning environment so that students learn a lot more than what is contained in a textbook. Applying smart and innovative learning designs is a crucial skill for educational institutions in Nigeria. Pedagogical research has shown that innovative learning and education approaches can significantly enhance student learning process. Thus, smart and innovating educational teaching and learning strategies are no easy feat, because it places institutions, government

and the end user out of their comfort zone, especially in financial obligations. However, experimenting new methods and strategies improves student engagement, motivation and attainment and is a win-win direction for both students and the system. However, experimenting new methods and strategies can improve student engagement, motivation and attainment and is a win-win direction for both students and the system.

8. Recommendations

The paper recommends that:

1. The Nigeria government should re-evaluate the educational system to identify area of needs, innovations and collaborations that supports challenging era teaching and learning environment.
2. Government should show genuine concerns in developing the pedagogical practices and structures to meet the best global standard in the 21st century.
3. A team of academic, technological, curriculum developers and financial think-tanks should be harnessed to design a smart and innovative learning roadmap that will embrace holistic digital instructional application in the Nigerian educational system.
4. There should be an action driven plan for a smart and innovative learning design in Nigeria.

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