Rethinking Secondary Education Classroom Design to Meet E-Learning Needs in Imo State, Nigeria

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Abstract
The study focused on rethinking secondary education classroom design to meet e-learning needs in Imo State, Nigeria. Three research questions and three hypotheses guided the study. The study adopted the descriptive research design. The population of the study comprised 488 computer teachers in the 597 secondary schools in Imo State, Nigeria. Using stratified random sampling technique, a sample size of 219 was drawn representing 44.8% of the population based on the 3 Education Zones. An instrument titled "Rethinking Secondary Education Classroom Design to meet E-learning Needs Questionnaire (RSECDENQ)" structured by the researcher which was validated and with reliability index of 0.85 determined with Cronbach Alpha was used for data generation. Mean and standard deviation were used in answering research questions while z-test statistics was used to test the hypotheses at 0.05 alpha level. The study revealed among others that there are e-learning needs that necessitate the rethink of classroom design in secondary schools in Imo State. It was recommended among others that on the basis of the needs, educators, planners, designers and architects should rethink how to construct, create and organize classroom spaces to ensure e-learning in secondary schools.

Keywords: Rethinking, Secondary Education, Classroom Design, E-learning Needs.

Introduction

Technology has become such an integral part of the society. The influence of a highly technological age has impacted people's lives, social patterns and career options. This has also contributed to shape the teaching-learning process and operating cultures of schools. The education system continues to see a marked increase in the incorporation of technology in learning opportunities in schools. Learning through or with the aid of digital technologies is a phenomenon that has many terms to describe it and few consistent understandings of what these terms

mean. For example, common terms to describe some or all aspects of learning through technology include distance education, distributed learning, open learning, online education, virtual classrooms and blended learning. The umbrella term that houses the above descriptions is electronic learning.

Electronic learning (hereafter e-learning) is relatively new and advanced form of educating students through the use of technology as an instructional medium. The term evolved as a result of the recent changes taking place in pedagogy, whereby actual learning has been transposed into virtual learning thanks to developments in information and communication technology. Ravenscroft (2001) conceptualized e-learning in terms of learning processes and interactions that are stimulated, supported and favoured by innovative educational technologies. For Mangal and Mangal (2012), e-learning is the type of learning carried out, facilitated or supported by some or other electronic gadgets, media or resources. From the above views, e-learning is not a learning goal per se but rather a structure or context for technology-supported learning through which content, communication, critical thinking, creativity, problem solving, and production can all take place. E-learning contexts range from those carried out in the classrooms to those completely online and at a distance from the teacher. E-learning in the classrooms is the focus of the study. For e-learning to be ensured in a classroom, smart classroom is imperative.

Smart classroom is a classroom of modern age. Smart Classroom is a classroom designed to enhance instructions and learning through the use of technology. Edusys (n.d.) stated that a smart classroom is edtech-upgraded classroom that cultivate education by opening doors to digital teaching and learning methods for both the teachers and the students by coordinating latest advancements in technology with academics. Smart Classrooms are technology enhanced classrooms that foster opportunities for teaching and learning by integrating learning technology, such as computers, specialized software, audience response technology, assistive listening devices, networking, and audio/visual capabilities (Bansal & Singh, 2017). Such classrooms invoke interest in education and introduce students to real-time e-learning with help of technology. The classroom is multidisciplinary, dynamic, and expansive enough to fill the geographies and mobilities of learners today. The classroom is a place that is full of a variety of activities with both students and teachers interacting, as teaching and learning are not static behaviours but are responses to a variety of social and material stimuli. Could this be a reflective of the classrooms in secondary schools in Imo State, Nigeria?

The existing classrooms in the nation's secondary schools and in particular Imo State is the 700-to-900 square foot classrooms superbly designed for a teacher to stand in front of a class of 50 students set in neat rows, listening, taking notes and doing worksheets. Giving credence to this, Wallis and Sonja (2006) surmised that the classrooms are designed for students to sit in rows of desks and chairs facing a presentation wall where teachers lecture and students take notes by hand. The classroom is said to have solid concrete walls, immobile, and stable.The design of the classrooms is not tied to technological-driven, collaborative, student-centered

approach to education. Leander, Phillips, Taylor, Nespor and Lewis (2010) drew a parallel analysis of the classroom as "the epitome of immobility" bounded and contained by conventions. This implies that the existing classrooms are obsolete for e-learning which require learning environments that support collaboration and technology-enabled work. The use of technology for e-learning makes it imperative to rethink the design of secondary education classrooms.

Rethinking secondary education classroom design has to do with both the way in which the classrooms are set up and the practices that derive from that configuration. The focus will shift from old factory model of classrooms to virtual environments that encapsulate - physical and online, technological and human resources - that support the 21st century learning all children deserve and these may appear in a variety of physical and non-physical spaces. The rethinking is therefore not just the buildings in which learning is housed but every element that makes up the learning environment – internal spaces, furniture, technology, lighting, storage systems, communication (even down to whatever it is that makes schools smell like they do) and ensure that we continue to provide innovative solutions designed to improve the experience of learning (Heppell, Chapman, Millwood, Constable, & Furness, 2004). The rethinking could involve reconstructing the existing classrooms and/or creating new types of classrooms in line with technology, which implies classrooms' transformation towards learner engagement, formative assessments and active methodologies. Rethinking secondary education classroom design is inevitable to meet e-learning needs.

E-learning needs are discussed here in terms of various tools, media, components, features and other exigencies that can be conducive to e-learning. These needs are paramount to ensure e-learning in educational institutions. The study of Azimi (2014) on needs assessment of learning e-learning and how certain demographic variables (male and female, type of institution and teaching-learning subject) affect e-learning needs assessment among students in colleges of education or secondary level (B.Ed.) affiliated with the University of Mysore found the e-learning needs to include: internet tools, multimedia components, connections and service provider, computer and storage devices, and instructional design. Khan (2005) identified seven categories of e-learning components or tools that can be used in e-learning programs to provide various features conducive to learning namely: instructional design (ID), multimedia component, internet tools, computers and storage devices, connections and service providers, authoring/management programs, enterprise resource planning (erp) software, and standards, server and related applications. Khan (2005) emphasized that these components or tools must be meaningfully integrated into an e-learning program to achieve its learning goals.

The existing classrooms in Imo State, Nigeria are said to have a number of practical design elements that may hinder technology use. Heppell, et al. (2004) identified some of the design issues to include: area or width of room too small to allow a variety of layouts and activities, awkward shapes reducing flexibility,

inappropriate or fixed furniture and equipment, poor ventilation and lighting, bad acoustics, inappropriate servicing, insufficient or badly located support spaces for small groups or staff , rigid or inflexible structures that reduce the chance to adapt space, design which does not allow for expanding or varying departments and year groups, and the location and relationship of facilities. According to Educational Origami (n.d), these classrooms are: teacher-centric, designed for single to many communication styles, lack flexibility, are poorly designed for collaboration and communication, have limited support for technology, rigid in design often unable to be adapted for any other purpose, individual focused rather than group focused. Heppell, et al. (2004) averred that the design issues can be barriers to innovation and good practice in the classrooms and these will continue to be a hindrance to innovation in the future unless designs conform to some simple minimum standards.

Growing attention about the design of classroom spaces has sought to connect spatial characteristics and technologies to particular pedagogies and learning experiences (Dovey & Fisher, 2014). This is a shift away from old factory model of classrooms towards more adaptable, flexible and technology-focused 'Modern classrooms'. Maheshwari (2016) identified the following principles to be embedded in modern classrooms: the principle of adaptability, the principle of connectivity, the principle of comfort, the principle of flexibility of physical arrangement, the principle of multiplicity, the principle of order/organization, the principle of openness, the principle of personalization and the principle of safety/security. According to Nair and Fielding (2009), the classrooms need to offer flexibility, adaptability and variety and to ensure this, the schools should have items such as: movable furnishing systems on casters, transparent glass roll-up doors, flexible wall partitioning systems to create larger learning suites when desired, adjustable and moveable furniture that can easily be reconfigured for different class sizes. Khan (2004) stated that a systematic understanding of these factors can help designers create meaningful learning environments.

Statement of the Problem

Classroom design is changing to accommodate the shift in pedagogy and the ways schools are educating the next generation of students via digital technologies. In this context, Smart classroom gains force as a means to meet e-learning needs as it enables technology-driven, personalized and adaptive learning environments. However, the researcher observed that trends in classroom design in Nigeria have not kept pace with changes in teaching and learning, with many classroom settings remaining the old factory model which appear to hinder the 21st century learning all children deserve. When classroom design is not revamped from time to time on need based, then students would not be equipped with the right skills and expertise to succeed in ever changing globally competitive world. There is therefore a need for rethinking the educational system and in particular the design of classroom in Imo State, Nigeria to meet the needs of e-learning in secondary schools.

Aim and Objectives of the Study

The study aimed at rethinking secondary education classroom design to meet e-learning needs in Imo State, Nigeria. The specific objectives were to:

1. identify the e-learning needs that necessitate the rethink of classroom design in secondary schools in Imo State, Nigeria?
2. find out the design issues of existing classrooms that are barriers to meet the e-learning needs in secondary schools in Imo State, Nigeria?
3. determine the design features that are to be incorporated in the design of classrooms to meet the e-learning needs in secondary schools in Imo State, Nigeria?

Research Questions

The following research questions guided the study:

1. What are the e-learning needs that necessitate the rethink of classroom design in secondary schools in Imo State, Nigeria?
2. What are the design issues of existing classrooms that are barriers to meet the e-learning needs in secondary schools in Imo State, Nigeria?
3. What design features are to be incorporated in the design of classrooms to meet the e-learning needs in secondary schools in Imo State, Nigeria?

Hypotheses

The following hypotheses were tested at 0.05 alpha level

1. There is no significant difference between the mean values of male and female computer teachers on the e-learning needs that necessitate the rethink of classroom design in secondary schools in Imo State, Nigeria.
2. There is no significant difference between the mean scores of male and female computer teachers on the design issues of existing classrooms that are barriers to meet the e-learning needs in secondary schools in Imo State, Nigeria.
3. There is no significant difference between the mean ratings of male and female computer teachers on thedesign features that are to be incorporated in the design of classrooms to meet the e-learning needs in secondary schools in Imo State, Nigeria.

Methodology

The study adopted the descriptive research design. The population of the study comprised 488 computer teachers in the 597 secondary schools in Imo State, Nigeria. Using stratified random sampling technique, a sample size of 219 was drawn representing 44.8% of the population based on the 3 Education Zones. An instrument titled "Rethinking Secondary Education Classroom Design to meet E-learning Needs Questionnaire (RSECDENQ)" structured by the researcher and validated by experts in Educational Management with reliability co-efficient of 0.85 determined

with Cronbach Alpha was used for data generation. Mean and standard deviation were used in answering research questions while z-test statistics was used to test the hypotheses at 0.05 alpha level. An item with a calculated mean value equal or greater than 2.50 was accepted while an item with the calculated mean value less than or equal to 2.49 was rejected.

Results

Research Question One: What are the e-learning needs that necessitate the rethink of classroom design in secondary schools in Imo State, Nigeria?

Table 1: The Mean Values and Standard Deviations on the E-learning Needs that necessitate the Rethink of Classroom Design in Secondary Schools in Imo State, Nigeria.

S/N	Items: E-learning Needs Variables	$\bar{X}$	SD	Decision
1	Ubiquitous connectivity	3.10	0.56	Agreed
2	Powerful learning devices	3.03	0.64	Agreed
3	High-quality digital learning content and resources.	3.16	0.51	Agreed
4	Network access	3.12	0.53	Agreed
5	Multidimensional space	3.01	0.68	Agreed
6	Internet tools.	3.15	0.43	Agreed
7	Computer and storage devices	3.17	0.40	Agreed

Table 1 reveals that all the items have mean values above the criterion mean of 2.50. The data showed that all the items are the e-learning needs that necessitate the rethink of classroom design in secondary schools in Imo State, Nigeria.

Research Question Two: What are the design issues of existing classrooms that are barriers to meet the e-learning needs in secondary schools in Imo State, Nigeria?

Table 2: The Mean Scores and Standard Deviations on the Design Issues of Existing Classrooms that are Barriers to meet the E-learning Needs in Secondary Schools in Imo State, Nigeria.

S/N	Items: Design Issues Variables	$\bar{X}$	SD	Decision
8	Area or width of room too small to allow a variety of layouts and activities.	3.06	0.57	Agreed
9	Awkward shapes reducing flexibility.	3.00	0.59	Agreed
10	Rigid or inflexible structures that reduce the chance to adapt space.	2.87	0.71	Agreed
11	Inappropriate or fixed furniture and equipment.	3.14	0.45	Agreed
12	Poor ventilation and lighting.	2.49	0.98	Disagreed
13	Inefficient energy system	2.91	0.64	Agreed
14	Bad acoustics.	2.86	0.79	Agreed

Table 2 shows that all the items except item 12 with the mean score of 2.49 have mean scores above the criterion mean of 2.50. The data indicated that items 8, 9, 10, 11, 13 and 14 are the design issues of existing classrooms that are barriers to meet the e-learning needs in secondary schools in Imo State, Nigeria.

Research Question Three: What design features are to be incorporated in the design of classrooms to meet the e-learning needs in secondary schools in Imo State, Nigeria?

Table 3: The Mean Ratings and Standard Deviations on the Design Features that are to be incorporated in the Design of Classrooms to meet the E-learning Needs in Secondary Schools in Imo State, Nigeria.

S/N	Items: Design Features Variables	$\bar{X}$	SD	Decision
15	Flexibility within the space for multiple activities.	3.10	0.47	Agreed
16	Movable furnishings for both individual and group activities.	3.09	0.49	Agreed
17	Versatile layout for both personalized and collaborative activities.	3.08	0.59	Agreed
18	Large windows to the exterior for generous natural daylight and Ventilation.	2.89	0.87	Agreed
19	Furniture that is ergonomically friendly.	2.99	0.65	Agreed
20	Efficient energy systems.	3.05	0.52	Agreed
21	Acoustic panels and carpet that diminish noise levels.	3.01	0.58	Agreed

Table 3 indicates that all the items have mean ratings above the criterion mean of 2.50. The data revealed that all the items are the design features to be incorporated in the design of classrooms to meet the e-learning needs in secondary schools in Imo State, Nigeria.

Hypothesis One: There is no significant difference between the mean values of male and female computer teachers on the e-learning needs that necessitate the rethink of classroom design in secondary schools in Imo State, Nigeria.

Table 4: z-test Analysis of Difference between the Mean Values of Male and Female Computer Teachers on the E-learning Needs that necessitate the Rethink of Classroom Design in Secondary Schools in Imo State, Nigeria.

Respondents	N	$\bar{X}$	SD	df	Z-cal	Z-crit	Decision
Male Teachers	117	3.13	0.50	217	0.50	1.96	Accepted
Female Teachers	102	3.08	0.57				

Table 4 indicates that at 217 degrees of freedom and 0.05 alpha level, the calculated z-value of 0.50 is less than the critical z-value of 1.96. Since the calculated z-value of 0.50 is less than the critical z-value of 1.96, the study failed to reject the null hypothesis. On this regard, there is no significant difference betweenthe mean values of male and female computer teachers on the e-learning needs that necessitate the rethink of classroom design in secondary schools.

Hypothesis Two: There is no significant difference between the mean scores of male and female computer teachers on the design issues of existing classrooms that are barriers to meet the e-learning needs in secondary schools in Imo State, Nigeria.

Table 5: z-test Analysis of Difference between the Mean Scores of Male and Female Computer Teachers on the Design Issues of Existing Classrooms that are Barriers to meet the E-learning Needs in Secondary Schools in Imo State, Nigeria.

Respondents	N	$\bar{X}$	SD	df	Z-cal	Z-crit	Decision
Male Teachers	117	2.96	0.64	217	0.99	1.96	Accepted
Female Teachers	102	2.85	0.71				

Table 5 shows that at 217 degrees of freedom and 0.05 alpha level, the calculated z-value of 0.99 is less than the critical z-value of 1.96. Since the calculated z-value of 0.99 is less than the critical z-value of 1.96, the study retained the null hypothesis. Based on the above, there is no significant difference between the mean scores of male and female computer teachers on the design issues of existing classrooms that are barriers to meet the e-learning needs in secondary schools.

Hypothesis Three: There is no significant difference between the mean ratings of male and female computer teachers on the design features that are to be incorporated in the design of classrooms to meet the e-learning needs in secondary schools in Imo State, Nigeria.

Table 6: z-test Analysis of Difference between the Mean Ratings of Male and Female Computer Teachers on the Design Features that are to be incorporated in the Design of Classrooms to meet the E-learning Needs in Secondary Schools in Imo State, Nigeria.

Respondents	N	$\bar{X}$	SD	df	Z-cal	Z-crit	Decision
Male Teachers	117	3.07	0.57	217	0.76	1.96	Accepted
Female Teachers	102	2.99	0.62				

Table 6 reveals that at 217 degrees of freedom and 0.05 alpha level, the calculated z-value of 0.76 is less than the critical z-value of 1.96. Since the calculated z-value of 0.76 is less than the critical z-value of 1.96, the study upheld the null

hypothesis. Therefore there is no significant difference between the mean ratings of male and female computer teachers on the design features that are to be incorporated in the design of classrooms to meet the e-learning needs in secondary schools.

Discussion of Findings

The study revealed the e-learning needs that necessitate the rethink of classroom design in secondary schools to include: ubiquitous connectivity, powerful learning devices, high-quality digital learning content and resources, network access**,** multidimensional space**,** internet tools and, computer and storage devices. The findings are in line with Azimi (2014) who found the e-learning needs to include: internet tools, multimedia components, connections and service provider, computer and storage devices, and instructional design. The findings are also in consonance with e-learning components or tools that were identified by Khan (2005). Khan (2005) emphasized that these components or tools must be meaningfully integrated into an e-learning program to achieve its learning goals.

The study also indicated the following design issues in existing classroom: area or width of room too small to allow a variety of layouts and activities, awkward shapes reducing flexibility, rigid or inflexible structures that reduce the chance to adapt space, inappropriate or fixed furniture and equipment, inefficient energy system and bad acoustics as barriers to meet the e-learning needs in secondary schools. The findings are consistent with those identified by Heppell, et al. (2004). The findings lay credence to the assertion of Educational Origami (n.d) that these classrooms are: teacher-centric, designed for single to many communication style, lack flexibility, are poorly designed for collaboration and communication, have limited support for technology, rigid in design often unable to be adapted for any other purpose, individual focused rather than group focused. Heppell, et al. (2004) averred that the design issues can be barriers to innovation and good practice in the classroom and these will continue to be a hindrance in the future unless designs conform to some simple minimum standards.

The study further showed that the design features that are to be incorporated in the design of classrooms to meet the e-learning needs in secondary schools include: flexibility within the space for multiple activities, movable furnishings for both individual and group activities, versatile layout for both personalized and collaborative activities, large windows to the exterior for generous natural daylight and ventilation, furniture that is ergonomically friendly, efficient energy systems and, acoustic panels and carpet that diminish noise levels. The findings are in line with the principles identified by Maheshwari (2016). The findings concur with the remarks of Nair and Fielding (2009) that the classroom needs to offer flexibility, adaptability and variety, and to achieve this, the schools should offer items such as: movable furnishing systems on casters, transparent glass roll-up doors leading to a central commons for breakout learning, flexible wall partitioning systems to create larger learning suites when desired, adjustable height work surfaces and even extending learning to covered outdoor learning terraces directly connected to

learning studios. Khan (2004) stated that a systematic understanding of these factors can help designers create meaningful learning environments.

Conclusion

On the basis of the findings, the study concluded that ubiquitous connectivity, powerful learning devices, high-quality digital learning content and resources, network access**,** multidimensional space**,** internet tools**,** computer and storage devices are needs that necessitate the rethink of classroom design in secondary schools. Existing classroom design issues such as area or width of room too small to allow a variety of layouts and activities, awkward shapes reducing flexibility, rigid or inflexible structures that reduce the chance to adapt space, inappropriate or fixed furniture and equipment, inefficient energy system and bad acoustics are barriers to meet the e-learning needs. Flexibility within the space for multiple activities, movable furnishings for both individual and group activities, versatile layout for both personalized and collaborative activities, large windows to the exterior for generous natural daylight and ventilation, furniture that is ergonomically friendly, efficient energy systems and, acoustic panels and carpet that diminish noise levels are the design features that are to be incorporated in classroom design to meet the e-learning needs.

Recommendations

Based on the findings, the following recommendations were made:

- On the basis of the needs, educators, planners, designers and architects should rethink how to construct, create and organize classroom spaces to ensure e-learning in secondary schools.
- State education institutions and Secondary Education Board concurrently should draft plans for the upgrade of infrastructure necessary to meet the needs of increased user demand as well as for the use of evolving technologies
- Government and the relevant agencies should develop policies for classroom design that embody the flexibility and power of technology that make e-learning possible and ensure their strict implementation.

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