

**EFFECT OF COMPUTER-TUTORIAL ON STUDENTS PERFORMACE AND RETENTION
IN ORTHOGRAPHIC CONCEPT OF BUILDING ENGINEERING DRAWING IN
TECHNICAL COLLEGES, KADUNA STATE, NIGERIA**

BY

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Abstract

This study investigated the Effect of Computer-Tutorial on Students Performance and Retention in Orthographic Projection concept of Building Engineering Drawing in Technical Colleges, Kaduna State, Nigeria. The study was guide by two purpose of the study, two research questions and two hypotheses. The design of the study was Quasi-experimental research design. Specifically, the pretest, posttest, post posttest non-randomized groups, two intact classes were used for the study. The area of the study comprised six Technical Colleges in Kaduna State. The Population of the study was 969. Comprising all the TS2 students from the six (6) Technical Colleges. The sample for the study comprised 46 control group and 82 as experimental group. The instrument used for the data collection was Computer Tutorial Performance and Retention Test (CTPRT). Mean and standard deviation were used to analyze all the research questions. Paired Sample t-test was used to test the hypotheses at 0.05 alpha level of significance. The findings of the study revealed that; significant differences existed between academic performance of students taught Orthographic Projection concept of building engineering drawing using Computer Tutorial instructional strategy using experimental and control group in favour of experimental group; among others. Based on the findings of the study, the recommends among others; the use of Computer Tutorial should be encouraged for the teaching of Orthographic Projection concept of building engineering drawing, by providing necessary facilities needed for its effective implementations





Key Words: Orthographic Projection, Computer-Tutorial, Performance and Retention

Introduction

Orthographic Projection concept of building engineering drawing is a two dimensional representation of object to be interpreted and produce in production industry (Fazeeha, 2017). Building engineering drawing is a language of communication between technicians and engineers but unfortunately technical college graduates find it difficult to communicate and measure up to expectations after assessment at various levels, Oke & olakutan, (2019). The results of National Business and Technical Examination Board (NABTEB), certificate examinations over the years had shown poor performance in building engineering drawings of technical college students, for instance, National Business and Technical Examination Board (NABTEB), conducted in May 2022 showed very high the rate of failure (F9). According to the report, candidate's weaknesses among others are lack of skills and knowledge on how to construct projection drawings.

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 Patrick & Raymond (2019). 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 (2025, 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 Facilities such as drawing instruments, Infrastructure and facilities are necessity in every technical college, in order to develop a conducive teaching and learning environment for every student. The failure of the technical college administration, or Government to provide complete facilities and infrastructure caused various problems. Main problem in his study on technical college offering technical subjects were the inadequate workshop equipment, lack of ICT facilities, lack of

maintenance of equipment, limited learning software, and lack of teaching aids (Mohd-Taib & Mustapha, 2017). This happened since little to no provision was made to repair the little maintainable facilities since there is no separate budgetary provision for technical and vocational education in the country.

Many factors have been attributed to the poor performance in building engineering drawing subject, one of the factor is; teachers' competence, Learning and teaching experience in drawing are crucial to be known before deciding if a teacher should teach the Building Engineering Raihana, Mohd & Rufaizah, (2021)

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, Raymond & Samuel, (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 Moses & Samuel,(2016). It has also transpired that students perform poorly in the spatial visualization test (Moses, & Samuel, 2016).

However, they also agreed that they still need to acquire the latest knowledge and view that a teacher should be competent before teaching the students. On the other hand, teachers with less than 5 years experiences and below admitted that they are facing time constraints to find and prepare teaching materials. It takes quite a while to find and process the reference material before starting the lesson. Another factor is teachers Training Courses and training should be provided to new teachers who teach Building Engineering Drawing to further enhance their knowledge.

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However, the results of the conversation found that during the last 5 years, both new teachers and experienced teachers did not attend any courses or training related to the subject area. Everyone agreed that if they were given the opportunity, they would like to attend any training or courses related to Building Engineering Drawing to improve their knowledge and skills in teaching the subject. Additionally, Curriculum and content of the syllabus need to be improved and modified to meet the actual needs of Building Engineering Drawing. This will help the teachers to provide real knowledge and skills for the subject of Building Engineering Drawing. In addition, it is also needed to meet the real needs and aspirations of the learners and the industry.

Drawing subject. Teachers with 10 years of experience and above have less problems in teaching Building Engineering Drawing. The teachers communicate instructions for acquisition of knowledge and skills to students in the teaching and learning process. Oke & Olakotan (2017). Teacher's novelty in dishing out good instructions rely heavily on their preparation and readiness at all times.

Based on the observation and interview, all teachers agreed that the existing classroom were not suitable to be used as drawing studio for teaching building engineering drawing. The condition in the drawing studios including the facilities, lighting and airflow were not designed to ensure a comfortable learning environment for the students. It is suggested that to ensure the learning process to be effective, the condition of the drawing studios should to upgraded and improved. There is a need to set a benchmark or level for teachers to complete teaching in the drawing studios (Azodo, 2016). Teachers should be given guidelines to deliver their lessons in building engineering drawing. The fact is that in the technical colleges, the teachers do not know the extent to which lessons need to be completed. Many teachers conducted the lessons based only on their own perspective, although the curriculum and syllabus are present. For proper consultations, they still need a benchmark to know the extent of knowledge of Building Engineering Drawing to be taught to their students. This issue needs to be addressed so that

teachers will not be wasting their time on teaching the less important topics to technical college students. Asilokun, (2016).

All students in technical colleges are taught building engineering drawing as one of the requirement. This help to develop their spatial ability, design competence and expertise needed for problem solving prevalent in engineering profession. Asilokun, (2016). observed that there is drastic decline in performance level of Nigerian engineering students in building engineering drawing. Predominant challenges engineering students encounter in engineering drawing are difficulties to see an image in 2 & 3-dimensions, understanding of projection view methodology, producing drawings of professional quality, and reading and interpreting building engineering drawings (Azodo, 2016). Numerous factors lead to the challenges students encounter in building engineering drawing includes teaching approach, instructional and educational items, acquisition of the fundamental knowledge of the subject in secondary education, the learning atmosphere and time allocated for the subject (Asilokun, 2016).

Computer Tutorial are interactive and help students remember the concepts they have been taught previously (Raihana etal, 2021)

The CAI tutorial when used in combination with drill provides instruction in such a way that each tutorial lesson has a series of frame or branches. The frame or branch poses questions to students at the end of each lesson. Student answers questions about the lesson and gets immediate feedback. On each answer, if the student answers correctly, he will be told to proceed to the next frame but if the response of the student is otherwise, the package will take him or her back to the frame where the answer could be found or on the alternative gives the correct answer to the student before proceeding to a new frame. The student has to respond to every framed questions in the exact order presented and there is no deviation from this presentation but the student does have the freedom to work through the material at his or her own pace (Azodo, 2016). In addition, the use of computer tutorial and drill for instruction package brings with it

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several benefits as a teaching/learning medium. These include self-paced learning, self-directed learning, the exercising of various senses and the ability to represent content in a variety of media.

United Nations Educational, Scientific and Cultural Organization (UNESCO, 2017) and International Labour Organization (ILO) (2017) recommended that all technical and vocational education system in the 21st century should be geared towards lifelong learning. This requires that schools should in addition to academic skills; inculcate workplace basic skills such as learning to learn, creativity, problem solving skills, collaborative skills and higher order thinking skills in order to increase the students' flexibility and job mobility which will make them adaptable to the present and envisaged changes.

Purpose of the Study

The purpose of the study is to determine the effect of Computer Tutorial on students' performance and retention in Orthographic-Projection concept of building engineering drawing in technical colleges in Kaduna state, Nigeria. Specifically, the study will seek to:

- 1 compare the students' performance in experimental and control groups in Orthographic Projection concept of building engineering drawing taught using Computer Tutorial instructional strategy in technical colleges in Kaduna state,
- 2 compare the students' retention rate taught in Orthographic Projection concept of building engineering drawing using conventional teaching method and Computer Tutorial 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:

- 3 What are the students' performance in experimental and control groups in Orthographic Projection concept of building engineering drawing taught using Computer Tutorial instructional strategy in technical colleges in Kaduna state?
- 4 What are students' retention rate taught in Orthographic Projection concept of building engineering drawing using Computer Tutorial instructional strategy 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 Orthographic Projection concept of building engineering drawing using Computer Tutorial instructional strategy using experimental and control groups in technical colleges in Kaduna state.

HO₂: There is no significant difference between posttest scores and post posttest scores of technical college student's exposed to Computer Tutorial instructional strategy in Orthographic Projection concept of building engineering drawing in technical colleges Kaduna state.

Methodology

The study was conducted using Quasi-experimental research design. Specifically, the pretest, posttest, post posttest non-randomized groups (intact classes) were 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 area of the study comprised all the six (6) Technical Colleges offering building-engineering-drawing in National Business and Technical Examination Board (NABTEB). These Colleges are: Government Technical College Abet. Zangon-Kataf, Government Technical College Fadan Chawai, Government Technical College Kajuru, Government Technical College Malali. Kaduna, Government Technical College Soba, and Federal Science and Technical College Kafanchan.

The Population of the study was 969. Comprising all the TS2 students from the six (6) Technical Colleges, and the sample for this study comprised of 46 control group and 82 experimental group from two intact classes' nonrandomized selected The College was purposefully selected from six Technical colleges because of the availability of ICT facilities in the institution. In assigning the selected school in to experimental group; purposive sampling techniques was employed. Purposive sampling techniques is the deliberate selection of sample on the basis of the objectives of the research or sample done on purpose. Nworgu, (2015) pointed out that when there is element of interest among members of population, the researcher is free to purposefully select its sample.

The instruments used by the researcher for collection of data for the study was; Computer Tutorial Performance and Retention Test (CTPRT); the instrument consist of 10 items in Orthographic Projection concept of building engineering drawing. The researcher administer pretest for the period of one week, after teaching the experimental group for the period of six weeks. The researcher administered posttest, after two weeks the researcher also administered post posttest.

Mean and standard deviation was used to analyze all the research questions and paired sample t test to test all the hypotheses at 0.05 level of significance. Mean and standard deviation were used to analyze all the research questions. For the inferential analysis paired sample t test was used to test hypotheses at 0.05 alpha level of significance.

Findings

Presentation of Results: The findings of this Research were presented based on the research questions in the following tables:

Question One: What are the students' performance in experimental and control groups in Orthographic Projection concept of building engineering drawing taught using Computer Tutorial instructional strategy in technical colleges in Kaduna state?

Table 1: Descriptive Mean and Standard Deviations Statistics on Differences Between Control and Experimental Performances of Students.

Variables	N	Mean	STD	Mean difference
Control	46	11.561	3.154	25.414
Experimental	82	36.975	1.777	

The descriptive Mean and standard deviations statistics in table 1 showed that differences exist between performances of students taught Orthographic Projection concept of building engineering drawing using Computer Tutorial instructional strategy using experimental and control group in technical colleges in Kaduna. The performance of students in Orthographic Projection concept of building engineering drawing in Control group was 11.561 and it increased to 36.975 after taught with the computer simulation instructional strategy, indicating a mean difference of 25.414 in favour of experimental group (after the exposure to the Computer Tutorial instructional strategy). This clearly shows that the intervention of Computer Tutorial instructional strategy has had great effect on their academic performance of students taught Orthographic Projection concept of building engineering drawing.

Question Two: What are students' retention rate taught in Orthographic Projection concept of building engineering drawing using Computer Tutorial instructional strategy in technical colleges in Kaduna state?

Table 2: Mean and Standard Deviation Statistics on Difference in Posttest Scores and Post Posttest Scores

Variables	N	Mean	STD	Mean difference
Post Test	82	36.975	1.777	4.48780
Post Posttest	82	32.487	1.945	

Table 2 showed the scores and post posttest scores of student's exposed to Computer Tutorial instructional strategy in Orthographic Projection concept of building engineering drawing in technical colleges in Kaduna state. The Post test and Post Post test scores are 36.975 and 32.487 respectively indicating a mean difference of 4.487 in favour of the Post test. This clearly shows that the Post test score of the Computer Tutorial instructional strategy is higher than the post posttest of the Computer Tutorial instructional strategy. This indicated that the performance of student decreased after some period of time.

Hypothesis One: There is no significant difference between academic performance of students taught Orthographic Projection concept of building engineering drawing using Computer Tutorial instructional strategy using experimental and control group in technical colleges in Kaduna state.

Table 3: Paired Sample T Test Statistics on Difference between Academic Performances of Students Taught Orthographic Projection

Variables	N	Mean	STD	Mean difference	Df	T computed	T critical	P
Control	46	11.561	3.154	25.414	81	66.371	1.96	0.000
Experimental	82	36.975	1.777					

$P = 0.000, t_{computed} = 66.371 > 1.96$ at df 126

Table 3 shows Paired sample t test statistics, significant differences exist between academic performance of students taught Orthographic Projection concept of building engineering drawing using Computer Tutorial instructional strategy using experimental and control group in technical colleges in Kaduna Reasons being that; the calculated p value of 0.000 is lower than the 0.05 alpha level of significance and the computed t value of 66.371 is greater than the 1.96 t critical at df 81. The academic performance of students in Orthographic Projection concept of building engineering drawing taught using Conventional teaching methods (Control Group) was 11.561 and it increased to 36.975 after taught with the computer simulation instructional strategy (Experimental Group), indicating a mean difference of 25.414 in favor of after the exposure to the Computer Tutorial instructional strategy (Experimental Group),. This clearly shows that the intervention of Computer Tutorial instructional strategy has had great effect on students' performance. Therefore the null hypothesis which state that; there is no significant difference between academic performance of students taught Orthographic Projection concept of building engineering drawing using Computer Tutorial instructional strategy using experimental and control group in technical colleges in Kaduna state, is hereby rejected

Hypothesis Two: There is no significant difference in posttest scores and post posttest scores of technical college student's exposed to Computer Tutorial instructional strategy in Orthographic Projection concept of building engineering drawing in technical colleges Kaduna state.

Table 4. Paired Sample T Test Statistics on Difference in Posttest Scores and Post Posttest Scores

Variables	N	Mean	STD	Mean difference	Df	T computed	T critical	P
Post test	82	36.975	1.777					
Post-Post Test	82	32.487	1.945	4.48780	81	14.901	1.96	0.002

P = 0.002, t computed = 14.901 > 1.96 at df 81

Table 4 shows Paired sample t test statistics, significant difference exist between posttest scores and post posttest scores of student's exposed to Computer Tutorial instructional strategy in Orthographic Projection concept of building engineering drawing in technical colleges in Kaduna state. Reasons being that the calculated p value of 0.002 is lower than the 0.05 alpha level of significance and the computed t value of 14.901 is greater than the 1.96 t critical at df 81. The Post test and Post Posttest scores are 36.975 and 32.487 respectively indicating a mean difference of 4.487 in favour of the Post test. This clearly shows that the Post test score of the Computer Tutorial instructional strategy is higher than the post posttest of the Computer Tutorial instructional strategy. Therefore the null hypothesis which state that There is no significant difference between posttest scores and post posttest scores of student's exposed to Computer Tutorial instructional strategy in Orthographic Projection concept of building engineering drawing in technical colleges in Kaduna state, is hereby rejected

Discussion

The finding of the analysis of the research question one shows that significant differences existed between academic performances of students taught projection drawing concepts of building engineering drawing using Computer Tutorial instructional strategy using experimental and control group in technical colleges in Kaduna State. In favour of experimental group. This shows that the treatment given is also effective and when maintained very good performance on students in building engineering drawing would be maintained and Computer Tutorial teaching strategy 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 (Lanre, 2021) who also concluded that the effectiveness of each of the treatment was not dependent on academic ability and finally that treatments were effective in improving students' performance. This finding is also in conformity with that of Patrick, Raymond & Samuel (2019) they always 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. Further, students perceived their teachers effective in preparing and organizing lesson notes adequately as such applied facts and principles to problem-solving.

The finding of the analysis of the research question two shows that significant difference existed between posttest scores and post posttest scores of student's exposed to Computer Tutorial instructional strategy in orthographic projections concepts of building engineering drawing in technical colleges in Kaduna state in favour of posttest. This shows that the performance of students also declined after some period of time and if the teachers of building engineering drawing will be trained in how to utilize computer packages in teaching there will be high retention ability by the students, this is in consonant of the recommendation made by Oke and Olakotun (2019) who recommended that procurement of ICT facilities and retraining of technical drawing teachers would enhance teaching and learning of the subject.

Relevant stakeholders responsible for the administration of technical colleges should procure ICT facilities for teaching and learning of technical drawing. Patrick, Raymond and Samuel (2019) 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. Further, students perceived their teachers effective in preparing and organizing lesson notes adequately as such applied facts and principles to problem-solving. The findings support the conclusion that there are aspects of teachers' knowledge, attitude and skills in teaching technical drawing that is less than excellent and in need of further enhancement.

Conclusion

In conclusion the following points could be deduced:

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1. the intervention of Computer Tutorial instructional strategy has had great effect on performance of technical college students taught Orthographic Projection concept of building engineering drawing;
2. the Post test score of the Computer Tutorial instructional strategy is higher than the post test score of the Computer Tutorial instructional strategy;

Recommendations

The researcher put forward the following recommendations

1. The use of Computer Tutorial instructional strategy in teaching building engineering drawing improved the performance of students in present study; therefore building engineering drawing teachers should endeavor to encourage students to use Computer Tutorial as an alternative strategy or incorporate this instructional strategy with other teaching methods in order to improve the teaching and learning of building engineering drawing in technical colleges in which building engineering drawing should be taught through Computer Tutorial for effective performance.
2. Teachers should lay emphasis on the use of Computer Tutorial since retention rate on students in Computer Tutorial is higher when teaching using Computer Tutorial instructional strategy, this will make the students perform better in external examinations such as NANTEB. And Government should motivate teachers by sponsoring them to attend seminars and workshops as well as in house trainings that involve the use of Computer Tutorial instructional strategy for the teaching and propagating the teaching of orthographic projection drawing concepts of building engineering drawing.

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