The Role of Library and Information Professionals in Creating a Smart learning Environment using Modern Technologies and Innovations in the COVID-19 Era: Introducing Individuals' Uniqueness Consideration

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ABSTRACT

With the spread of COVID-19 across the globe, a lot changed, diversified, abruptly halted or modified. Different sectors of the different countries were not left out in these changes. Nigeria learning system was also greatly affected and as such learning institutions across the nation had to be shut down till further notice. This begged to answer the question if the Nigeria learning situation has been improved enough to accommodate the technological changes that came with it. There was also the need for Library and Informational Science (LIS) professionals to step in to save the learning situation by creating a smart learning environment for the individuals while considering their uniqueness.

The need for learning environments to grow with the technological changes around the globe is on the increase and Nigeria is not left out at all. With the advent of modern technologies on the rise, learning environments have been developed and made flexible and efficient enough for learners to learn effectively in. Learners make use of smart technologies and have access to digital resources through wireless network and to immerse in both personalized and seamless learning. With the exponential technological advances, anything could be instrumented, interconnected, and infused with intelligent design, so is learning and the learning environment.

This study was conceived to examine how the Covid-19 pandemic affected learning and brought about the need for upgrades in learning environments. It considers the roles of LIS professionals in creating a smart learning environment. It seeks to examine the technologies and innovations used in creating a smart learning environment as well as challenges associated with the establishment of a smart learning environment by LIS professionals. Finally, the way forward is proffered on how Nigeria can create this smart learning environment as the onus lies on the LIS professionals in the information society.

Keywords: **Covid-19; Coronavirus; Library and Informational Professionals; Librarians; Smart Learning Environment; Education; Learning Uniqueness; Innovations; Smart Technologies.**

1. INTRODUCTION

The recent outbreak of the corona virus pandemic created as well as revealed the gap in the learning system in Nigeria. Though, the Coronavirus pandemic is novel, but it already has noxious effects on humanity (Edeh, et. al., 2020), it has currently affected education, research, sports, development, worship, social gatherings and meetings, transportation, businesses and politics. At the hub of these adverse effects is the effect on education and learning. The COVID-19 pandemic has created the largest disruption of education systems in history, affecting nearly 1.6 billion learners in more than 190 countries and all continents. Closures of schools and other learning spaces have impacted 94 per cent of the world's student population, up to 99 per cent in low and lower-middle income countries (United Nations, 2020). Nigeria's learning system is not left out from the negative effects that the coronavirus pandemic has brought with it. OECD (2020) made an observation that this crisis has exposed the many inadequacies and inequities in our education systems ranging from access to the broadband and computers needed for online education, and the supportive environments needed to focus on learning, up to the misalignment between resources and needs.

Prior to this time, learning environments in Nigeria refer to the diverse physical locations, contexts, and cultures in which children, students and adults learn. Since learning can take place in different environments outside of the school and classroom setting, the learning environment should be a term accurately used to describe alternatives to classrooms but with limited resources and a more traditional setting. When the Covid-19 struck, it put a halt to physical meetings and as such physical learning was affected.

As soon as this temporary lockdown took effect, the system changed from the normal traditional setting to digital settings. The learning environment, rather than being physical, became virtual. Virtual learning environment was created to continue learning. Hussien (2020) in her article shows evidences that country like China, France or Portugal created measures to meet up with the digital trends relating to virtual learning. In China, for example, the government provided students across all age with computers and digital learning resources. Portugal is seen partnering with different learning institutions to deliver digital worksheets to different learning individuals and providing access to the internet in order to create smart learning environments for them.

Smart learning environments, a concept that describes an improvement on physical environments with modern technologies to provide an increased interaction, efficient and personalized training focuses on virtual learning provided by Library and Information

Professionals. Away from the traditional methods of learning, such as, physical learning in the classroom, smart learning environments encompass an interactive learning system, technology enhanced system, Web-based learning or mobile learning (Kinchuk, Cheng & Chew, 2016). The library has since being known as the institution of learning and information; but with the hit of the Corona Virus and its adverse effect in Nigeria, it has also been affected.

The librarians and the information scientists have roles away from the traditional means of providing learning and education to provide a learning environment that considers all or most uniqueness of individuals. Depending on the library type, individuals in the information community no matter the age, learning disability, talent or environmental upbringing should be considered when creating a smart learning environment. With the advent of new and modern technologies, the continuous existence of the library and learning environments in Nigeria has been questioned. Researches over time have revealed that the library and information science professionals have since known their place in the digital information and knowledge society and have since been taking up their positions (Schöpfel, 2018). Creating a smart learning environment in Nigeria has been a major challenge for information professionals.

The factors that have overtime posed a threat to the establishment of smart learning environments in Nigeria include funding, unavailability of modern technologies, and lack of expertise to implement the technologies. Nagel (2013) posits that a major challenge of establishing a smart learning environment is resistance to change. According to him, teachers and learning instructors often see technological experimentation as outside the scope of their job descriptions.

Preliminary observation and extant literature review shows that prior to the outbreak of the Covid-19 pandemic, Nigeria had not been ready for the modifications of the physical learning environments to smart learning environments and as such this has in one way or the other hindered the learning process for both the individuals, information professionals and the learning instructors.

This study aims to examine these challenges the Covid-19 pandemic has brought on the learning system in Nigeria and how the Library and Information professionals can step in to tackle them in order to bring about a smart learning environment to suit the individuals' uniqueness.

2. CONCEPTUAL FRAMEWORK
SMART LEARNING ENVIRONMENT

Prior to the advent of the use of technologies to learn, learning was mostly done in the classrooms using white chalkboards. Technology was later introduced in the form of marker board. Classrooms in Nigeria saw this development as very exciting and an improvement in Nigeria's learning. This was later developed to interactive boards. Learning instructors and teachers could now make use of projectors and computers to teach. Students and adults started making use of mobile phones to study and get answers to their information queries.

The term "Smart" is used here to describe both learning and the environment the learning takes place in. When it comes to learning, Spector (2016) opines that the learner, learning instructor and the instructional system should be put in consideration when defining this key term. Schöpfel (2018) says the central focus is on information. The construction of learning environment is the foundation to reform teaching and learning. Making learning experience smart has always been the focus of researchers in the information, computer and education fields.

Smart learning environments, therefore, are Internet of Things (IoT) -based learning solutions, which are seamlessly integrated into our working and learning environment. Smart learning environments are therefore physical environments enriched with context-aware digital devices to improve and accelerate learning. Advances in technology in recent years have changed the learning behaviours of learners and reshaped teaching methods (Kinshuk, Cheng &Chew, 2016). They are regarded as the technology-supported learning environments that make adaptations and provide appropriate support through guidance, feedback, hints or tools in the right places and at the right time based on individual learners' needs, which might be determined through analyzing their learning behaviours, performance and the online and real-world contexts in which they are situated (Hwang, 2014). Boulanger et al. (2015) indicated that smart learning environments involve context awareness that can combine a physical classroom with many virtual learning environments.

Due to the advancement in technology, Spector (2016) categorized the characteristics of a smart learning environment based on human intelligence that might transfer to technologies and learning environments to include knowledge, task support, learners' sensitive, context sensitive, reflection and feedback. He asserts that a smart learning environment gives the learner access to information and also has the ability to add or modify that information. It has the ability to perform a task or provide a learner with tools and information needed to perform a task; maintains and makes use of a profile of the learner so

as to provide appropriate support and knowledge; the ability to recognize specific situations, including those situations in which a learner might be in need of assistance and the ability to critique a solution or performance and/or provide meaningful and timely feedback to a learner based on the learner's progress and profile and the learning task at hand.

Smart learning environment does not eliminate the necessary learning process. Hwang (2014) is of the opinion that learning in a smart learning environment does not imply that students have only a limited amount of leisure time; that is, no particular learning schedule is used to replace their leisure activities but it aims to help students gain knowledge even when they are doing leisure activities. It plays the role of a wise friend who seeks opportunities to advise learners in their daily life by taking their needs and preferences into account. The idea of a smart learning environment is to create a forum where technology assists the learning process; it is not there to make things harder, but to enhance the learning experience.

Simply put, smart learning environments are the modifications on learning with the use of modern technologies and digital resources away from the traditional physical learning environment. They are learning situations enabled by smart technologies, human and artificial intelligence modified or developed to suit learners' status at any given point in time.

SMART LEARNING TECHNOLOGIES

Amongst the sectors affected by the changes brought by the Covid-19 pandemic is the education and information sector. Physical meetings seized and as such most educational and learning centres had to close down. A lot of activities and events had to be postponed, while some were adapted to suit the new trends. The situation birthed virtual and smart services. One never stops learning, so new ways had to be birthed to continue learning. The use of technology and artificial intelligence of various sorts were birthed.

As a new educational paradigm, smart learning bases its foundations on smart devices and intelligent technologies. Kinshuk (2016) asserts that smart learning environments go beyond simple application of technology. They enable the fusion of technology and pedagogy to create an ecosystem that involves active participation of teachers, parents and others in the learners' learning process. They also provide real-time and ongoing evidence of changes in knowledge, instilling skills which are seamlessly transferred to learners as they move from one learning context to another.

Technologies should not support learning by attempting to instruct the learners, but rather should be used as knowledge construction tools that learners learn with, not from. Spector (2016) asserts that the two devices commonly referred to as smart technologies when it comes to learning are the smartphone and the interactive whiteboard. Smart learning

technology can support learners in both real and virtual environments (Kinshuk, 2016). He is of the view that there are thousands of technologies that have been implemented into smart learning that enable learning opportunities and instructional interventions that have been very difficult, if not impossible, in traditional settings.

1. Flipped Classroom: Kinshuk et. al, (2016) describes the concept of flipped classroom as one to have emerged in recent times out of the need to enhance learning and teaching qualities. It works in such a way as to flip the traditional physical learning environment and to create in such a way that the learner takes a very important role in the learning process and outcomes. The flipped classroom approach enables learning instructor to provide learners with different learning opportunities. Cheng (2015) states the benefits of the flipped classroom to include a shift in the traditional learning means to a student centered blended learning environment; it also allows information professionals and learning instructors to deliver the course content in a more interactive manner, along with interactive learning activities both inside and outside of the physical classroom. They include both formal and informal learning approaches, enriched with interesting and interactive learning activities to increase learners' engagement in the course and enhance their learning process.

2. Massive Open Online Course (MOOC): Chew et al. (2015) describes the concept of Massive Open Online Course (MOOC) as a technology that enables learners attend online courses anytime and anywhere. They are designed to provide learners with free access to open education and the courses are capable of having intakes of vast number of participants through the Internet. This implies that everyone from across the globe can pursue more knowledge with no limitation on the number of student intake and enrolment period. MOOCs encourage flexibility with the usage at the learners; time and pace to suit their own schedule. MOOCs enable self-directed learning where learners can achieve their own learning needs and goals (Paquette et al., 2015) by applying appropriate personal learning strategies. MOOCs are typically equipped with interactive video lectures and learning activities to engage learners in the learning process. Both asynchronous learning and synchronous learning modes are possible with MOOCs, allowing and increasing the interaction among the learners and between the learners and the instructors to facilitate better learner experience.

3. Augmented Reality and Virtual Reality: Augmented reality (AR) is defined as a live direct or indirect view of a physical, real world environment whose elements are supplemented by computer generated sensory input (Kinchuk et. al. 2016). Virtual

reality (VR), on the other hand, is a simulated real-world environment that is created to enable users to believe that the environment is real. Both realities can be used for education by simulating a real environment during the instruction process, thereby, providing learners with a better understanding and visualization of the subject matter. With the pervasive growth of the Internet of Things and wireless sensor networks, plus the wide accessibility of wearable devices, augmented or virtual technologies can be used to convert our physical contexts into 3D immersive learning environments that seamlessly integrate physical and digital worlds. A whole new learning experience with authentic, situated and timely response features is emerging. This obviously brings with it a great challenge of constructing a broad range of learning scenarios to be used in these virtual learning environments.

4. Gesture-Based Learning: Gesture-based learning makes use of gesture-based technologies in the learning process. It allows learners to engage in a virtual environment by interacting with computers primarily using their body motions and movements. Gesture-based technologies consist of various sensors (Hung et al. 2014), such as gravity sensor, infrared sensor and structured-light 3D sensor, body actions and movements, voice recognition, and action acceleration and direction changes.

Full context awareness in a smart learning environment is provided by combining smart learning environments with holistic Internet of Things (IOT) and ubiquitous sensing devices like wearable technologies such as smart watches, brainwave detection, and emotion recognition (Li et al. 2015).

Part of the technology needed for the creation and use of smart learning are artificial intelligence and the IoT, which is defined as a bundle of technologies that connects different types of IT ranging from RFID to data analytics and virtual reality. Smart learning environments at a very high level of maturity require a powerful recommender system. In this case, you need lots of data on the learning history of each user if you want to provide learning analytics (Hwang 2014).

With smart learning technologies, learning becomes more interactive. Students can learn more by receiving constant feedback on their work. Interactive learning material promotes a child's interest, passion and creativity. Smart technologies extend current resources used in learning by bringing activities to the learning environment that would have been impossible before making learners now experience a more technical side of what they are studying. With the interactions and ease of use suited according to both learner and the learner's instructors' status, there is increased efficiency. Learning based on IoT does not

necessarily constitute a physical learning environment full of students reading from a book. It fosters learning over the internet through group activities, discussions, webinars and debates. These benefits have all been recently seen since the beginning of the pandemic till now and this trend has come to stay. It can only be improved upon.

LEARNING UNIQUENESS OF INDIVIDUALS

Smart learning environments are expected to facilitate smart learning support that is based on each individual learner's learning profile. While creating a smart learning environment, the learning uniqueness of the individuals is put into consideration. This is because the individuals differ from the other in terms of age, learning habits, understanding capabilities, backgrounds and levels of exposures to the technology used. Recently, owing to the advancement and popularity of mobile, wireless communication and sensing technologies, researchers have attempted to provide personalized learning guidance or support in real-world learning environments.

The role of information professionals in creating this smart environment surpasses just being technically inclined and ICT knowledgeable. They are to consider the individuals age at the point in time. Their age would determine the learning modules, curriculum and contexts of learning. Some uniqueness to consider according to Yang et. al (2013) include learning status and personal factors, such as learning progress, knowledge levels, learning styles, cognitive styles and preferences.

Learners nowadays have multiple sources at their disposal to retrieve learning resources, such as open educational resource repositories, Wikipedia, MOOCs, and even content from TED talks, YouTube, and iTunes U. In smart learning environments, learning is customized and adapted to the individuals information needs. Hwang (2014) says that for the young ones, the smart learning environment should take in their age and unique understanding abilities. Yang (2013) says that an intelligent tutoring system or an adaptive learning system should be developed for supporting students to probe and acquire knowledge based on their unique learning styles.

They also talk about using the right tools and resources in the right context to suit all learners. For the young, this can be done using mind tools. Mindtools are computer systems that engage students in meaningfully and constructively thinking and learning via stimulating or guiding them to interpret, analyze, synthesize and organize knowledge during the learning process. Kinshuk (2016) defines mind tools as computer application program that engage learners in constructive, higher-order critical thinking about the subjects they are studying. He further indicated that several computer applications, such as database systems,

spreadsheets, expert systems, semantic nets, video conferencing systems, multimedia and hypermedia authoring tools, programming tools and simulation programs, are potential mind tools if they can be used in proper ways.

Therefore, smart learning environments must be created to suit every age, level of exposure to technology, learning disability levels, understanding level or personal status of the learners. Individual differences nowadays are caused not only by learners' background, competence, gender, personality, cognitive and metacognitive ability and learning progress, but also by the possibility of being able to access different learning resources easily (Kinshuk 2014). Using technologies make both the learning and teaching approach fit to the needs of the learners, and making it possible for the instructor to monitor an individual learner's learning process at a much effective pace. With the smart technologies for learning, the individual learners can be given the opportunity to choose and shape their own learning portfolios and fill such portfolios with actual evidence of learning.

Learners have the opportunity to acquire mastery of different topics with ease, without having to rely on the learning instructor or information professional in a physical environment. This makes learners much more diverse than ever in how they go about achieving their learning objectives. Providing an instructional design that can accommodate the needs of all the learners is a very challenging task. The availability of alternative learning resources is continuing to grow in all subject areas and is forcing traditional schools to reconsider how they support the learning process.

3. CHALLENGES ASSOCIATED WITH CREATING SMART LEARNING ENVIRONMENTS IN NIGERIA

Learning is an avenue in which the lives of individuals are improved through knowledge acquired. One form in which learning takes place generally is education. The technological situation in Nigeria is in a declining state. This has clearly affected the rate of performance in terms of efficiency and effectiveness of the information, education and ICT sector of the country.

1. Funding. Education is an area that touches and cuts across all spheres. Learning never stops and as such funding is needed to put in the needed developments in the area. Governments have been depended on to intervene to fund, direct or regulate the provision of services. There is no guarantee in Nigeria currently to provide equal access to learning, research and education and this is further seen in the unavailability of funds to boost the educational and technological sector of the economy. Funding pose as a big challenge because the cost of maintenance of the technical

infrastructures are on the high side. In Nigeria, the cost of maintenance extends into the cost of power supply as there is low or no power supply in most places in Nigeria. The cost of subscription to the internet services of Telecommunications Company in Nigeria is also high.

2. Diversity of Individual Differences: Due to the diversity in individual learners' differences, learning instructors and information scientists face difficulty in designing curriculum or course that can cater for every single learner in the learning environment. Some uniqueness to consider according to Yang et. al (2013) include learning status and personal factors, such as learning progress, knowledge levels, learning styles, cognitive styles and preferences. Individuals' exposures to technology or ICT based knowledge is also a factor to consider (Falana, 2015). In Nigeria, the underprivileged are not exposed to computer skills, while some have very little or no idea about it. This poses a serious challenge to the creation of smart learning environments in Nigeria.

3. Lack of Expertise: Although the idea of technological changes in Nigeria is not new, the experts to handle these new digital changes are few. The learning instructors, librarians, information professionals or teachers are not well equipped in the knowledge and skills of Information Communication Technology (ICT). This challenge is also due to the lack of early exposure to trending digital knowledge.

4. Inadequate infrastructures and resources: The establishment of smart learning environment require strategies of several factors, like the technical infrastructure, information and communication technologies available to the service to be provided and the access of the end users to the service and ease of use as well as the availability of other factors such as the rapid spread of smart devices and the high quality of mobile networks and the increasing demand for smart applications' high efficiency (Kinshuk, et. al. 2016). In Nigeria, these technical infrastructures are lacking. The techniques mostly adopted by most of the Nigerian learning institution are in form of prepared lectures on a CDROM that can be played as at when the need arises. This is limited by the fact that the number of computer system is inadequate to go round the learners (Olugbeko & Izu, 2013), making it difficult for the learning process to be interactive as compared to when the lecture is been received in real time over the internet. Intranet facilities are hardly maintained by most learning institutions in Nigeria due to high cost and poor power supply. Learners usually use public internet cafes where some of these facilities exists but they can hardly concentrate and learn at

their own pace. There is also the problem of low bandwidth in most learning environments with internet services thus, the systems operate at a very slow pace thereby obstructing free and smooth flow of smart learning.

Librarians and other information workers interest is to provide the best possible access for library users to information and ideas in any media or format. They promote the principles of open access, open source, and open licenses (IFLA, 2018). For effective creation of smart learning environments with the learning uniqueness of every information user put into perspective by LIS Professionals, the following strategic roles should be followed:

1. First and foremost, Library and Information Professionals need to develop themselves by acquiring necessary digital and technological skills in order to stay relevant in this digital information society. Times are changing and LIS professionals should take it upon themselves to also change and grow with it. It is expected that before they begin to making an impact in the smart learning environment, they must be computer and web literate. In the digital world, it is pertinent for the librarian to have knowledge management skills. A lot of virtual libraries exists and the librarian that would be deemed fit to work there is one with knowledge and competencies in digital library architecture and software, technical and quality standards, HTML coding, general computer skills and computer literacy, database development and management, Web mark-up languages such as SGML and XML, and Web development and design.

2. Secondly, diversification of sources of funds needed is very essential. The Library and information Professionals can reach out to Non-Governmental Organisations and other agencies to work with them. This relates to funding. Due to the lackadaisical situation and poor management of things in Nigeria, funding poses as a serious problem to bring about the level of technological operations needed to create the smart learning environment. The LIS professionals should work in partnership with not just the government but other agencies, NGOs, information centres, private individuals, curators, schools, parents, and the society at large. When the vision of the information professionals is shared, the society would respond positively. Government policies should encourage provision of ICT facilities and infrastructures in the rural areas, schools in the rural areas should be equally equipped with ICT facilities in order to promote smart learning. There should be deliberate efforts on the part of the government to make computer and other ICT facilities cheaper and

affordable to the people. Teachers and learners should be supported to develop their capacity in information technology through scholarship and other sponsorship projects.

3. Thirdly, Library and Information Professionals should incorporate advanced data manipulation techniques like making use of big data and learning analytics. This is to enable them put the learning uniqueness of each information seeker into perspective by collecting, combining and analyzing individual learning profiles in order to scientifically generalize and infer each individual learning need in real time in ubiquitous settings that encompass both physical and online activities. Learning analytics help monitor individual learners' progress and behaviour continuously in order to explore factors that may influence learning efficiency and effectiveness.

4. Fourthly, Information professionals should make use of the right resources and put into perspective the individuals' real-time location. Smart learning environment should be created help students comprehend and organize knowledge, solve problems and make inferences based on what they have learned. The right tools, resources and instructor or medium of learning should be created for them with different learning tasks or solve different types of problems at the right time and in the right context. To suit the learning experience to the individual, information professionals can adopt an approach known as Learners' learning autonomy. To respond to the diversity of individual needs, they can adopt various features of smart learning environments that support adaptive and personalized learning through innovations in technologies.

5. Public re-orientation should also be taken seriously, to this end, the information professionals should be empowered to create special smart libraries to suit specific information needs of learners. The use of web-based systems to provide personalized learning support or guidance to students based on their personal characteristics or learning performance should be encouraged. For instance, specialized adaptive learning system can be used to create learning content to adapt to individual learners' knowledge levels. Research experiments can be carried out to test their efficiencies. Library and Information Professionals can also create courses online and use platforms that allows learners learn at their pace and time.

CONCLUSION

Learning anytime and anywhere is not a new concept. However, in Nigeria, there are few support systems to help achieve this concept. The lack of preparation or support was further exposed when the COVID-19 pandemic it the globe. Nigeria was not exempted from

the adverse effects but while advanced nation sprung up to take actions to make sure learning was not affected, Nigeria's situation begged to answer a lot of questions relating to the level of preparedness and support systems to put in place.

The pandemic affected the education, information and computer fields of the country and as a result, alternatives had to be provided for learning to continue. This introduced the concept of smart learning. For smart learning to take place, a lot of factors have to be put in place and considered accurately.

From the discussion, using the need for a smart learning environment for analysis, it is clear that the role of information professionals in creating a smart learning environment that is suited to every individual learner's uniqueness that will improve the technological situation in Nigeria is indispensable. This is why library and information professionals add more to their skills and emphasis is always laid on the benefits of digital sills. They would also be relevant in the Nigeria technological field. The librarians and the information scientist have roles away from the traditional means of providing learning and education to provide a learning environment that considers all or most uniqueness of individuals. The role of information professionals in establishing a smart learning environment that suits individual information needs is very crucial. They should be involved more in the technological affairs of Nigeria.

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