



Combine Effects of Simulation, Drill and Practice on Students' Performance in Isometric Projection Concept of Building Engineering Drawing in Technical Colleges in Kaduna State, Nigeria

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ABSTRACT

This study investigated the combine effects of Simulation, Drill and Practice on students' performance and retention in Isometric Projection concept of Building Engineering Drawing in Technical Colleges in Kaduna State, Nigeria. The study was guide by three objectives, three research questions and three hypotheses. The study was conducted using One-Shot Case Study Quasi-experimental research design. Specifically, the pretest, posttest, post posttest non-randomized groups (intact classes) were used for the study. The Population of the study is 969. Comprised all the TS2 Technical College students from the six (6) Technical Colleges. The sample for this study comprised of 178 students with experimental group A comprising of 96 students and experimental group B 82. Two instruments, Simulation, drill and Practice Performance and Retention Test (SDPPRT) and Simulation, drill and Practice Satisfaction Inventory (SDPSI). Were used for data collection. Mean and standard deviation were used to analyze all the research questions. All the hypotheses were analyzed at 0.05 level of significance. findings revealed that; significant differences existed between academic performance of students taught Isometric Projection concept of building engineering drawing using simulation instructional strategy in favor of after the exposure to the simulation treatment; significant differences existed between academic performance of students taught Isometric Projection concept of building engineering drawing using drill and practice instructional strategy before and after treatment in favor of after the exposure to the drill and practice instructional strategy; there is no significant difference between academic performance of students taught projections drawing concepts of building engineering drawing using simulation and those taught using drill and practice instructional strategies; Based on the findings the study there for recommended among others; the use of simulation, drill and practice should be encouraged for the teaching of Isometric Projection concept of building engineering drawing, by providing necessary facilities needed for its effective implementation.

ARTICLE INFO

Article History

Received: September, 2023

Received in revised form: December, 2023

Accepted: March, 2024

Published online: June, 2024

KEYWORDS

Simulation, Drill and Practice, Performance, Retention and orthographic Projection

INTRODUCTION

Isometric Projection is a form of drawing that permit representation of component in three dimensional that is front view, side view and top view (plan view). Building engineering drawing

deals with graphical representations of ideas, knowledge or thought. Building engineering drawing is a means of clearly and concisely communicating all of the information necessary to transform an idea or concept into a reality Goetsh

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(2010). Therefore, building engineering drawing often contains more than just a graphical representation of its subject. It also contains dimensions, notes, tolerance and specifications. The Federal Government of Nigeria (FGN) in National Policy on Education (2013), and National Board for Technical Education (NBTE) stipulated that, building engineering drawing should be taught as a trade related course and should be taken by all students in technical colleges.

Building engineering drawing is a trade related course for all the trades in Technical Colleges (is offered by all technical college students as a general course) for the students to be able to draw and interpret drawings for the production of products in their various trades and occupations. The concern stemmed over poor performance, low and declined skill practice in performance and in NABTEB Examination. Pertinent questions and doubt were raised on the required competencies of technical drawing teachers currently teaching technical drawing in technical colleges. Sualaiman & Akeem (2014).

The picture emerging from research reports and chief examiners reports shows that students have difficulties in tackling with some building engineering questions. According to the report the candidate's weaknesses among others are lack of skills and knowledge on how to construct projection drawings, sectioning and assembly drawings. The decline in performance of engineering students in building engineering drawing is far reaching (Igbinomwanhia & Aliu, 2013).

Various factors that lead to the challenges students encounter in building engineering drawing which manifest itself in the inability of students to produce drawings of professional quality, reading and interpreting building engineering drawing Alkash & Alias, (2013). For an engineering graduate or engineer to future in all stage of design process and function optimally from conception to presentation of finished plans or product required good and proficient knowledge of building engineering drawing. It is therefore necessary that the training process shall be re-strategies for effective teaching and learning.

Reasons for the poor performance in building engineering drawing revolved round the in appropriate teaching methods or teaching strategy, inadequate teachers, lack of facilities and lack of finance to execute educational policies and projects are factors responsible for poor performance in building engineering drawing in Nigerian technical colleges. Other factors that militated against the performance of students in technical and engineering Drawing are poor background of students, truancy and language of the instruction of the teachers, among others Diraso, Manabete, Amola, Mbudai, Arabi & Jaoji (2013).

The teachers communicate instructions for acquisition of knowledge and skills to students in the teaching and learning process. Oke and Olakotan (2017). Teacher's novelty in dishing out good instructions rely heavily on their preparation and readiness at all times. The instructional delivery mode employed by building engineering drawing teacher plays an important role in skills acquisition and meaningful learning. Teachers knowledge, attitude and skills in teaching technical drawing that is less than excellent and in need of further enhancement Patrick, O. U., Raymond U. & Samuel C. N. (2019). Classrooms in all the technical colleges are dominated by chalkboard and marker boards. Also students on their parts confessed that they usually abscond classes, while some confessed that carrying drawing boards and T-squires to building engineering studio remain burdensome. Students have poor Engineering Graphic and Design Background; experienced difficulties in in understanding sectional drawings; lack of understanding sectional drawing principles; lack of knowledge of 2 dimension and 3 dimension sectional drawing as well as poor pedagogic practices. It has also transpired that students perform poorly in the spatial visualization test Moses, & Samuel, (2016).

The decline in performance of technical college students in building engineering drawing is far reaching (Igbinomwanhia & Aliu, 2013). A close examination of this results shows that building engineering drawing has the highest failure rate. This implies that most students that graduate from technical colleges may not achieve



their goals and aspiration of being self-reliance and further their studies into higher institutions. Many Technical College graduates are jobless, in extension this means that they are not competent to take up available job opportunities in industries, one should not anticipate them to be self-reliant and self-employed (Igbinomwanhia & Aliu, 2013).

Errors made in an attempt to interpret engineering documentation could pose some exigent catastrophe to the whole essence of design and production processes (Kosse and Senadeera (2011), reported a case where misinterpreted information due to lack of building engineering drawing knowledge hampered a fault resolving process. To avoid misinterpretation of working drawing, all the design and production or construction specifications should be properly detailed in form of detail drawing, in terms of quality and quantity, as inexplicit working drawings can lead to collapse or failure.

The effective utilization of using information and communication technology (ICT) in teaching and learning is based on the availability of facilities and teachers competence in using them. Hence enhancing students' performance in building engineering drawing require availability, adequacy and utilization of ICT facilities to match with the global practices. Relevant stakeholders responsible for the administration of technical colleges should procure ICT facilities for teaching and learning of building engineering drawing Oke & Olakotun (2019).

Building engineering drawing being an activity oriented subject should be taught using hands-on activities in the drawing studio that can cater for psychomotor domains of the learners. Such activities can be demonstrated, viewed and practiced in the drawing studio capable of displaying simulated videos. Computer simulations are products of the current development of digital and information technology Zubairu & Musa (2020), recommended the use of Computer Game, Drill and Practice in teaching. It is a logical consequence of adapting to the development of information and communication technologies, including the use of various virtual workshops and laboratories in teaching and

learning process (Saputri, 2021). Teaching building engineering drawing through computer simulation, drill and practice can cause students to gradually deduce the characteristics of the conceptual model of the computer, which in turn can lead to changes in the original perception of the students and lead to very high performance of students.

Objectives of the Study

The objective of the study is to determine the combine effects of simulation, drill and practice on students' performance and retention in Isometric Projection concept of building engineering drawing in technical colleges in Kaduna state, Nigeria. Specifically, the study will seek to:

1. compare the academic performance of students taught Isometric Projection concept of building engineering drawing using simulation and those taught using drill and practice instructional strategy in technical colleges in Kaduna state;
2. compare retention rate of students taught Isometric Projection concept of building engineering drawing using simulation and those taught using drill and practice instructional strategy in technical colleges in Kaduna state. And
3. compare students' satisfaction level in Isometric Projection concept of building engineering drawing taught using simulation, and those taught using drill and practice instructional strategy in technical colleges in Kaduna state.

Research Questions

The following research questions were formulated in line with the objectives of the study to guide the study:

1. What are the differences in students' academic performance taught Isometric Projection concept of building engineering drawing using simulation and those taught using drill and practice instructional strategies in technical colleges in Kaduna state?



2. What are the differences on students' retention rate taught Isometric Projection concept of building engineering drawing using simulation and those taught using drill and practice instructional strategies in technical colleges in Kaduna state?
3. What are students' satisfaction level taught Isometric Projection concept of building engineering drawing using computer, drill and practice instructional strategies in technical colleges in Kaduna state?

Research Hypotheses

The following null hypotheses were formulated to be tested:

HO₁: There is no significant difference between academic performance of students taught Isometric Projection concept of building engineering drawing using simulation and those taught using drill and practice instructional strategies in technical colleges in Kaduna state.

HO₂: There is no significant difference between retention ability of students taught Isometric Projection concept of building engineering drawing using simulation and those taught using drill and practice instructional strategies in technical colleges in Kaduna state

HO₃: There is no significant difference between satisfaction levels of students taught Isometric Projection concept of building engineering drawing using simulation and those taught Isometric Projection concept of building engineering drawing using drill and practice instructional strategies in technical colleges in Kaduna state

METHODOLOGY

The study was conducted using One-Shot Case Study Quasi-experimental research design. Specifically, the pretest, posttest, post posttest non-randomized groups (intact classes) was used for the study. Nworgu (2015), quasi-experimental research design permits the use of

intact classes. This design was adopted because it was not possible for the researcher to randomly sample the subjects and assign them to groups without disrupting the academic programme and the timetable of the Technical Colleges involved in the study. Hence, the design was considered quite suitable for conducting this study.

The Population of the study is 969. Comprised all the TS2 Technical College students from the six (6) Technical Colleges. This is made up of 877 boys and 92 girls. The study was carried out in Kaduna State, Nigeria, covering the six (6) Technical Colleges offering building engineering drawing in National Business and Technical Examination Board (NABTEB). These Colleges are: Federal Science and Technical College Kafanchan, Government Technical College Kajuru, Government Technical College Malali, Kaduna, Government Technical College Soba, Government Technical College Fadan Chawai and Government Technical College Abet. Zangon-Kataf.

The sample for this study comprised of 178 students from four intact classes nonrandomized selected from two Technical Colleges from the population of the study. The colleges were purposefully selected from six Technical colleges because of the availability of ICT facilities in the institutions. The Sample area were selected Experimental group A and Experimental Group B respectively because of availability of solar powered Information and communication Technology (ICT) facilities and projectors.

The instruments used by the researcher for collection of data for the study were; Simulation, drill and Practice Performance and Retention Test (SDPPRT) and Simulation Drill and Practice Satisfactory Inventory (SDPSI). Two instructional approaches were used for the study. The use of Computer Simulation in teaching Building Engineering Drawing instructional package in teaching the experimental group A while Drill and Practice in teaching building engineering drawing was used for the teaching of experimental group B. This is where the use of Building Engineering Drawing instructional strategies will employ practical illustrations and

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activities during the instruction. The pretest was administered to both the two experimental groups. After administering the pretest, the regular Building Engineering Drawing class teachers in the various technical colleges were trained and start the experiments. Each teacher is expected to use the appropriate instructional procedure developed from the test blue print for his group. Their guiding principle will the five days training to be received during the pre-experimental conference which was conducted for them by the researcher. During the training, the researcher discussed with them what should be required of them during the experiments. The experiments were conducted during the normal school hours using the school time- table for classes. The duration for the experiment was eight weeks. At the end of the experiment, the teachers administered the posttest to the subjects in the two groups. The pretest and posttest achievement questions will be the same in content for both

groups but were reshuffled. After two weeks of posttest, post posttest was conducted using the reshuffled posttest questions. The students were not informed about the post posttest in advance. The data collected from the pretest, posttest and post posttest on the instruments (performance test and satisfaction inventory), were kept separately for the two groups. For the purpose of answering the research questions and also testing the hypotheses for the study.

RESULTS

In answering the research questions all results were presents in the following tables

Question One: What are the differences in students' academic performance taught Isometric Projection concept of building engineering drawing using simulation and those taught using drill and practice instructional strategies in technical colleges in Kaduna state?

Table 1: Mean and Standard Deviation on difference between Academic Performances taught using Simulation and those taught using Drill and Practice.

Variable	Study Groups	N	Mean	STD	Mean difference
Mean Academic Performance	Simulation	96	23.338	2.716	0.929
	Drill & Practice	82	24.268	1.884	

According to the above descriptive Mean and standard deviations statistics in table 1, There is no statistical difference between academic performance of students taught Isometric Projection concept of building engineering drawing using simulation and those taught using drill and practice instructional strategies in technical colleges in Kaduna state. The academic performance of students taught Isometric Projection concept of building engineering drawing using computer simulation were 23.338 and those taught using drill and practice instructional strategies was 24.268. This

shows that both groups of students (simulation and drill and practice) strategies have almost the same level of mean academic performance when taught Isometric Projection concept of building engineering drawing

Question Two: What are the differences on students' retention rate taught Isometric Projection concept of building engineering drawing using simulation and those taught using drill and practice instructional strategies in technical colleges in Kaduna state?

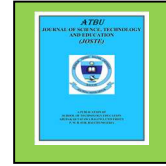


Table 2: Mean and Standard Deviation on difference between Retention Rate of Students taught using Simulation and those taught using Drill and Practice

Variable	Study Groups	N	Mean	STD	Mean difference
Retention Ability score	Simulation	96	24.822	3.234	7.664
	Drill & Practice	82	32.487	1.945	

According to the above descriptive mean and standard deviations statistics in table 2, difference exist between retention ability of students taught Isometric Projection concept of building engineering drawing using simulation and those taught using drill and practice instructional strategies in technical colleges in Kaduna state. The Retention ability of students taught Isometric Projection concept of building engineering drawing using simulation and those taught using drill and practice instructional strategies were 24.822 and 32.487 respectively with a mean retention ability difference of 7.664 in favour of

those students taught using drill and practice instructional strategies. This implies that the retention ability of students taught Isometric Projection concept of building engineering drawing with drill & practice is relatively higher than those taught with simulation

Question Three: What are students' satisfaction level taught Isometric Projection concept of building engineering drawing using simulation, drill and practice instructional strategies in technical colleges in Kaduna state?

Table 3: Mean Rank Non Parametric test on difference between satisfaction levels of students taught using simulation and those taught using drill and practice

	Study groups	N	Mean Rank	Sum of Ranks
SATISFACTION	Simulation	96	90.76	8712.50
	Drill & Practice	82	88.03	7218.50
	Total	178		

The outcome of the Mean Rank Mann Whitney statistics in table 3, revealed that; There is no statistical difference between satisfaction levels of students taught Isometric Projection concept of building engineering drawing using simulation and those taught projections concepts of building engineering drawing using drill and practice instructional strategies in technical colleges in Kaduna state. The computed Mean Rank satisfaction levels of students taught Isometric Projection concept of building engineering drawing using simulation and those taught Isometric Projection concept engineering drawing using drill and practice instructional strategies are 90.76 and 88.03 respectively. This

implies that the level of Mean Rank Satisfaction levels for the two groups (simulation and those taught projections concepts of building engineering drawing using drill and practice instructional strategies) are basically the same.

Hypotheses Testing

Hypothesis One: There is no significant difference between academic performance of students taught Isometric Projection concept of building engineering drawing using computer simulation and those taught using drill and practice instructional strategies in technical colleges in Kaduna state.

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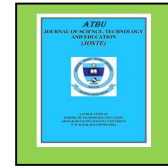


Table 4: Independent T Test Statistics on difference between Academic Performance of Students taught using Simulation and those using Drill and Practice

Variable	Study Groups	N	Mean	STD	Mean difference	Df	T computed	T critical	P
Mean Academic Performance	Computer Simulation	96	23.338	2.716	0.929	81	1.682	1.96	0.070
	Drill & Practice	82	24.268	1.884					

$P = 0.070 > 0.05, t_{computed} = 1.682 < 1.96 \text{ at } df \ 176$

According to the above independent t test statistics in table 4, there is no significant difference between academic performance of students taught Isometric Projection concept of building engineering drawing using simulation and those taught using drill and practice instructional strategies in technical colleges in Kaduna state. This is because the calculated p value of 0.070 is greater than the 0.05 alpha level of significance and the computed t value of 1.682 is below the 1.96 t critical at df 176. The academic performance of students taught Isometric Projection concept of building engineering drawing using simulation were 23.338 and those taught using drill and practice instructional strategies was 24.268. This shows that both groups of students have almost the same level of

mean academic performance Therefore the null hypothesis which state that There is no significant difference between academic performance of students taught Isometric Projection concept of building engineering drawing using simulation and those taught using drill and practice instructional strategies in technical colleges in Kaduna state, is hereby accepted and retained

Hypothesis Two: There is no significant difference between retention ability of students taught Isometric Projection concept of building engineering drawing using computer simulation and those taught using drill and practice instructional strategies in technical colleges in Kaduna state.

Table 5: Independent T Test Statistics on difference between Retention Ability of Students taught using Simulation and those taught using Drill and Practice

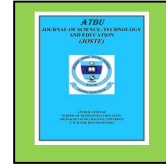
Variable	Study Groups	N	Mean	STD	Mean difference	Df	T computed	T critical	P
Retention Ability score	Computer Simulation	96	24.822	3.234	7.664	176	18.752	1.96	0.000
	Drill & Practice	82	32.487	1.945					

$P = 0.000 < 0.05, t_{computed} = 18.752 > 1.96 \text{ at } df \ 176$

According to the above independent t test statistics, significant difference exist between retention ability of students taught Isometric Projection concept of building engineering drawing using simulation and those taught using

drill and practice instructional strategies in technical colleges in Kaduna state. This is because the calculated p value of 0.000 is lower than the 0.05 alpha level of significance and the computed t value of 18.752 is higher than the

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1.96 t critical at df 176. The Retention ability of students taught Isometric Projection concept of building engineering drawing using simulation and those taught using drill and practice instructional strategies were 24.822 and 32.487 respectively with a mean retention ability difference of 7.664 in favour of those students taught using drill and practice instructional strategies. Therefore the null hypothesis which state that There is no significant difference between retention ability of students taught Isometric Projection concept of building engineering drawing using simulation and those

taught using drill and practice instructional strategies in technical colleges in Kaduna state, is hereby rejected.

Hypothesis Three: There is no significant difference between satisfaction levels of students taught Isometric Projection concept of building engineering drawing using computer simulation and those taught Isometric Projection concept of building engineering drawing using drill and practice instructional strategies in technical colleges in Kaduna state

Table 6: Mann Whitney Non Parametric Test on difference between Satisfaction Levels of Students taught using Simulation and those using Drill and Practice

	Study groups	N	Mean Rank	Sum of Ranks	Mann-Whitney U	Z	P
SATISFACTION	Simulation	96	90.76	8712.50	3815.50	0.353	0.724
	Drill & Practice	82	88.03	7218.50			
	Total	178					

Z score = 0.353 < Mann Whitney, P = 0.724 > 0.05

The outcome of Mann Whitney statistics in table 6, revealed that; There is no significant difference between satisfaction levels of students taught Isometric Projection concept of building engineering drawing using simulation and those taught Isometric Projection concept of building engineering drawing using drill and practice instructional strategies in technical colleges in Kaduna state

Reasons being that the calculated p value of 0.724 is above the 0.05 alpha level of significance and the computed Z score of 0.353 is lower than the 3815.5 Mann Whitney U score. The computed Mean Rank satisfaction levels of students taught Isometric Projection concept of building engineering drawing using simulation and those taught Isometric Projection concept of building engineering drawing using drill and practice instructional strategies are 90.76 and 88.03 respectively. This implies that level f Mean Rank Satisfaction levels for the two groups are basically the same. Therefore the null hypothesis which state that is there is no significant difference between satisfaction levels of students taught

Isometric Projection concept of building engineering drawing using simulation and those taught Isometric Projection concept of building engineering drawing using drill and practice instructional strategies in technical colleges in Kaduna state, is hereby accepted and retained.

DISCUSSION OF FINDINGS

The purpose of this study is to determine the combine effects of simulation, drill and practice on students' performance and retention in isometric concept of building engineering drawing in technical colleges in Kaduna state, Nigeria. It was established a pretest that; both the two experimental groups had equivalent knowledge of projection drawing concepts of building engineering drawing in technical colleges in Kaduna state, Nigeria. Therefore, the observed differences in the results were due to the treatments simulation, drill and practice instructional packages (CSDPIP) given to experimental groups at post posttest.

The finding of the analysis of the research question one shows that there is no significant difference between academic

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performance of students taught isometric projections drawing concepts of building engineering drawing using simulation and those taught using drill and practice instructional strategies in technical colleges in Kaduna state. This shows that the treatments given are effective and when both maintained very good performance on students in building engineering drawing would be maintained and simulation, drill and practice teaching strategies should be employed in teaching building engineering drawing as a means of improving students' performance in the subject. This finding is in conformity with that of Zubairu and Musa (2020) who recommend that both Computer Game, Drill and Practice can both be used in teaching Students since it enhances Students performance. The study also is in consonant with that of Suleiman and Yohanna (2018) who recommended that computer game, drill and practice can both be used in teaching students since it enhances students' performance.

The finding of the analysis of the research question two shows that significant difference exist between retention ability of students taught isometric projection drawing concepts of building engineering drawing using simulation and those taught using drill and practice instructional strategies in technical colleges in Kaduna State, in favour of those taught using drill and practice. The Retention ability of students taught projections drawing concepts of building engineering drawing using drill and practice instructional strategies is higher. This is in consonant with finding of Odogwu (2014). This study is related to the present study in that CAI is still part of instructions that depend on computer for its operation or usage just like computer tutorial and drill. Without computer, both instructions cannot work. The same procedures were used for the studies. The study also is in consonant with that of Mudasiru and Adedeji (2014) who recommend the use of micro-computers in special education like music in Tutorial, Drill and Practice methods of CAI

The finding of the analysis of the research question three shows that there is no significant difference between satisfaction levels of students taught projections drawing concept of

building engineering drawing using simulation and those taught projections concepts of building engineering drawing using drill and practice instructional strategies in technical colleges in Kaduna state. This shows that both the two groups have very high level of satisfaction meaning that this can improve students' performance this is in consonant with the findings of Lanre (2021) who concluded that the effectiveness of each of the treatment was not dependent on academic ability and finally that each of the three treatments were effective in improving students' performance. And also Zubairu and Musa (2020) recommend that Computer Game, Drill and Practice can both be used in teaching Students since it enhances Students performance. Also the study recommend that both male and female students be taught using Computer Game, Drill and Practice. Oke and Olakotun (2019) recommended that traditional mode of classroom instruction dominated the teaching and learning of technical drawing and that procurement of ICT facilities and retraining of technical drawing teachers would enhance teaching and learning of the subject. He further recommended, among others that relevant stakeholders responsible for the administration of technical colleges should procure ICT facilities for teaching and learning of technical drawing. And also Patrick, Raymond & Samuel (2019) also encourage good laboratory habits among technical drawing students and encouraged parents to equip their children with the required materials they need for effective learning of technical drawing. This is also in conformity with the study of Odogwu (2014) is related to the present study in that CAI is still part of instructions that depend on computer for its operation or usage just like computer tutorial and drill. Without computer, both instructions cannot work. The same procedures were used for the studies. Also Hong (2014) recommended that computer simulation may be an alternative to traditional teaching that produces comparable results. This research adds more knowledge to existing literature on integrating computer simulation into (technology) education.

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CONCLUSION

The use of simulation, drill and practice strategies improve the interest and satisfaction level of technical college students taught isometric projection drawing concepts of building engineering drawing, the intervention of simulation, drill and practice instructional strategy improve the academic performance of technical college students taught isometric projection drawing concepts of building engineering drawing, the retention ability of students taught projections drawing concepts of building engineering drawing with drill and practice is relatively higher than those taught with simulation, the level of Mean Rank Satisfaction levels for the two groups (simulation and those taught projections concepts of building engineering drawing using drill and practice instructional strategies) are basically the same.

RECOMMENDATIONS

The researcher put forward the following recommendations

1. Government should encourage teaching using of simulation, Drill and practice instructional strategies by enforcing the existing National Policy on ICT through liaising with National Information and Technology Development Agency (NITDA) in providing necessary Solar Powered ICT facilities needed for its effective implementation and by sponsoring building Engineering drawing teachers in technical college's to attend seminars and workshops as well as in house trainings that involve the use of simulation, Drill and practice instructional strategies and there should be adequate maintenance and supervision by the ministry of Education.
2. Teachers should encourage retention rate of students by using modern teaching strategies such as simulation, Drill and practice for teaching building engineering drawing that will increase students retention performance and retention,
3. Student's level of satisfaction towards the teaching of projection drawing concepts of building engineering drawing can be

sustained through intrinsic and extrinsic motivational plans put in place by each school.

REFERENCES

- Akasah, Z. A., & Alias, M. (2010). *Bridging the spatial visualization skills gap through engineering drawing using the whole-to-parts approach. Australasian Journal of Engineering Education*, 16(1), 81.
- Diraso, D. K., Menabeta, S. S., Amalo, K., Mbudai Y. D., Arabi, A. S. & Jaoji, A. A (2013), Evaluation of students' performance in technical and engineering drawing towards an effective career choice in engineering and technical and vocational education. *International Journal of Education Research and Development* 2(4). 089-097.
- Federal Ministry of Education (2013). National Policy on Information and Communication Technology (ICT) in Education. Abuja Federal Ministry of education.
- Goetsch, D. L., Chalk, W. S., Nelson, J. A. and Rickman, R. L. (2010). *Technical drawing and engineering communication (six edition)*. New York: Delmar Cengage Learning Publishers.
- Horn, M. & Staker H, (2014). *Blended: Using Disruptive Innovation to Improve Schools*. Cristian Institute: San Francisco: Jessey Bass.
- Igbinomwanhia, D. I., & Aliu, S. A. (2013). *Investigation of the continuing poor performance in engineering drawing in Nigerian universities – a case study of the University of Benin. Research Journal in Engineering and Applied Sciences*, 2(5), 346- 350.
- Kosse, V., & Senadeera, W. (2011). *Innovative approaches to teaching engineering drawing at tertiary institutions. International Journal of Mechanical Engineering Education*, 39(4), 323-333. <http://dx.doi.org/10.7227/IJMEE.39.4.5>

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- Lanre I. (2021) Effects of computerized simulation, drill and practice, and tutorial instructional packages on learning outcomes of fine-arts in Nigerian junior secondary schools. *Journal of Education and practice* ISSN222-1735 (paper) ISSN 2222-288X (online) 8(5)s
- Moses M. Samuel D. K. (2016), Difficulties of student teachers in the engineering graphics and design course at South African University: Snapshot of Sectional Drawing Eurasia Journal of Mathematics, Science & Technology Education. 12(4) 609-621. Mudasiru, M. & Emmanuel, C. (2014) Effect of Computer Animation Instructions (CAI) on Secondary School Student's Performance in Biology in Oyo State, Nigeria .
- Nworgu, B. G. (2015), *Educational Research. Basic Issues and Methodology.* Wisdom Houses
- Odogwu, H. N. (2014). *Female students' perception and attitude to mathematics: A bane to their STM education.* The Journal of the Mathematics Association of Nigeria. 27(1) 19 – 29.
- Oke, J. O., & Olakotan, O. O. (2019). *Enhancing Effectiveness in Teaching and Learning Technical Drawing for Sustainable Development in Nigerian Technical Colleges.* 1, 12– 18.
- Patrick, O. U., Raymond U., Samuel C. N. (2019), Students perception on teachers' knowledge, attitude and skills in the teaching of technical drawing in Edo and Delta States, Nigeria. *Journal of Trektoria Nauki=Path of Science* 5(5) 5001-5007 ISSN2413-9009.
- Sulaiman A. & Akeem U (2014) Competencies required by technical drawing teachers in technical colleges. *Journal of research & method in education e-ISSN: 2320-7388 P- ISSN2320-737X* 4(2)
- Zubairu, S. A., & Musa Y. S (2020), Effect of computer game, drill and practice on academic performance in Biology among Senior Secondary Schools Students in Maiduguri Metropolis, Borno State, Nigeria. *Bulgerian Journal and Education policy* 2(14) 462-477.