

# Impact of AutoCAD Application Instruction on Students' Academic Performance and Motivation in Building/Engineering Drawing in Technical Colleges of Adamawa State, Nigeria

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**Abstract:** - The objective of the study was to examine the use of AutoCAD Application Instruction (AAI) on academic performance and students' motivation in Building/Engineering Drawing (BED). The study raised two research questions and formulated two hypotheses. The study design was a pre-test post-test Quasi-experimental research. 86 students of mechanical engineering craft practice and block/brick laying and concreting students from Yola and Numan technical colleges of Adamawa state, Nigeria formed the population of the study. The instrument of the study were standard questions adapted from National Technical and Business Examination Board (NABTEB) of 2016 to 2018 past questions and questionnaire on the perception of students' motivation on the use of AAI. Students taught with AAI is an experimental group, while those taught with demonstration method is the control group. SPSS was used to analysed data. Mean and standard deviation were used to answer the research question while, ANCOVA and t-test were used to test the null hypotheses at 0.05 level of significance. The findings of the study, among others, revealed that teaching and learning BED motivates learners and increase academic performance significantly. The study concluded by recommending technical colleges to integrate AutoCAD application instruction in the teaching and learning of building/engineering drawing.

**Keywords:** AutoCAD Application Instruction, Performance, Motivation and Building/Engineering Drawing

## I. INTRODUCTION

Education is an experience that develops mind, character, physical ability and behavior of an individual to live well and contributes to the wellbeing of his society ([17], [10]). While, technical education is the acquisition and utilization of knowledge and skills. Technical education stresses on acquisition and application of skills [13]. The aims of education in Nigeria include: Free, just and democratic society; a land full of opportunities for all citizens; great and dynamic economy and united strong and self-reliant nation[5]. In realizing these educational policy, Technical education was setup and offered at the juniorsecondary schools as Basic Engineering Skill Training (BEST) centres, while in Technical Colleges at senior secondary. The objective of

Technical College is to produce graduates with vocational and technical skills leading to the production of artisans and craft men who will be self-reliance; gainfully employed as lower level sub-professionals; work as self-reliance individuals; and having potentials for further studies[5]. National Business and Technical Education Board (NABTEB) supervised, monitored and ensure the accreditation of all Technical colleges in Nigeria leading to National Technical Certificate (NTC) and National Business Certificate (NBC) [13]. Consequently, the NTC/NBC trade syllabuses were designed to meet overwhelming demand and desire of students and to bridge the gap between various trades with adequate knowledge and skills that can be demonstrated at their level and certification for further learning and skills development for the willing and the able [13]. Accordingly, the NTC/NBC syllabuses have been produced in six broad of related or cluster trades to facilitates the acquisition of practical and applied skills as well as basic scientific knowledge. These trades include: construction, engineering, miscellaneous, general education and modular.

Building/Engineering Drawing (BED) is a trade related subject with general objective of introducing the students to the use of drawing as a language and to enable them make and interpret simple technical drawing; the basic knowledge of the application of geometrical methods in the analysis, solution to elementary space problem and skill in making and interpreting engineering and construction drawing [13].

Information and Communication Technology (ICT) has since been integrated in teaching and learning, and consequently improve the quality of educational delivery [2]. ICT has created a personalized, diversified and comprehensive teaching environment[4]. The common computer applications for instruction of BED is Computer Aided Design (AutoCAD), a real user friendly interface software for product design and drafting [7]. AutoCAD application in teaching BED is being backed by National Business and Technical Examination Board (NABTEB) Chief

Examiner [12]. The chief examiner underpinned the challenges that make students fail examinations in two fold. One is due to the teaching method practiced by the instructors to teach the students: identified as the traditional teaching method. The other challenging factor was the slow implementation of computer-based-learning in the core trades. AutoCAD software application instruction guides student on the following: Reference[18] suggested students should be guided to use drawing and design software such as AutoCAD, ArchiCAD among others as these will bridging the gap between prior learning and new knowledge, and indirectly stimulating hands-on practice. AutoCAD experts also suggest that the teachers' lecturing and demonstrating the effects of commands and students' engagement of hands-on practice exercises and real-world applications facilitate learning [21]. As Computer-Aided-Design (CAD) is taking lead in transforming the construction industries design concepts [19], the construction related trades students must change with this trend of knowledge and skill based society [15].

Motivation is an energy that drives an individual to value, desire and pursuit a giving situation with great enthusiasm. It is fundamental for academic success. Internal and external motivational factors stimulate desire and energy in a person to get committed to particular task, role, or subject and make necessary effort to attain a goal [6]. In a classroom situation motivation is what keeps a student to stay and received instructions. It makes a student to willingly decides, pursue and sustain academic activities despite associated challenges. Motivation helps student to excel academically [1]. It pushes the student to consider, value, put in effort, and show interest in the task [1]. According to [1] students who have optimum motivation have an advantage because they have adaptive attitudes and strategies, such as maintaining intrinsic interest, goal setting, and self-monitoring.

### 1.1 Statement of the Problem

The integration of ICT for teaching and learning has been the challenges of public schools in Adamawa. Efforts were made by government agencies, local and internal development partners in training of teachers, provision of infrastructure and procurement of ICT facilities, yet ICT instructions in Technical colleges was not integrated for teaching and learning. Despite the fact that educational success is not only measure in the academic performance of students, but also on how students used technology to solve problems in the society. In addition to the traditional method of building/engineering drawing and easy adaptation to meetup with global trend, students of BED must be engaged and be familiarized with the emerging design and construction application software technology to fit appropriately in the field. Consequently, the researchers employed the use of Auto CAD application instruction for teaching BED in Technical colleges of Adamawa State and it impact on students' motivation and academic performance.

### 1.2 Significance of the Study

This research study will be significance to students of Technical Colleges in Adamawa State Nigeria as familiarize with use of computer in building/engineering design. The study will also encourage teachers of Building/engineering design to incorporate the application ICT for instructional purposes.

### 1.3 Purpose of the Study

The purpose of this study was to examine the use of AutoCAD application instruction on academic performance and students' motivation in Building/Engineering Drawing. Specifically, the purpose of the study was to:

1. Determine the impact of AutoCAD application instruction on students' performance in Building/Engineering Drawing in mechanical Engineering Craft Practice students and Block/Brick Laying and Concreting students in Numan and Yola Technical Colleges of Adamawa State.
2. Determine the perception of students' motivation in using AutoCAD application instruction in teaching and learning Building/Engineering Drawing.

### 1.4 Research Questions

1. What is the mean performance scores of students taught Building/Engineering Drawing using AutoCAD application and Demonstration methods of instruction?
2. What is the mean perception scores of students' motivation on the use of AutoCAD application for teaching and learning building/engineering drawing?

### 1.5 Hypotheses

1. There is no significant difference between the mean performance scores of students taught Building/Engineering Drawing using AutoCAD application instruction and demonstration method of instruction.
2. There is no significant difference between the mean perception scores of students' motivation on the use of AutoCAD application for teaching and learning building/engineering drawing.

## II. METHODOLOGY

The design of the study was Quasi pre-test post-test experimental design. The population of the study consisted of 96 National Technical Certificate (NTC) 2 students registered for 2018/2019 academic session in Block/Brick Laying and Concreting (BBC) and Mechanical Engineering Craft Practice (MECHP) trades in two Technical colleges. There was no sampling the intact classes were used since they are strata. There were 28 students in BBC and 16 students in MECHP from Technical college Yola. Similarly, there were 32 BBC students and 20 MECHP students in Technical College

Numan. The instrument of this study were test questions adapted from NABTED past questions from 2014-2018 of Building/Engineering Drawing and structured questionnaire designed by the researchers to elicits response on student’s level of motivation on the use of AutoCAD application instructionmethod. The Questionnaire instrument has 10 items designed based on Likert rating scale was validated by three experts from Modibbo Adama University of Technology Yola.Students of technical college Yola who in BBC NTC 2 are taught using demonstration instruction, while NTC 2 students of MECHP were taught using AutoCAD application instruction. Conversely, students of BBC NTC 2 Numan were taught using AutoCAD application instruction, while students of MECHP NTC 2 were taught using demonstration method. Students taught with AutoCAD application method were the experimental group while students taught with demonstration instruction are the control group.The treatment lasted for two weeks. Before the treatment commences, pre-test was administered to all the BBC and MECHP students in the Technical colleges,and after taken all the lessons, post-test wasadministered to them as well. The objectives of the AutoCAD application instruction and demonstration method instruction are the same.On the other hand, questionnaires were administered to only the experimental group after the instruction. The data collected were analysed using Analysis of Covariant (ANCOVA) which was used to answer research questions and test the hypothesis 1 at 0.05 level of significant. While, t-test was used to test null hypothesis 2. The decision rule was that: reject the null hypothesis if the p-value is greater than the significant value of 0.05, and otherwise, accept the null hypothesis. Similarly, the decision rule on research question and null hypothesis 2 was that any item on the questionnaire that has the mean of 3.0 and above was considered agreed and below was rejected, while when t-value is less than significant value of 0.05, accept the null hypothesis, otherwise, reject the null hypothesis.

2.1 Data Analysis

Research question 1:

What is the mean performance scores of students taught Building/Engineering Drawing using AutoCAD application and Demonstration methods of instruction?

Table 1: Comparison on students’performance taught Building/Engineering Drawing using AutoCAD application and Demonstration methods of instruction

Item	Control Group (N=48)		Experimental group (N=48)		Range ( $\bar{x}_2 - \bar{x}_1$ )
	$\bar{x}_1$	SD	$\bar{x}_2$	SD	
1	53%	2.00	75	1.17	32%
2	43%	1.89	86%	1.06	43%
3	48%	0.82	70%	1.42	22%
4	63%	1.50	90%	1.11	27%
5	56%	0.73	75%	1.08	19%
Total	53%	1.39	82%	1.67	29%

N = Sample size SD = Standard Deviation  $\bar{x}_1$  = Mean of Control group  $\bar{x}_2$  = mean of Experimental group

The analysis present on table 1 indicated there were discrepancies in the mean performance scores of the students in the groups. Students in experimental group performed better in all the 5 test questions than their counterpart in control group. The students in the experimental group had high mean score with mean difference in the range of 32, 43,22,27 and 19. The grand mean of control group was 53% and 82% for the control and experimental groups respectively, with 29% mean difference. Hence, teaching and learning using AutoCAD application enhances academic performance of the students.

Research question 2:

What is the mean perception scores of students’ motivation on the use of AutoCAD application for teaching and learning building/engineering drawing?

Table 2: mean perception of students’ motivation on the use of AutoCAD application

Item	$\bar{x}_{mec}$ (N=20)	SD	$\bar{x}_{bbc}$ (N=28)	SD	$\bar{x}_G$ (N=48)	SD <sub>G</sub>	Remark
1	3.8	1.52	3.63	0.83	3.72	1.18	Agreed
2	4.2	1.49	3.43	1.4	3.82	1.45	Agreed
3	4.5	1.09	3.6	0.88	4.05	0.99	Agreed
4	4.1	1.38	3.61	1.03	3.86	1.21	Agreed
5	3.7	1.42	3.11	1.16	3.41	1.29	Agreed
6	3.3	1.13	3.5	1.03	3.4	1.08	Agreed
7	4.0	1.8	3.64	0.64	3.82	1.22	Agreed
8	3.05	0.32	4.25	0.31	3.65	0.32	Agreed
9	3.44	1.28	3.65	0.78	3.55	1.03	Agreed
10	3.53	1.22	3.79	0.86	3.66	1.04	Agreed
<b>Total</b>	3.76	1.27	3.62	0.89	3.70	1.08	Agreed

$\bar{x}_G$  = Grand mean;  $\bar{x}_{mec}$  = mean of Mechanical Class;  $\bar{x}_{bbc}$  = mean of Block/Bricklaying and concreting Class; N = Sample size; SD = Standard Deviation; SD<sub>G</sub> = Grand Standard Deviation

The result of the analysis presented on table 2 also indicated that the perception of students’ motivation on these use of AutoCAD application for teaching and learning building/engineering drawing were above the cutup point of 3.00. The grand mean was 3.7 and 1.08 standard deviation, showed that students have with all the items presented.

Null Hypothesis 1

There is no significant difference between the mean performance scores of students taught Building/Engineering Drawing using AutoCAD application instruction and demonstration method of instruction.

Table 3 Tests of Between-Subjects Effects

Dependent Variable: 1, 2						
Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Decision
Corrected Model	18.813 <sup>a</sup>	13	1.447	43.483	0.000	
Intercept	6.582	1	6.582	197.779	0.000	
Pre-test	0.013	1	0.013	0.387	0.536	
<b>Post-test</b>	<b>18.712</b>	<b>12</b>	<b>1.559</b>	<b>46.854</b>	<b>0.000</b>	<b>Rejected</b>
Error	2.396	72	0.033			
Total	200.000	86				
Corrected Total	21.209	85				

The analysis of Covariant indicated that at 1, and 85 degree of freedom null hypothesis was rejected since the F value is greater than the significant value. Hence, the mean performance scores of the group differs significantly.

*Null Hypothesis 2*

There is no significant difference between the mean perception scores of students' motivation on the use of AutoCAD application for teaching and learning building/engineering drawing.

Table 4: Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	T	Df	Sig. (2-tailed)	Mean Diff.	Std. Error Diff.	95% Confidence Interval of the Difference	
									Lower	Upper
Motivation	Equal variances assumed	<b>0.263</b>	<b>0.61</b>	0.13	46	0.90	0.04	0.27	-0.52	0.59
	Equal variances not assumed			<b>0.13</b>	<b>44.42</b>	<b>0.89</b>	<b>0.036</b>	<b>0.27</b>	<b>-0.50</b>	<b>0.57</b>

The t-test analysis presented on table 4 indicated that at 2 and 46 degree of freedom, the null hypothesis was accepted since, the t-value is less than the significant value.

**III. RESULTS AND DISCUSSION**

The findings of this study based on research question one and null hypothesis one was that AutoCAD application instruction enhances students' academic performance (table 1); on the group mean difference, the group mean of AutoCAD application and demonstration differs significantly at 0.05 level of significance (table 3). The high performance scores obtained in table 1 may not be far from the fact that learning building/engineering drawing using AutoCAD application instruction is student's centre and students are at

liberty to repeat multimedia instruction over and over until they fully understand the concept of the content very well even outside the classroom setting without the present of the teacher. The outcome of this study affirmed the study of ([14], [9] - [20]) who have both found that ICT improves students' performance. Although, the performance of the control group (Students taught using demonstration method) was not poor, however academic performance depend on how effectively the instructional method was used by teachers[8].

Similarly, the findings of research question 2 (table 2) and null hypothesis 2 (table 4) revealed that AutoCAD application method of instruction motivates learners in their cause to learn building/engineering drawing with grand mean score of 3.70 and 1.08 standard deviation. Likewise, the group mean difference was not significantly different at 0.05 level of significance. The findings indicated that the group share similar opinion in their perception on the use of AutoCAD application instruction. This finding may be connected with the fact that the excitement of the students using Laptops and receiving multimedia instruction made them felt connected to the world and not looking difference with peers in the developed world. Hence, the outcome of their performance most likely be connected to their excitement and energy they put in learning with technology. These findings were in consonance with [8] who affirmed that motivation and effective application of instructional methods enhance students' academic performance. Similarly, the finding goes well the result of [9] who confirmed that multimedia motivates students and increase student academic performance.

*3.1 Recommendations*

In line with the findings of the study, the recommendations were made. AutoCAD application instruction method should be integrated in teaching and learning of building engineering drawing; instructional methods that create excitement and motivates learner to put more effort and energy in learning process should be used by teachers so that higher academic score may be attained.

*3.2 Conclusion*

The use of technology in our building/engineering drawing improves quality and standard of education delivery. Its makes learning excited and motivates learner to put more energy as her learn with technology. It also acquaints the learner the use and manipulations of tools and skill used in the contemporary world and in the field. Despite the effectiveness of AutoCAD application for instruction, teacher remains the focal point in teaching and learning, to bring the excitement that drives the learner to put in their best in the cause of his study. Therefore, teachers should update themselves with modern instructional technology to keep with the global knowledge economy.

REFERENCES

[1]. Alderman, M. K. (2013). *Motivation for achievement: Possibilities for teaching and learning*. Routledge.

[2]. Alhasan, N.U. & Adullahi, T. (2013). Revitalizing technical and vocational education (TVET) for youth empowerment and sustainable development. *Journal of Educational and Social Research*, 3(4) 55-61. Retrieved from: <http://doi.org/105901/jesr.2013.v3n4p49pdf>.

[3]. Asaju, K., Kajang, T. & Anyio, S.F. (2013). Human resources development and educational standard in Nigeria. *Global Journal of Human Social Science Linguistic and Education*, 13(7) 34-40. Retrieved from: <http://creativecommons.org/licenses/by-nc/3.0/>.

[4]. Bamidele, A. (2011). Vocational technical education, the state and citizenry in Nigeria. *A Paper Presented to the School of Vocational Education of the Federal College of Education (Technical) Akoka on Thursday, the 27<sup>th</sup> day of January, 2011*. Retrieved from <http://dx.doi.org/10.15640/jea.v2n2a16.pdf>.

[5]. Federal Republic of Nigeria (2016.) *National Policy on Education*. Lagos. NERDC press.

[6]. Gbollie, C., & Keamu, H. P. (2017). Student academic performance: The role of motivation, strategies, and perceived factors hindering Liberian junior and senior high school students learning. *Education Research International*, 2017.

[7]. Graff, Z. (2018). Getting Familiar with BIM 360 <http://www.thecadmasters.com/2018/08/07/bim-360-webinar-getting-familiar/>

[8]. Harris, J. L., Al-Bataineh, M. T., & Al-Bataineh, A. (2016). One-to one technology and its effect on student academic achievement and motivation. *Contemporary Educational Technology* 7 (4), 368-381.

[9]. Kumazhege, S. Z. (2015). *Effects of edutainment on academic achievement and motivation of students in motor vehicle mechanics work in technical colleges of Adamawa state*. Doctoral dissertation submitted to the Department of Technology Education, Modibbo Adama University of Technology Yola, Yola.

[10]. LaShaw, M.N., Sago, B. & Lambert, T. (2013). University student perceptions and learning outcomes of an experiential audit project. *International Journal of Business, Humanities and Technology*, 3(3) 33-40. Retrieved from <http://www.ijbhtnet.com>

[11]. Mousoulides, N., & Philippou, G. (2005, July). Students' motivational beliefs, self-regulation strategies and mathematics achievement. In *Proceedings of the 29th Conference of the International Group for the Psychology of Mathematics Education (PME)* 3, 321-328. Retrieved from: [http://emis.ams.org/proceedings/PME29/PME29CompleteProc/PME29Vol3Fug\\_Mou.pdf#page=327](http://emis.ams.org/proceedings/PME29/PME29CompleteProc/PME29Vol3Fug_Mou.pdf#page=327)

[12]. National Business and Technical Examinations Board (NABTEB)(2012). Chief examiner's report on the 2012 Nov/Dec National Technical Certificate (NTC) and Advanced National Technical Certificate (ANTC) examinations. Retrieved from: <http://www2.unesco.org/wef/countryreports/iraq/contents.html>.

[13]. National Business and Technical Examinations Board (NABTEB) (2015). *Syllabuses for Engineering Trades Based on NBTE Modular Curricula*. (Revised Edition).

[14]. Noor-Ul-Amin, S. (2008). An Effective use of ICT for Education and Learning by Drawing on Worldwide Knowledge, Research, and Experience: ICT as a Change Agent for Education: Retrieved from:

[15]. Okuntade, T.F. (2014). Building construction technician training: it's relevance to modern construction industry in Nigeria. *International Journal of Technology Enhancements and Emerging Engineering Research*, 2(3), 2347-4289. Retrieved from: <http://dx.doi.org/10.5169/seals-21509>.

[16]. Oluwale, B.A., Jegede, O.O. & Olamide, O.O. (2013). Technical and vocational skills development depletion in Nigeria and the need for policy intervention. *International Journal of Vocational and Technical Education*, 5(6) 100 - 109. Retrieved from: <http://www.academicjournals.org/ijvte>.

[17]. Sirswal, D.R. (2011). The meaning and objectives of education. *Merit Journal of Education and Review*, 3(4), 262-271. Retrieved from: <http://drsirwal.webs.com/>.

[18]. Tibangay, M.N. (2006). The integration of AutoCAD in teaching drafting in public secondary schools in Baguio city, Benguet State University, la Trinidad, Benguet. Retrieved from: <http://dx.doi.org/10.1016/0959>.

[19]. Uwakonye, O.A., Oluwole, O., Adedapo, A. & Taiye, A.G. (2015). Developing a new framework for integration and teaching of computer aided architectural design (CAAD) in Nigerian schools of architecture. *Journal of Education and Practice*, 6(3), 15-26. Retrieved from: <http://www.iiste.org>.

[20]. Wilfred, S. (2016). Effect of Multimedia Instruction on Performance of Students in Mechanical Engineering Craft Practice in Technical Colleges of Adamawa State. M. Tech dissertation submitted to the Department of Technology Education, Modibbo Adama University of Technology Yola, Yola.

[21]. Wodi, S.W. & Dokubo, A. (2012). Innovation and change in technical and vocational education in Nigeria: challenges for sustainable industrial development. *British Journal of Arts and Social Sciences*, 10(1)78-85. Retrieved from: <http://www.bjournal.co.uk/BJASS.aspx>.

APPENDIX

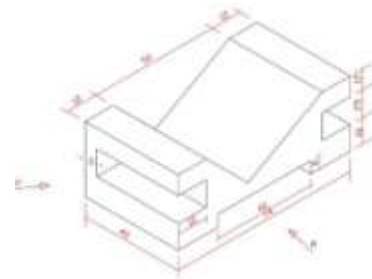
A. Building/Engineering Drawing Questions

1. Draw an ellipse by using the rectangular method given length of 130mm and a breadth of 65mm.
2. Using circular method, draw a regular pentagon with 25mm length.
3. Draw the development of a round pipe of 40mm intersecting a vertical cylinder of 40mm.

Use figure the below to answer questions 4 and 5. All dimension are in millimetres.

4. Draw the given isometric Vee-block to full scale in first angle orthographic project.

(a). The front elevation in the direction of arrow 'A.'(b). The plan view.



B. Questionnaire on Students' Motivation on the use of BED

S/ N	Item	SA	A	UD	D	SD
1	AutoCAD application instruction motivates me to set and achieved challenging skills targets					
2	AutoCAD application instruction motivates me to bring the best of my capability					

3	I find pleasure and satisfaction learning with AutoCAD application instruction					
4	AutoCAD application instruction motivates me to prove my capability in BED					
5	AutoCAD application instruction makes learning more like fun than an Activity					
6	AutoCAD application instruction motivates me to learn interesting new design and drawing skills					
7	AutoCAD application instruction gives me control over my class					

8	Teachers using AutoCAD application instruction motivates my learning style.					
9	AutoCAD application instruction motivates me to prepare better for the carrier I have chosen					
10	I felt motivate when I am using my own idea on AutoCAD application instruction to produce drawing designs					