

Impacts of Drafting Media on Students' Design Studio Productivity in Some Selected Universities of South-West, Nigeria

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ABSTRACT

Over the years, it is expected that in design studio, the learning gained in different courses must be incorporated into the plan procedure keeping in mind the end goal to locate an ideal answer for the design problem. The article describes the result of the project "impacts of drafting media on student's productivity in design studio in selected schools in South West Nigeria" aimed at evaluating the two drafting media and the effect of each on student's productivity outcome in design studio. Design students should learn by experiencing, reflecting, thinking and practicing during the time spent discovering answers for allotted design problems for productive outcomes in design studio irrespective of the drafting style used. The significance is essential at this time when unemployment is in a top gear. This study would provide valuable insight into the medium of drafting that is most productive for students of Architecture in other to prepare them for good job opportunity. The study adopted a mixed approach method of data collection and analysis. The result was presented using descriptive approach with the aid of a photographic images for easy understanding. The result of the survey suggests that both manual and digital drafting are very much relevant. Even as technological approaches to design continue to evolve, the old-fashioned drafting method is still very relevant and should not be evaporated from the curriculum, not only in South-West Nigeria, but also across the globe. The results brought about the question of the connection between these drafting media and students' productivity. There is a limit to the generalization of the results of this study since only students in University of Lagos, Covenant University and Bells University were selected as the sample frame because there are many more schools within Lagos and Ogun state.

Keywords

Design Studio, Drafting Media, Productivity, Students Performance, Building Information Modeling (BIM), Computer Aided Drafting (CAD)

Introduction

In this context, the term 'drafting media' refers to those methods of drafting in architecture practice or teaching. The drafting media which are manual drafting which is also known as hand or traditional drafting and digital drafting which is also known as software drafting. Architectural design students in many schools of architecture in Nigeria are affront with the policy of using manual drafting at the undergraduate levels for their design studio projects. The option of using digital or Computer Aided Design (CAD) media to design and present their works is not permitted by the existing school curriculum. Nevertheless, it is often detected that students operate CAD while camouflaging the presentations to speculate manual drawings in an attempt to work with the standards (Pektas, 2010).

Some innovation instruction educators feel that they are engaged with educating an excess subject (Pektas2008). They believe that, in a world of CAD and BIM, there is no place for drawing boards and set squares. Others are inflexible that school understudies need to 'know the nuts and bolts' of specialized attracting before working a

CAD and BIM condition. This isn't a civil argument that is limited to Nigerian education. Schools of architecture have an idea of the drafting media but don't have an in depth understanding of how it positively improves the productivity rate of students in design studio. It is one thing to know about the media and another to know what medium is most appropriate for improved design outcome in this present age.

This study examines the outright place of manual technical drawing in the 21st century alongside with talking about the apparent esteem and importance of showing school understudies how to draw utilizing conventional instruments, in a world of computer aided drafting (CAD) and building information modeling (BIM). The utilization of advanced instruments is progressively overwhelming design education in parallel with the improvements in proficient practice. There is a consistently developing collection of writing regarding the matter; nonetheless, it was watched that the majority of the current examinations have just centered on moderately specialized issues, for example, exploratory employments of new media, apparatus

improvement, or usage of related courses. The wide socio-social and behavioral settings of Computer Aided Design (CAD) and Building Information Modeling (BIM) instruction have stayed to be overlooked (Pektas and Erkip, 2009n). Tweed (2001) perceived that CAD frameworks regularly epitomized a cliché perspective of architects while singular contrasts of clients were once in a while considered. It is broadly acknowledged that there might be a few qualities of people that influence their practices in digital design assignments, however such associations have not yet been examined systematically (Tweed, 2011).

This paper aimed at evaluating the existing two drafting medium and their effects on students' productivity in three selected universities in South-West, Nigeria in order to promote which of them has a better edge.

2.0. Literature Review

Performance in school relies upon different elements, yet they can be gathered by diverse methods. For the students to perform, they should understudy qualities, instructor effect and school properties. With respect to qualities, factors in corporate identity, subjective capacities, inspiration, confidence, and financial elements (Gajda, 2016). School execution can be spoken to by course reviews, the consequence of consistent evaluation or tests. Since students are at the center of learning process, an investigation custom fitted to their inspirations and procedures and components preventing their learning are basic as understudies themselves assume critical parts in moving their own particular learning and getting upgraded scholarly accomplishment.

The educational movement includes an intricate procedure whereby inputs, (for example, human and money related assets) are changed over into yields. By similarity with the sort of generation work that is commonly used to break down the innovation of a firm, the work and capital information sources utilized by a school are probably going to impact its yield. Be that as it may, since understudies themselves shape both an info and yield, and since they themselves are changed by the experience of training, such a straightforward structure bombs satisfactorily to catch some key remarkable highlights of the procedure. This is an extremely surely understood test in the existent writing about Educational

Production Function (EPF). Without a doubt, the learning procedure of understudies is affected by understudies' own particular attributes, those of their family, their associates, the area in which they live, and in addition by the qualities of the school that they are going to. Besides, the manner by which different contributions (at various levels) influence yield is probably going to shift generously over the instructive frameworks that work in various nations (Masci, Johnes, Agasisti, 2018).

2.1 Creativity of Student

According to Biggs (2002), creativity includes the broadened theoretical results of learning like – guessing, integrating, reflecting, creating thoughts, applying the known to 'far spaces', and working with issues that don't have one of a kind arrangements. Creativity likewise includes the ability to produce, interface thoughts, make systems to judge the value of thoughts and give potential arrangements. Numerous scholastics would see these as higher request of scholarly aptitudes and capacities that they try to create in their orders. Creative execution additionally requires inspirational states of mind and elevated amounts of inspiration (zeal) confirm by industriousness and eagerness to buckle down. Such demeanors get from individual convictions that hindrances can be overcome. In this way, learning procedures to cultivate innovativeness must create self-viability; empower chance taking in safe conditions and help understudies to draw in with muddled or mind boggling and erratic circumstances where there are no good and bad answers. While distinctive controls perceive and esteem diverse types of creativity, look into thinks about perceive a scope of scholarly properties, states of mind and practices related to creativity. DeWulf and Baillie (2004) identify three characteristics, which are; ability to visualize ideas, effective use of memory, convergent and divergent ways of thinking. Scholarly mindsets tend to esteem joined mindsets - rationale, thinking, examination, objectivity, judgment. Divergent reasoning brings into play the correct cerebrum thinking which is related with transparency, subjectivity, feeling, instinct, feeling, tangible and inventive procedures (Jackson, 2005).

2.2 Grades of Student

Design grade is essential in schools of architecture because it is considered as the bedrock of architecture profession, Alagbe, et.al. (2015). Grading in education is the way toward applying standardized estimations of changing levels of accomplishment in a course. Grades can be appointed as letters (usually A through F), as a range; as a level of an aggregate number of inquiries addressed accurately, or as a number out of a conceivable aggregate (Intravaia, 2009). In a few nations, all evaluations from every single current class are averaged to make a grade point average (GPA) for the stamping time frame. The GPA is computed by taking the quantity of focuses earned in light of the review got (generally four focuses for A, three focuses for B, two focuses for C, one point for D, and no focuses for F) and partitioning by the quantity of classes. This number can be utilized by potential businesses or instructive foundations as a metric to evaluate and look at candidates. A total review point normal (CGPA) is an estimation of the normal of the greater part of an understudy's aggregate earned focuses isolated by the conceivable number of focuses. This evaluating framework computes for the majority of the understudy's total training vocation. Review point midpoints can be unweighted (where all classes with a similar number of credits have square with effect on the GPA) or weighted (where a few classes are given more impact than others). (Warne, Russell, 2017).

2.3 Tools Used for Drafting

Drafting tools might be utilized for estimation and format of illustrations, or to enhance the consistency and speed of production of standard illustration components. The instruments utilized for manual specialized illustration have been uprooted by the approach of the computer and its regular use as the primary tool in computer-aided drawings (CAD). Equipment changed profoundly amid the 1990s, when PC supported plan totally removed illustration by hand (Pektas, 2010). Technical design has changed from attracting by hand to creating computer-aided design illustrations, where illustrations are never again "drawn", yet are built from an implicitly produced model. Illustrations are not really created in printed version with the exception of in the event that they are required they are printed consequently by a computer program. Hand-

drawn outlines, nonetheless, are still generally utilized as a part of the draft configuration stage.

2.4 Manual or Digital Drafting Medium

There is little writing accessible about the subjective load engaged with changing inner workspace to the outside workspace outside the mind. There is limited understanding on how students can store and control visual data. Notwithstanding, it is perceived that the subjective procedure used to draw a line with a pencil is unique in relation to that of determining the end focuses for computer aided design portrayal (CAD). Psychology discloses today that the 'inner memory' has a limited capacity, it is intense, quick and it is utilized for visual recognition, drawing and creation. While the 'outside memory' has infinite capacity, access is slow and not direct. It needs a sign for recovery. The extra psychological load to execute CAD frameworks as of now is backing off plan process using symbol and menu choosing which include ventures in picture creation. The advancement of outlining, drafting aptitudes and traditions help portrayal of dynamic and solid ideas. The outlining procedure can be constrained at the point when there is constrained capacity to utilize designs as a subjective expansion.

McLaren (2008) cite Bhavnani and John (1996) who take note of that students who have breezed through the required capability tests in CAD created better and more entire illustrations with less exertion utilizing drafting sheets, paper and pencil. CAD operators can perform poorly, display frustration and reduced performance in creativity due to the complexity of commands, input parameters and requirements of the system. This is an indication that CAD does not make students productivity standout but proficiency does. Haapasalo (2000) states that troubles experienced and cognizant exertion with CAD exchanges the consideration and fixation far from the object to be designed. The more cognizant the exertion the user interfaces requires the more hurtful for the inventiveness. Hand-eye co-appointment of drawing permits the intuitive memory to stream all the more normally and speedier (Pektas, 2008). Further stated that, the synopsis of his findings revealed that, those employed in an industry related CAD condition were definitely not proposing an arrival to the planning phases. Be that as it may, they felt that

the estimation of showing manual specialized attracting lay creating related learning and comprehension of the ideas and details of drafting. This was simpler to appreciate when managed with as particular from taking in the product. The upsides of CAD were recognized and delight in engaging in the virtual condition was moreover obvious. According to that study, some respondents were in favour of manual drafting as a stepping stone to CAD mastery. More so, learning the basics on the board gave a full understanding of what was to be created in CAD. However, on the contrary in McLaren (2008) the respondents were of the opinion that CAD is without doubt, far better than the old drafting board. The simplicity of making, duplicating and changing cannot be beat by anybody on the drafting board and because of this, the people generally delighted using manual drafting. According to the study there was an abnormal state of mindfulness and valuation for attitudinal esteems created through manual drafting. These can be ordered as far as: determination, persistence, train, energy about the benefits of new innovations, look after exactness, significance of arranging, imaginativeness in arrangement/format for motivations behind clearness and individual fulfillment.

CAD is a critical mechanical craftsmanship widely utilized as a part of numerous applications, including car, shipbuilding, and aviation ventures, modern and architectural design, prosthetics, and some more. As computers turned out to be more economical, the application territories have steadily extended. The improvement of CAD programming for individual work stations was the driving force for relatively all-inclusive application in every aspect of development. The creation of the 3D CAD/CAM is credited to a French specialist, Pierre Bézier (Arts et Métiers ParisTech, Renault). After his numerical work

concerning surfaces, he created UNISURF, in the vicinity of 1966 and 1968, to facilitate the plan of parts and apparatuses for the car business. At that point, UNISURF turned into the working base for the accompanying ages of CAD programming (Narayan and Lalit, 2008).

Obligatory to the unpredictability of social affair all the significant data when working with BIM on a building venture a few organizations have created programming planned particularly to work in a BIM structure. These bundles contrast from compositional drafting instruments, for example, AutoCAD by permitting the expansion of additional data (time, cost, makers' points of interest, supportability and upkeep data, and so forth.) to the building model.

3.0 Research Methodology

In this research work, the researchers considered the observation technique and the use of questionnaires as instruments in the collection of data. The use of questionnaire is the main instrument used for collection of primary data. It would help to provide answers to the questions asked by the study which is about the impacts of drafting styles on students' performance (productivity outcome) in design studio. Samples for this study was taken from three major institutions in South West Nigeria. University of Lagos, Covenant University, Bells University. The sample sizes of the various institutions were determined using the formula;

$$n = \frac{z^2pqN}{e^2(N-1) + (z^2pq)}$$

Where; n = sample size, P =level of confidence (for 95 percent confidence level, p = 0.05), q = 1 – p (sample proportion), N = population size, z = the standard normal deviate (or confidence coefficients), which corresponds to the confidence level adopted. (z= 1.96 for 95% confidence), e = acceptable error (0.02 for 2% of true value).

Table 1: Table showing the Sample size of the selected Institutions

Institution	200 Level Sample Size	300 Level Sample Size	400 Level Sample Size	Sample Size Per Institution
University of Lagos	51	54	52	157
Covenant University	49	48	49	146
Bells University	56	70	49	175

4.0 Results and Discussions

Effects of Drafting Media on Students Productivity Outcome in Design Studio

Frequency distribution table showing if manual drafting gives a better appearance of design visually

Table 2: Digital Drafting and Design Presentation

	Frequency	Percent
Strongly Disagree	6	2.0
Disagree	23	7.5
Indifferent	37	12.1
Agree	138	45.2
Strongly Agree	101	33.1
Total	305	100.0

From Table 2 above, 2.0% of the respondents strongly disagree, 7.5% disagree, 12.1% are indifferent, 45.2% agree and 33.1% strongly agree

that manual drafting gives a better appearance of design visually. Therefore, it can be deduced that manual drafting gives a better appearance of design visually.

Table 3: Frequency distribution table showing if manual drafting produces designs of standard quality

	Frequency	Percent
Strongly Disagree	50	16.4
Disagree	79	25.9
Indifferent	91	29.8
Agree	69	22.6
Strongly Agree	16	5.2
Total	305	100.0

From Table 3 above, 16.4% of the respondents strongly disagree, 25.9% disagree, 29.8% are indifferent, 22.6% agree and 5.2% strongly agree

that manual drafting does not produce designs of standard quality. Therefore, it can be deduced that manual drafting does not produce designs of standard quality.

Table 4: Frequency distribution table showing if digital drafting produces designs of standard quality

	Frequency	Percent
Strongly Disagree	9	3.0
Disagree	11	3.6
Indifferent	32	10.5
Agree	151	49.5
Strongly Agree	102	33.4
Total	305	100.0

From Table 4 above, 3.0% of the respondents strongly disagree, 3.6% disagree, 10.5% are indifferent, 49.5% agree and 33.4% strongly agree that digital drafting not produces designs of

standard quality. Therefore, it can be deduced that digital drafting produces designs of standard quality.

Manual Drafting Effects on Productive Outcome in Design Studio

MANDRAEF - MANUAL DRAFTING EFFECTS ON PRODUCTIVE OUTCOME IN DESIGN STUDIO

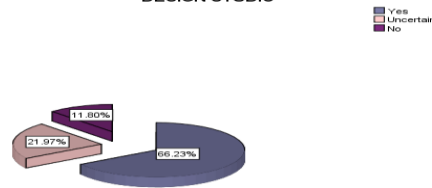


Figure 1: Pie chart showing if manual drafting has a positive effect on productive outcome in design studio
From Figure 1 above, 66.23% of the respondents are in support that manual drafting has a positive effect on productive outcome in design studio, 21.97% are uncertain about their opinion, and 11.80% are not in support. Therefore, it can be said that manual drafting has a positive effect on productive outcome in design studio.

DIGDRAEF - DIGITAL DRAFTING EFFECTS ON PRODUCTIVE OUTCOME IN DESIGN STUDIO

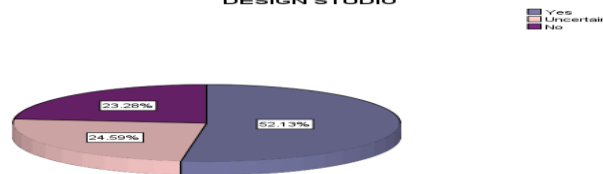


Figure 2: Pie chart showing if digital drafting has a positive effect on productive outcome in design studio
From Figure 2 above, 52.13% of the respondents are in support that digital drafting has a positive effect on productive outcome in design studio, 24.59% are uncertain about their opinion and 23.28% are not in support. Therefore, it can be said that digital drafting has a positive effect on productive outcome in design studio.

Table 5: Regression coefficients table showing the relationships between the dependent and independent variables.

Coefficients ^a					
Model	Unstandardized Coefficients		Standard ized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	2.443	.415		5.884	.000
STUCOG - Drafting Style and Student Cognition	-.017	.055	-.019	-.306	.760
MANDRASPE - Manual Drafting and Speed	-.010	.045	-.013	-.218	.828
DIGDRASPE - Digital Drafting and Speed	-.010	.055	-.011	-.176	.861
ORIDES - Manual Drafting and Drawing Originality	.059	.053	.070	1.105	.270
DRAACCU - Drafting and Drawing Accuracy	-.025	.050	-.034	-.500	.617
DRAFLEX - Digital Drafting Flexibility Compared to Manual	.011	.062	.014	.178	.859
EXPIDE - Expression of Ideas in Digital Drafting Compared to Manual	.021	.073	.026	.287	.774
EXPCRE - Expression of Creativity in Digital Drafting Compared to Manual	-.079	.063	-.101	-1.241	.216

DESAPPVIS - Manual Drafting and Visual Appearance	-.101	.050	-.130	- 2.023	.044
DESPRE - Digital Drafting and Design Presentation	-.024	.061	-.026	-.390	.697
DESTIM - Time Spent on Design in Digital Drafting Compared to Manual	.020	.051	.028	.390	.697
CORDESER - Correction of Errors in Manual Drafting	.034	.053	.047	.636	.525
DESQLA - Standard Quality of Design in Digital Drafting Compared to Manual	-.008	.065	-.009	-.123	.902
MANDESEF - Manual Drafting and Design Efficiency	-.117	.051	-.153	- 2.310	.022
DIGDESEF - Digital Drafting and Design Efficiency	.097	.069	.102	1.406	.161

From the above Table 5 above; design studio is compared with other fifteen coded independent variables, the result indicated as follows;

- Digital drafting and design efficiency has a coefficient of .097 which is the highest on the table and it indicates that there is a very strong mutual relationship with studio grade.
- Manual drafting and drawing originality has a coefficient of .059 which is the second highest, indicating that there is strong mutual relationship with studio grade.
- Time spent on design in digital drafting compared to manual has a coefficient of .034 which is the third highest in the rank which implies a good mutual relationship with studio grade.

- Flexibility in digital drafting compared to manual has a coefficient of .011 which is a low mutual relationship with studio grade.
- Manual drafting and design efficiency has a coefficient of -.117 which is the lowest on the table and it indicates that there is a very high disparity with studio grade and there has absolutely no effect on studio grade.

Therefore, the higher the coefficient for the independent variables, the stronger the mutual relationship with the dependent variables and the lower the coefficient (negative) for the independent variables, the higher the disparity and level of insignificance with the dependent variables.

Table 6; Cross table of the different institutions and their respective mostly used drafting mode

	Manual	Digital	Both	
University of Lagos	0	49	24	73
Covenant University	84	11	25	120
	27	29	56	112
Bells University	111	89	105	305
Total				

From Table 6 above, 73 respondents from University of Lagos, no student uses manual drafting most consistently, 49 students use digital drafting most consistently, 24 students use a combination of both consistently. In Covenant University with 120 respondents, 84 students use only manual most consistently, 11 students use

only digital most consistently and 25 use a combination of both consistently. However, Bells University has 112 respondents, 27 students use only manual most consistently, 29 students use only digital most consistently and 56 use a combination of both consistently. Therefore, it is evident that University of Lagos students uses digital drafting while Covenant University

students uses manual drafting the most, whereas Bells University students use a combination of both the most. The study also investigated the grades of the students in their design studios. The result in presented in figure 3 below.

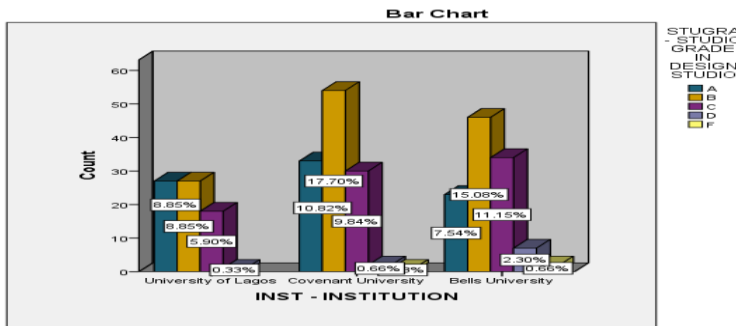


Figure 3: Bar chart showing the different institutions and their respective last studio grades

Figure 3 above, 8.85% of University of Lagos students got an A in their last studio, 8.85% got a B as well, 5.90% got a C, 0.33% got a D, and nobody got an F. 10.82% of Covenant University students got an A in their last studio, 17.70% got a B, 9.84% got a C, 0.66% got a D, and 0.33% got an F. 7.54% of Bells University students got an A in their last studio, 15.08% got a B, 11.15% got a C, 2.30% got a D, and 0.66% got an F. Therefore, it can be deduced that Covenant University has the highest percentage of students who got an A or B in their last design studio which implies that Covenant University student have more productive outcome in their design studio as manual drafting is the only medium of drafting that is allowed.

Table 7: Cross table between preferred drafting mode and students grade in design studio

Crosstab

		A	B	C	D	F	
PREFDRAMOD	- Manual	8	11	10	0	1	30
PREFERRED	Indifferent	16	31	16	2	1	66
DRAFTING MODE	Digital	59	85	56	8	1	209
Total		83	127	82	10	3	305

From table 7 above, there are a total of 30 respondents who prefer to use manual drafting which is the least preferred, out of which 8 of them got an A in their last studio grade, 11 got a B, 10 got a C, nobody got a D and only 1 F was recorded. 66 respondents in all do not have a preference, out of which 16 of them got an A in their last studio grade, 31 got a B, 16 got a C, 2 got a D and only 1 F was recorded. 209 respondents in total prefer to use digital drafting which is clearly the most preferred, out of which 59 of them got an A in their last studio grade, 85 got a B, 56 got a C, 8 got a D and only 1 F was recorded. Therefore, it can be said that most of the students who prefer digital drafting got a B in their last studio grade.

Discussion

The study set out to evaluate the two drafting media and the effect of each on students' productivity outcome in design studio using a selected number of institutions in South West Nigeria as a case study. The factors that affect productivity in design studio as a course are speed

of drawing, originality of drawing, accuracy, flexibility, expression of creativity and ideas, time spent drawing and efficiency of drawing to mention just a few. Digital drafting produces designs of standard quality than manual drafting, digital drafting does affect the speed of drafting positively. Digital drafting and design efficiency has the strongest relationship with studio grade, while manual drafting and design efficiency has a very high disparity with studio grade which implies there is absolutely no effect on studio grade. Therefore, digital drafting has a positive effect on productive outcome in design studio with respect to design efficiency. Although manual drafting and digital drafting both have positives impact on students' productive outcome in design studio.

A higher percentage of the respondents that took part in the research use manual drafting most consistently. Majority of the respondents rated manual drafting as 7/10 and a higher percentage of the respondents rated it below 7/10 while most of the respondents rated digital drafting as 9/10 and a higher percentage of the respondents rated it above 7/10. Digital drafting is the most preferred

drafting mode by the respondents across the three schools, while those who are indifferent and do not have a preference over the drafting media have the second highest frequency across the institutions and manual drafting is the least preferred drafting mode among the respondents in all the schools. The correlation between the rating of manual drafting and the rating of digital drafting is negative which implies that there is disparity and does not have any effect on one another. There is disparity between the correlation of the preferred drafting mode and the rating of manual drafting because the Pearson correlation value is really low as it is a negative value of -0.407 . Therefore, it can be implied as not significant. While is a mutual relation and strong correlation between the preferred drafting mode and the rating of digital drafting because the Pearson correlation value is very high and has a positive value of $+0.332$. Therefore, it can be implied as that this correlation is significant.

Conclusion

The results suggest that both manual and digital drafting are very much relevant. Even as digital approaches to design continue to evolve, the manual drafting method is still very relevant and should not be scrapped from the curriculum, not only in South-West Nigeria, but also across the globe. According to Izobo-Martins and Oluwole (2020) a learning environment identify learning strategies that can be implemented at different times. Therefore, this study was carried out mainly to highlight what impacts the two media of drafting have to offer and why they are both important. The study adopted the academic work of students in University of Lagos, Covenant University and Bells University as the sample frame, purposely for the work and nothing more. Therefore the study recommends that Institutions should adopt both the manual and digital drafting media into their design studio curriculum. Drafting should not be biased with priority given to one over the other because they both have their contributions into productivity in design. Students should be open to both drafting media and should not limit themselves to any of them. Architecture students should practice both intermittently to improve their skills in both areas, there should be a strong relationship between manual and digital drafting during the presentation of studio designs, each of the drafting media have areas of designs in

which they impact on productivity. This would lead to ability of students to identify all their strength, weakness and ability to improve in other not to be at the same drafting level with untrained people who only get to use the software. In conclusion, it is an advantage for any of them to be able to design via any of the mediums.

Conflict of Interest

The authors declare no conflict of Interest.

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References

- [1] Abidin, M. D. (2010). Printmaking: Understanding the Terminology. *Procedia- Social and behavioural Sciences*, 405-410.
- [2] Adegbile, M. (2012, June 27-30). Nigerian architectural education in a sustainable age. *Sustainable Futures: Architecture and Urbanism in the Global South* Kampala, Uganda, p. 82.
- [3] Adeyemi, E. A. (2012). In the making of an architect: the Zaria experience. Ota Covenant University. Ogun State: PRESS.
- [4] Alagbe, Oluwole, Peter Aderonmu, Pearl Opoko, Albert Adeboye, Omolade Akinjare, and Oladunni Izobo-Martins. "Comparison of design studio and jury systems in architectural schools in southwest Nigeria." *Global Journal on Humanities and Social Sciences* 1, no. 1 (2015).
- [5] Anthony, K. H. (2001). *Design juries on trial: The renaissance of the design studio*. New York: New York: Van Nostrand Reinhold.
- [6] Augenbroe, G. (2007, 07 27). Integrated building performance evaluation in the early stages. *Building environments*, pp. 149-161.
- [7] Cespedes, K. A. (2008). Design Education of the Digital Native. . *Joint study Journal*, 33.
- [8] Chukwunonso, F. &. (2013). Challenges for the adoption of new ICTs in architectural education in Nigeria. *International Journal of Informatics and Communication Technology*, 201-222.
- [9] Emmitt, S. (2002). ABU Website. [http://www.abu.edu.ng/dept/view_departments.php?depid=19&dept= Department+of+Architecture. Architectural Technology. Pub Blackwell Science: \(pp. 155-174\). London: \]](http://www.abu.edu.ng/dept/view_departments.php?depid=19&dept= Department+of+Architecture. Architectural Technology. Pub Blackwell Science: (pp. 155-174). London:]) ABU Website. http://www.abu.edu.ng/dept/view_departments.php?depid=19&dept= Department+of+Architecture.
- [10] Green, L. N. (2003). Studio-based teaching: history and advantages in the teaching of design. . *World Transactions on Eng. and Tech. Edu*, 269- 272.

- [11] Gu, N. &. (2010). Understanding and facilitating BIM Adoption in the AEC industry. *Automation in Construction* 19, 988-999.
- [12] Izobo-Martins, O.O., Ayo-Vaughan, E.O., Badejo, O.O., Ekhaese, E.N., Elenwo, C., Nwakudu, I. (2018): Safety in construction: Reducing the physical demands on workers in Nigeria (Article). *International Journal of Civil Engineering and Technology (IJCIET)* Volume 9, Issue 9, pp. 215–221.
- [13] Izobo-Martins, O. O., & Oluwole, O. O. (2020). Investigation of Circulation and Users Comfort In Secondary School Buildings In Kaduna, Nigeria. *Solid State Technology*, 7517-7531.
- [14] J Zhao, D. M. (2010). Building Collaborative Construction Skills through BIM integrated Learning Environment. *International Journal of Construction Education and Research* 11, 97- 120.
- [15] McGraw H. Ameri, A. (2008). Architecture Pedagogy, Cultural Identity, and Globalization. *The International Journal of the Arts in Society*, 208.
- [16] Mostafa, M. &. (2010). How do Architects Think? Learning Styles and Architectural education. *Archnet- Ijar*, (pp. 310-317).
- [17] Oh, Y. I.-L. (2013). A theoretical Framework of design critiquing in architecture studios. *Design Studies*, 302-325.
- [18] T., G. (2002). ‘CAD’, Architect’s Studio Handbook. .
- [19] Tokman, L. Y. (2010, September 26-28). Disciplinary/Interdisciplinary Virtual Design Studio. . *Proceedings of Conference ICL*.
- [20] Wong, K. A. (2011). Building Information Modeling for Tertiary Construction Education in Hong Kong. *Journal of Information Technology in Construction*, 467-476.
- [21] Yurtsever, B. (2012). Re-thinking bauhaus on the context of architectural education. . *Social and Behavioural Sciences*, 135-139.