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PROPRIETORS' INFLUENCE ON FUNDING AND CONTENT INCLUSION FOR IMPLEMENTING COMPUTER AIDED DESIGN CURRICULUM IN ARCHITECTURE SCHOOLS IN NIGERIA

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Abstract

Proprietors of Universities in Nigeria where the architecture program is offered can be categorised into three groups viz Federal, State and Private. The evolution of architectural education has necessitated curriculum changes to include emergent vital areas such as Computer Aided Design (CAD). Implementing these changes involves deploying additional resources to include new content, employ/retrain staff, build new infrastructure and acquire new equipment. This study sought to evaluate the impact that proprietorship had on inclusion of content and provision of funds for implementing CAD curriculum in universities with a view to developing strategies for encouraging successful implementation by the institutions. Survey research design focused on departments of architecture in National Universities Commission accredited universities in south-east Nigeria was employed. Data were obtained in the areas of content and ICT budgets for CAD implementation. A multi-stage, stratified, random sampling method was adopted. The first stage involved categorization of accredited departments. Sampling size formulae was applied to obtain respondents' number in the second stage. Analysis of variance tool for testing differences of means was used for data analysis. With $\rho<0.5$, the study found significant differences between private-funded, state-funded and federal-funded departments of architecture in the provision of content and ICT budget. The implications of these findings were that for effective implementation leading to achievement of CAD proficiency to occur in every institution regardless of proprietorship, guidelines for minimum acceptable attainment levels need to be set. A regular comparison of implementation levels in institutions was recommended as a means of rating performance and encouraging improvement.

***Keywords**: architecture, computer-aided design, curriculum, funding,*

INTRODUCTION

Over the years, buoyed by changes in the nation's laws, the Federal Government of Nigeria has approved private proprietorship of universities in the country. The first three private universities in Nigeria were established by the National Universities Commission (NUC) in 1999 and the number has grown to seventy-four by 2017 (NUC, 2018). Aside from Private ownership, other categories of ownership in the country are Federal ownership and State ownership (NUC, 2018). These two categories combined grew from thirty-six in 1999 to eighty-six in 2017, bringing the total number of national universities commission approved

universities to one hundred and sixty (NUC, 2018). This increase has, perhaps, been driven by the need to provide greater access to higher education for a growing population of young citizens seeking the opportunity for a better livelihood a university certificate suggests. Concurrent with this is the resolve of implementing the nation's educational goals as stated in the National Policy on Education (Nigerian Educational Research and Development Council, 2013). However, various commentators agree that several factors, notably poor funding and lack of capacity have hindered the smooth performance of these institutions, hence their ability to individually and effectively achieve the desired goals (Asiyai, 2013; Aluede, Idogho, & Imonikhe, 2012). This can be seen in the preference of new universities to begin with courses requiring least investment in staffing and equipment. Those who offer the architecture program, however, are particularly saddled with the responsibility of meeting a higher than average cost per head for training because of the infrastructure/equipment requirements of the course.

In addition, a common view is that evolution of society has brought significant challenges that have redefined the architect's role in it, thus making it imperative to redraw the basis of training so as to ensure better equipping for the new realities (Oluigbo, 2005). As a result, Computer Aided Design (CAD) has become an important skill, whose training must be incorporated in the curriculum of architectural education. Following this, the NUC in its Basic Minimum Academic Standards (BMAS) guidelines specifies CAD proficiency as an important goal (National Universities Commission, 2007). This was made even more urgent because architects employing graduates require them to be proficient in CAD (Dare-Abel, Igwe, & Ayo, 2014) since clients/design-approving bodies demand that architectural work be submitted in CAD produced formats. Notwithstanding this, stakeholders in the profession still averred that curriculum change was slow in coming (Olotuah & Adesiji, 2005; Olaniyi & Olusola, 2011) and that, though increased inclusion of content was documented in literature, the extent and rate were still not agreed (Ogunsote, 2001).

The NUC carries out accreditation visits to evaluate the implementation of the guidelines it has set out for universities. During this exercise, it conducts programme evaluation under the categories outlined in Table 1. As noted, CAD content is a required part of architecture curriculum in the BMAS for Environmental Sciences, the working document and basis for assessment. Evaluation of implementation of CAD content is nonetheless, not conducted separately. The importance of CAD skills as a vital tool/language for communicating within the industry however, makes it necessary to examine the implementation process within the universities.

Table 1: Components of Accreditation

S/N	Components
i.	Academic Matters
ii.	Staffing
iii.	Physical Facilities
iv.	Financing of programme by the university
v.	Books, journals and other resource materials for the programme

vi.	Employer's rating of graduates, if any

Source: (Okojie, 2008)

This is brought more into focus by the documented lack of needed skills for industry exhibited by graduates of universities (Pitan & Adedeji, 2012). It creates a problem which evaluation of performance of universities by categories will aid stakeholders in resolving. The major objective of the study was therefore to examine the difference between Private-funded, State-funded and Federal-funded schools of architecture in implementation of Computer Aided Design curriculum in Architecture Departments in Nigerian Universities with a view to developing strategies for encouraging successful implementation by the institutions. It specifically evaluated the impact that proprietorship had on inclusion of content (item [i.] in Table 1) and provision of funds (item [iv.] in Table 1) for implementing CAD curriculum. The research sought to question if there was indeed a difference between Federal-funded, State- funded and Private-funded schools of architecture in providing funding and content to implement CAD in their curriculum. As a focus for this research the following was proposed as hypothesis: 'There is no significant difference between Federal-funded, State- funded and Private- funded schools of Architecture in their departments' average annual ICT budgets/expenditure and extent of use of CAD in design in their curriculum'.

The study area, Southeast Nigeria, is one of six geopolitical regions in Nigeria (Gaadi, 2014). The others are North-East, North-Central, North-West, South-West and South-South. Nigeria is, however, constitutionally divided into 36 states and the Federal Capital Territory (CIA, 2015)(Figure 1). Southeast region is comprised of five states, namely Abia State, Anambra State, Ebonyi State, Enugu State and Imo State (Nwozor, 2014).

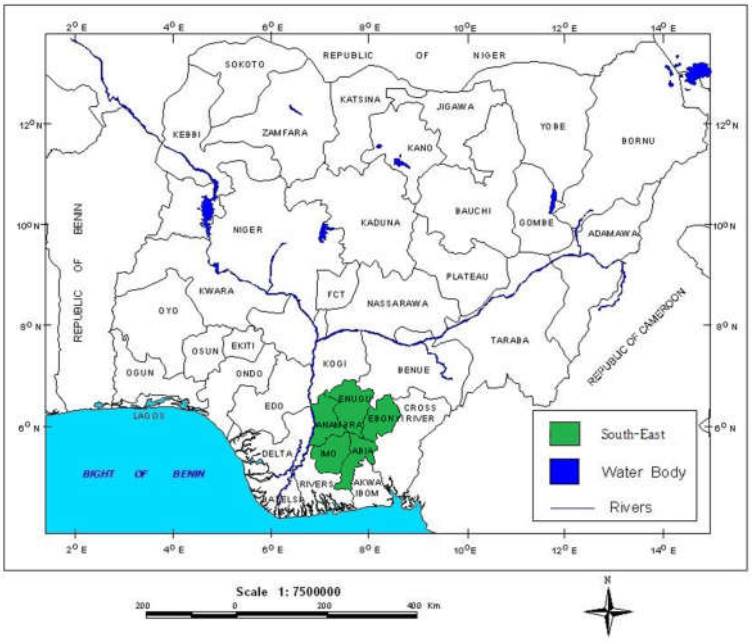

Figure 1: Nigeria, showing the Location of South-east States

Source: (COOU, 2015)

The scope of the study was delimited to departments of Architecture in universities in South-east Nigeria that had been accredited by the National Universities Commission. It was focused on the Computer Aided Design component of curriculum for these departments.

LITERATURE REVIEW

Theoretical Framework

To undergird the study, the Social Comparison Theory developed by Leon Festinger in 1954 was chosen. It states that an individual needs to solicit information from a group of people to confirm or re-assess his or her abilities. This action is also taken by individuals in order to realize the extent they can use these particular abilities and eventually validate other people's opinion (psychologynoteshq, 2018). Festinger put forth two hypotheses, namely; that persons could evaluate their abilities by comparing themselves with others who had extensive experience in the same abilities, based on how close they could get to the one who is considered best in the evaluated ability; and to the extent that objective and non-social means were not available, people evaluated their opinions and abilities by comparing respectively with opinions and abilities of others (psychologynoteshq, 2018). Depending on their motivation, they engaged in one of two types of comparison: (1) Upward Comparison (with people better than themselves) and (2) Downward Comparison (with others less than themselves). These were carried out to achieve the goals of Self-evaluation and self-enhancement.

Applying this to the study, the goals of evaluation and enhancement were adopted because they are embedded in the functions of the NUC. The means for accomplishing these is through socio-educational comparison of the similar abilities (funding and content provision) of the ownership groups (Federal, State and Private) and the motivation was to cause upward comparison and hence improvement in the quality of architectural education.

Review of Empirical Literature

Okebukola (2006) identified five main challenges facing Nigerian universities. These included funding, quality, access, relevance of programmes and university governance and management. It posited that these challenges were thwarting the potential of the Nigerian university system to contribute significantly to the social and economic development of the country through the advancement and application of knowledge. It noted underfunding as one of the chief factors inhibiting quality of programmes. Other commentators agreed that

funding was a limiting factor for progress and development in various aspects of the industry. Whereas Okebukola (2006) stated that the quantity of funds released to federal universities has increased significantly between 2001 and 2006, Afolayan (2015) showed that the funding pattern for federal institutions reduced yearly between 2010 and 2013, though student enrolment increased geometrically within the same period. This highlighted the germane need of increased funding in the sector. Asiyai (2013) also averred that inadequate funding was a most critical challenge which threatened the attainment of good quality higher education in Nigeria and that it was a bane to educational development in the country. Odeleye, Oyelami, and Abike (2012) recognised the need for private entrepreneurs to seek alternative sources of funding if they were to meet their obligations towards quality in the higher education they provided.

Ahmed (2015) showed that Nigerian universities had four sources of revenue namely

i. Funds from the proprietors. This accounted for 78 percent of the total revenue of universities. Broken down further by group, this was over 90 percent of revenue amongst State universities, 80 percent for Federal universities and 3.5 percent for Private universities.
ii. Revenues from fees and tuitions. This accounted for 18 percent of revenue in Federal and State universities and 64.8 percent in Private universities
iii. Investments and other forms of internally generated revenue (IGR). This constituted about 2 percent of the total revenues
iv. Donations, endowments, grants and other forms of gifts. This accounted for 1 percent of the total revenue. (Ahmed, 2015)

There was evidence, therefore that the disparities in funding were significant enough as to affect, in differing degrees, the ability of institutions in the different groups to meet the common goals for higher education.

The rapid growth in Information and Communication Technologies (ICT) had brought remarkable changes in the twenty-first century, as well as affected the demands of modern societies. As a result, ICT has become increasingly important in the educational system leading to a growing demand for educational institutions to use ICT to teach the skills and knowledge students need for the 21st century (Buabeng-Andoh, 2012). Also, several stakeholders in evaluating the results of CAD course introduction in various schools in Nigeria, gave various interpretations. Suleman (2006) observed that the time currently allotted within both the undergraduate and postgraduate programmes was less than what was required to implement the curriculum of 2-dimensional drafting, implying insufficient CAD content in curriculum; Olaniyi and Olusola (2011) noted that a majority of architectural educators are products of curricula devoid of computer education and are hence not computer literate, implying a lack of academic staff capacity to implement the curriculum; Uwakonye, Alagbe, Oluwatayo, Alagbe, and Alalade (2015) observed that when CAD was introduced at the 200 level, students did not possess sufficient knowledge of Architecture to handle CAD projects, implying that CAD could distract the students from the first objective of learning

architecture to being engrossed in acquiring CAD skills; Uwakonye, Alagbe, Oluwatayo, Alagbe, and Alalade (2015) also opined that students in 200 level of study would profit more if they were focused on learning Architecture through manual drafting and that students spent more time with CAD courses to the detriment of other courses. It observed as well that, in the school of study, the curriculum was overloaded to the effect that students could not accommodate any excess credit load occasioned by failed courses.

A comparison of CAD courses in the curriculum of selected architecture departments from universities in the South-east is shown in Table 2. This indicated a fair disparity amongst universities in what was included, the quantity and the levels where they were included.

Table 2: Comparison of CAD Content of Course Outlines of Selected NUC Accredited Departments of Architecture in South-east Nigeria

		Imo State University	**University of Nigeria**	**Chukwuemeka Odumegwu Ojukwu University**	**Nnamdi Azikiwe University**	**CARITAS University**	**Abia State University**
Level	**Sem**	**Course Title**	**Course Title**	**Course Title**	**Course Title**	**Course Title**	**Course Title**
100	**1st**	Nil	Nil	Nil	Nil	Nil	Nil
	2nd	Nil	ARC 172- Computer Application to Architecture I	ARC 114- Computer Application to Architecture I	Nil	Nil	Nil
200	**1st**	ARC 271- Introduction to Computers for Architecture	ARC 271- Computer Application to Architecture II	ARC 213 - Computer Application to Architecture II	Nil	Nil	Nil
	2nd	ARC 272- Computer Application for Architects	ARC 272- Computer Application to Architecture III	ARC 214 - Computer Application to Architecture III	Nil	Nil	ARC 208 - Computer Applications
300	**1st**	Nil	ARC 371- Computer Application to Architecture IV	Nil	Nil	Nil	Nil
	2nd	ARC 324- Computer Aided Design		Nil	Nil	Nil	Nil
400	**1st**	Nil	ARC 471- Computer Application to Architecture VI	Nil	Nil	Nil	Nil
	2nd	ARC 424- Computer Aided Design	ARC 472- Computer Application to Architecture V	Nil	Nil	Nil	Nil
500	**1st**	Nil	Nil	Nil	ARC 771- Computer Application in Design I	Nil	Nil

	2nd	Nil	Nil	Nil	ARC 772- Computer Application in Design II	Nil	Nil
600	**1st**	Nil	Nil	Nil	Nil	Nil	Nil
	2nd				ARC 872- Advanced CAD		

Source: Fieldwork, 2015, (ABSU, 2007; ANSU, 2012)

METHODOLOGY

The research design employed was survey method. Staff and students of the departments of architecture were questioned on the extent of use of CAD in design and their Department's average annual ICT Budget/Expenditure. A multi-stage stratified random sampling method was adopted. At the first stage, the accredited departments within the study area were categorized into Federal, State and Private owned groups following the categorization of universities used by the NUC (NUC, 2015). This is shown in Table 3.

Table 3: List of NUC Accredited Departments of Architecture in South-East Nigeria Categorized by Funding/Ownership Structure

S/N	FEDERAL	STATE	PRIVATE
1	Nnamdi Azikiwe University	Abia State University	Caritas University
2	University of Nigeria	Enugu State University of Science and Technology	
3		Chukwuemeka Odumegwu Ojukwu University	
4		Imo State University	

Source: NUC (2014)

At the second stage, through random balloting, a sample of universities were picked from their groups. A second sample was picked from the State-owned group, which was larger in size, to ensure better representation. Those picked were: FEDERAL: - (i.) University of Nigeria (UNN); STATE: - (i.) Chukwuemeka Odumegwu Ojukwu University (COOU), (ii.) Imo State University (IMSU); PRIVATE: - (i.) Caritas University (CARITAS).

At the third stage, sampling size formulae was applied to the obtained numbers of staff and students (in the sampled departments) to obtain respondents' number. Data was analysed using the Analysis of Variance (ANOVA) tool for testing differences.

PRESENTATION OF RESULTS

Area-wise analysis of extent of use of CAD in design

The results from the investigation of this variable show that at all the universities except CARITAS, the majority of respondents considered the extent of use 'average'. At COOU, this was 70.6%, at IMSU, 59.4% and at UNEC, 52.5%. At CARITAS however, the majority (51.7%) indicated 'low' usage. This is illustrated in Table 4 and Figure 4.

Table 4: Area-wise data on Extent of use of CAD in design

Value label	COOU		IMSU		CARITAS		UNEC	
	%	Cum %	%	Cum %	%	Cum %	%	Cum %
Low	17.6	17.6	18.8	18.8	51.7	51.7	18.2	18.2
Average	70.6	88.2	59.4	78.1	44.8	96.6	52.5	70.7
High	11.8	100.0	21.9	100.0	3.4	100.0	29.3	100.0
Total	100.0		100.0		100.0		100.0	

Source: (Fieldwork, 2015)

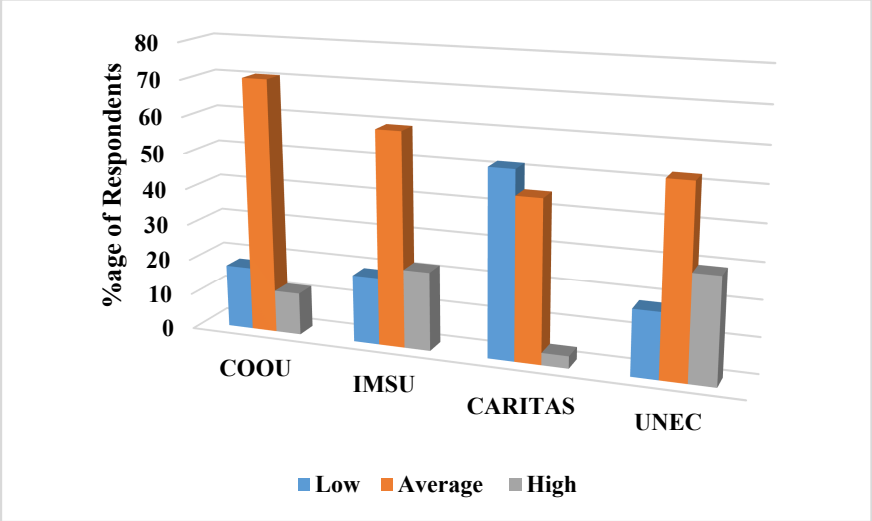

Figure 4: Appraisal of institutions on extent of use of CAD in design

Source: (Fieldwork, 2015)

Aggregated data analysis of extent of use of CAD in design

Following a simple 3-level scale, above half of respondents indicated 'average' when asked the extent of their use of CAD in design and assignments. The remaining responses were evenly split between 'low' use and 'high' use. This is illustrated by Table 5 and Figure 5.

Table 5: Aggregated data on extent of Use of CAD in design

VALUE LABEL	%	CUM %
Low	21.6	21.6
Average	58.2	79.8
High	20.2	100.0
Total	100.0	

Source: (Fieldwork, 2015)

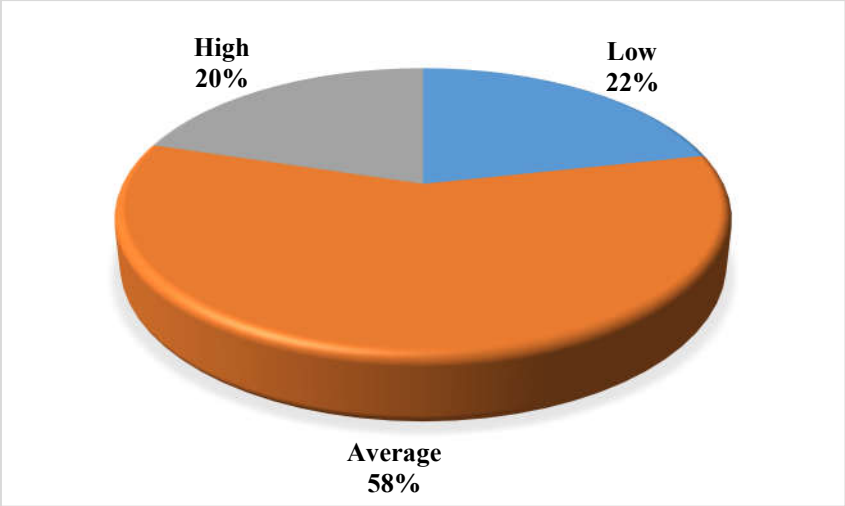

Figure 5: Analysis of Extent of Use of CAD in Design

Source: (Fieldwork, 2015)

Aggregated data analysis of department's average annual ICT budget/expenditure

The results here showed that over half of respondents were from institutions which spent between 0.5-0.75 million naira. A third indicated that their departments spent 0.75-1 million naira annually on ICT, while the remaining tenth indicated that their departments spent 0-0.5 million naira. No institution had an average annual ICT budget/expenditure of above 1 million naira. This is illustrated by Table 6 and Figure 6.

Table 6: Aggregated data on average annual ICT Budget/Expenditure of Department

VALUE LABEL	%	CUM %
0-0.5 million	10.2	10.2
0.5-0.75 million	56.7	66.9
0.75-1.0 million	33.1	100.0
Above 1.0 million	0.0	100.0
Total	100.0	

Source: (Fieldwork, 2015)

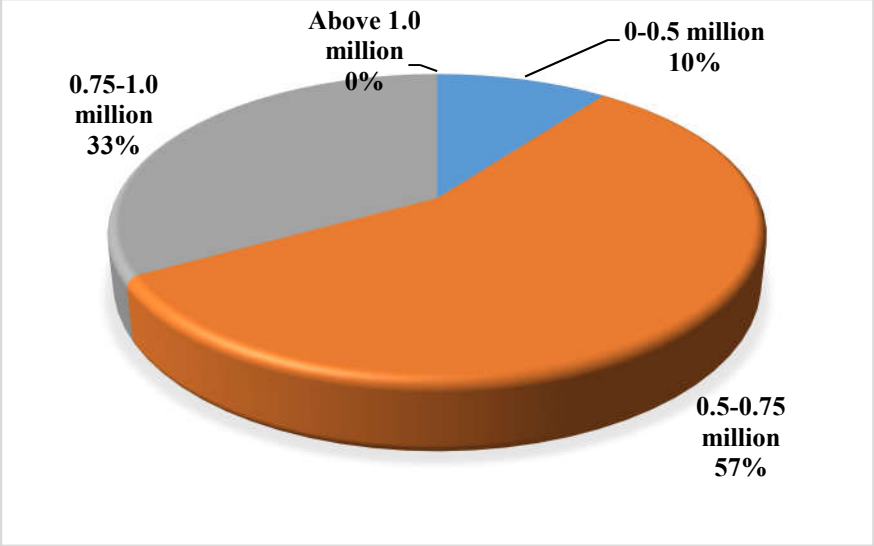

Figure 6: Analysis of average annual ICT Budget/Expenditure of department

Source: (Fieldwork, 2015)

The difference between federal-funded, state-funded and private-funded departments of architecture in departments' average annual ICT budgets/expenditure and extent of use of CAD in design

The following results were obtained after analysis.

i. Differences in extent of use of CAD in design in their curriculum (EUCD): The result of the one-way ANOVA test for this variable is shown in Table 7. It indicates a significance value of 0.000, implying that there is a significant difference between the funding groups in the extent of use of CAD in design. The part of the null hypothesis regarding this variable is therefore rejected. A Tukey HSD posthoc test was carried out to establish the level of significance contributed by each section of the group. This is shown in Table 8. It shows a significance value of 0.243 for difference between Federal and State, a significance value of 0.000 for difference between federal and private, and a significance value of 0.000 for difference between private and state. This implies that there is no significant difference between federal and state-funded institutions in the extent of use of CAD in design, but there is significant difference between federal-funded and private-funded as well as state-funded and private-funded.
ii. Differences in departments' average annual ICT budgets/expenditure (DAIB): Table 7 also shows the one-way ANOVA test results for this variable. The results show a significance value of 0.000. It implies that there is a highly significant difference between the three groups in the provision of funds for their departments' average

annual ICT budget/expenditure. The part of the null hypothesis relating to this variable is therefore rejected. The results of the Tukey HSD posthoc test carried out to establish the level of significance contributed by each section of the group is shown in Table 8. It indicates a significance value of 0.000 for difference between federal-funded and state-funded departments, a significance value of 0.000 for difference between federal-funded and private-funded departments, and a significance value of 0.000 for difference between private-funded and state-funded departments. The implication is that there is also significant difference between any pairs of the groups.

Having rejected the null hypothesis based on the test for both variables, the alternative is accepted. This states that 'there is significant difference between federal-funded, state-funded and private-funded departments of architecture in their departments' average annual ICT budgets/expenditure and extent of use of CAD in design in their curriculum.'

Table 7: One-way ANOVA analysis test results showing the difference between funding groups in EUCD and DAIB

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
Extent of Use of CAD in Design	Between Groups	8.921	2	4.460	11.405	.000
	Within Groups	113.025	289	.391		
	Total	121.945	291			
Department's Average Annual ICT Budget/expenditure	Between Groups	71.703	2	35.852	260.083	.000
	Within Groups	39.976	290	.138		
	Total	111.679	292			

Source: (Fieldwork, 2015)

The results of the difference in means from Table 8 showed that Federal-funded (institutions) had a slightly higher extent of use of CAD in design than state-funded (.129), though this was not statistically significant. Federal-funded also had higher extent of use of CAD in design than private-funded (.622*). State-funded also had a higher extent of use of CAD in design than private-funded (.494*). The results from the same table showed that State-funded had a higher department's average annual ICT budget/expenditure than federal-funded (.588*), State-funded had a much higher department's average annual ICT budget/expenditure than private-funded (1.588*) and federal-funded also had a much higher expenditure than private-funded (1.000*)

Table 8: Tukey HSD Post Hoc analysis test results showing the nature of difference between funding groups in EUCD and DAIB

Multiple Comparisons
Tukey HSD

Dependent Variable	(I) University Funding Type	(J) University Funding Type	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Extent of Use of CAD in Design	Federal	State	.129	.080	.243	-.06	.32
		Private	.622*	.130	.000	.32	.93
	State	Federal	-.129	.080	.243	-.32	.06
		Private	.494*	.124	.000	.20	.79
	Private	Federal	-.622*	.130	.000	-.93	-.32
		State	-.494*	.124	.000	-.79	-.20
Department's Average Annual ICT Budget/expenditure	Federal	State	-.588*	.047	.000	-.70	-.48
		Private	1.000*	.077	.000	.82	1.18
	State	Federal	.588*	.047	.000	.48	.70
		Private	1.588*	.074	.000	1.41	1.76
	Private	Federal	-1.000*	.077	.000	-1.18	-.82
		State	-1.588*	.074	.000	-1.76	-1.41

Source: Fieldwork, 2015

DISCUSSION

The results of a one-way ANOVA analysis done at 95% confidence level led to the null hypothesis being rejected and the alternate chosen. It was found statistically that there is a positive significant difference between federal-funded, state-funded and private-funded departments of architecture in departments' average annual ICT budgets/expenditure and extent of use of CAD in design in the curriculum of architecture schools in South-east Nigeria.

The Tukey HSD post hoc test results showed that federal-funded departments had a slightly higher extent of use of CAD in design than state-funded departments. This was however not statistically significant. Federal-funded departments also had a significantly higher extent of use of CAD in design than private-funded departments. State-funded departments also had a significantly higher extent of use of CAD in design than private-funded departments. When the difference in department's average annual ICT budget/expenditure was tested, the results showed that state-funded departments had a significantly higher department's average annual ICT budget/expenditure than federal-funded departments. State-funded departments also had a significantly higher department's average annual ICT budget/expenditure than private-funded departments. Federal-funded departments had a significantly higher department's average annual ICT budget/expenditure than private-funded departments.

The implications were namely

i. State-funded institutions in south-east Nigeria were superior to private-funded institutions in south-east Nigeria in departments' average annual ICT budgets/expenditure and extent of use of CAD in design
ii. State-funded institutions in south-east Nigeria were superior to federal-funded institutions in south-east Nigeria in departments' average annual ICT budgets/expenditure

iii. Federal-funded institutions in south-east Nigeria were superior to private-funded institutions in south-east Nigeria, in departments' average annual ICT budgets/expenditure and extent of use of CAD in design
iv. The difference between federal-funded institutions in south-east Nigeria and state-funded institutions in south-east Nigeria with regard to extent of use of CAD in design was not statistically significant
v. Private-funded institutions in south-east Nigeria were inferior to others in the listed categories in the two variables examined.

RECOMMENDATIONS

While it is intuitive to expect that institutions under the federal-funded category would receive better funding than any other category, it is still the prerogative of each institution to determine her priorities for expenditure. The recommendations, therefore, are that

i. Stakeholders must robustly engage with the administrators whose responsibility it is to allocate resources so that they can see the necessity to allocate the needed funds for CAD implementation.
ii. Regulators should also track performance of institutions under the variables listed like ICT budget/expenditure. The data gained would then be used for advising them on preparedness for achieving successful curriculum implementation.
iii. Also, such comparative data provide a logical basis for ranking on performance and public ranking (comparison) provides incentive for increased effort towards improvement. The statistics gained in this research could be used in this direction.
iv. This results provide a basis for closer evaluation of weak categories of institutions by the regulatory bodies i.e. National Universities Commission and the Architects Registration Council of Nigeria. The private-funded category was statistically proven to be the worst performer in all variables. The consistent lower-end performance of this category within the study area cannot be generalised for other regions in Nigeria. However, it could be an indicator of the lack of preparedness of this funding group (in the study area) to prosecute the architecture programme. The result of such inquiry could lead to rapid improvement in the quality of the programme at such institutions or its necessary closure.
v. Regular comparative analysis of difference between institutions or groups of institutions is therefore recommended as a means of evaluating performance with the aim of engaging those who consistently show weakness to improve on implementation.

CONCLUSION

CAD has become the standard medium for communicating architectural ideas. There is, therefore, a burden of responsibility on architectural educators to ensure that their graduates are thoroughly trained in it. This informed CAD curricula requirements by the NUC of institutions offering the architecture programme. Accreditation visits have been a tool used

by this regulator to examine compliance with all aspects of required standards. This comparative study showed that through empirical methods, a means of evaluation of this aspect of architectural education can be developed. If the recommendations are applied, the graduates produced by the architecture departments would greatly benefit from improved implementation. The result would be a more efficient workforce.

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