

EFFECT OF DRILL AND PRACTICE ON STUDENTS PERFORMANCE AND RETENTION IN ORTHOGRAPHIC CONCEPT OF BUILDING ENGINEERING DRAWING IN TECHNICAL COLLEGES IN KADUNA STATE, NIGERIA

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Abstract

The study was guided by two objectives, two research questions and two hypotheses. Quasiexperimental research design was used for this study. Specifically, the study population comprised of 128 TS2 Government Technical College Soba students. The sample for the study comprised of 82 students as experimental. The instrument used for the data collection was Drill and Practice Performance and Retention Test (DPPRT). Mean and standard deviation was used to analyze all the research questions. All the hypotheses were tested at 0.05 level of significance. Findings revealed that; significant differences existed between academic performance of students before and after treatment in favor of after treatment, significant difference existed between posttest scores and post posttest scores of students in favour of the Posttest; the study concludes that the intervention of drill and practice instructional strategy has had great effect of academic performance of technical college students taught Orthographic projection concept of building engineering drawing. Based on the findings of the study, it recommends among others; the use of drill and practice should be encouraged for the teaching of Orthographic Projection concept of building engineering drawing, by providing necessary facilities needed for its effective implementation.

Keywords: Orthographic Drawing, Drill and Practice, Performance and Retention

Introduction

Technical Colleges are Vocational Training Institutions in Nigeria. They give full training intended to prepare students for entry into various occupations in the field of engineering. Technical College students require knowledge, skills and competency that will enable them to be employable, self-reliant or proceed to higher institutions for training in the fields of engineering. Technical college graduates are likely to make great contributions to the development of society and the Nation at large from their career choices in the field of engineering, Technical and Vocational Education. (Diraso, Manabete, Amola, Mbudai, Arabi & Jaoji, 2014).

Orthographic Projection concept of building engineering drawing is a two dimensional representation of object to be interpreted and produce in production industry. 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. 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 (1140 students sat for the examination, 359 passed with credit, indicating 29%. And 781 failed indicating 69%) According to the report, candidate's weaknesses among others are lack of skills and knowledge on how to construct orthographic projection drawings, sectioning and assembly 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 (Goetsh, 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.

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 a teacher should be assign to teach Building Engineering 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.

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-squares to building engineering studio remain burdensome. Students have poor Engineering Graphic and Design Background; experienced difficulties 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. (Raihana, Mohd, & Rufeizah, 2020). 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. However, the results of the conversation from Raihana, Mohd, & Rufeizah, (2020). 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 (Raihana, Mohd, & Rufeizah, 2020). 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.

An observation and interview conducted by Raihana, Mohd, & Rufeizah, (2020), revealed that 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 (Kosse & Senadeera 2011), 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. Igbinomwanhia & Aliu, (2013).

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. Igbinomwanhia and Aliu (2013), 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 (Akasah & Alias, 2010). 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 (Igbinomwanhia & Aliu, 2013; Diraso 2013).

Drill and Practice are interactive and help students remember the concepts they have been taught previously (Mudasiru & Adedeji 2010). 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 (Mudasiru and Adedeji 2010).

In addition, the use of computer tutorial and drill for instruction package brings with it 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 (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.

Objectives of the Study

The general objective of the study is to determine the effect of drill and practice 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. examine the effect of drill and practice on students' academic performance taught Orthographic Projection concept of building engineering drawing using drill and practice instructional strategy before and after treatment in technical colleges in Kaduna state;
2. ascertain students' retention rate in Orthographic Projection concept of building engineering drawing 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 students' academic performance before and after treatment in Control and experimental groups taught Orthographic Projection concept of building engineering drawing taught using drill and practice instructional strategy in technical colleges in Kaduna state?
- 2 What are students' retention in Control and experimental groups taught rate taught in Orthographic Projection concept of building engineering drawing using drill and practice instructional strategy in technical colleges in Kaduna state?

Methodology

The study was conducted using 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 128 Technical Students Class two of Government Technical College Soba. The sample for this study comprised of 82 students from two intact classes' nonrandomized selected purposive sampling technique was used. In assigning the selected school in to experimental groups; 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; drill and Practice Performance and Retention Test (DPPRT); 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.

Analysis of covariance (ANOVA) was used to analyze all the research questions

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’ academic performance before and after treatment in Control and experimental groups taught Orthographic Projection concept of building engineering drawing taught using drill and practice instructional strategy in technical colleges in Kaduna state?

Table 1 Analysis of Covariance of students’ academic performance before and after treatment in Control and experimental groups

Tests of Between-Subjects Effects
Dependent Variable: Performance

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	36269.981 ^a	3	12089.994	1714.318	.000
Intercept	103996.734	1	103996.734	14746.368	.000
Groups	9219.667	1	9219.667	1307.316	.000
Tests	16178.193	1	16178.193	2294.010	.000
Groups * Tests	8453.500	1	8453.500	1198.676	.000
Error	2087.499	296	7.052		
Total	149180.000	300			
Corrected Total	38357.480	299			

a. R Squared = .946 (Adjusted R Squared = .945)

Descriptive Statistics

Dependent Variable: Performance

Groups	Tests	Mean	Std. Deviation	N
Control	pretest	11.0882	2.88452	68
	Posttest	15.1765	2.64260	68
	Total	13.1324	3.43578	136
Drill & Practice	pretest	11.5610	3.15484	82
	Posttest	36.9756	1.77761	82
	Total	24.2683	12.99934	164
Total	pretest	11.3467	3.03445	150
	Posttest	27.0933	11.10919	150
	Total	19.2200	11.32634	300

Table one showed that differences exist in the performances of Pretest and the post test performance of the Drills and practice and control study groups Reasons being that at the

Groups versus the Tests scores the calculated p value of 0.000 is lower than the 0.05 alpha level and its computed F value of 1198.676 is greater than the 3.00 F critical value a df 1. Its computed performances showed that At the control study group, the scores for pre and post are 11.088 and 15.176 respectively. While at the Drill & Practice study group, the scores for pre and post are 11.561 and 36.975 respectively

Question Two: What are the difference in students’ retention ability in Control and experimental groups taught rate taught in Orthographic Projection concept of building engineering drawing using drill and practice instructional strategy in technical colleges in Kaduna state?

Table 2 Analysis of Covariance of students’ retention in Control and experimental groups

Tests of Between-Subjects Effects

Dependent Variable: Tests

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	13183.508 ^a	3	4394.503	1295.024	.000
Intercept	240277.207	1	240277.207	70807.736	.000
Post	1320.540	1	1320.540	389.153	.000
Groups	11829.634	1	11829.634	3486.097	.000
Post * Groups	5.554	1	5.554	9.637	.002
Error	1004.439	296	3.393		
Total	266720.000	300			
Corrected Total	14187.947	299			

a. R Squared = .929 (Adjusted R Squared = .928)

Descriptive Statistics

Dependent Variable: Tests

Post and Post Post	Groups	Mean	Std. Deviation	N
Posttest	Control	21.0882	1.78497	68
	Drill & Practice	37.1098	1.74982	82
	Total	29.8467	8.19374	150

Post-Post	Control	17.1471	1.84686	68
	Drill & Practice	33.1463	2.62994	82
	Total	25.8933	8.31603	150
Total	Control	19.1176	2.68068	136
	Drill & Practice	35.1280	2.98494	164
	Total	27.8700	8.47580	300

Table 2 showed that significant differences exist in the performances of post and the Post-Post performance of the two study groups. Reasons being that at the Groups versus the Post/Post-post scores the calculated p value of 0.002 is lower than the 0.05 alpha level and its computed F value of 9.637 is greater than the 3.00 F critical value a df 1. Its computed performances showed that At the Control group, posttest and Post-Post scores are 21.088 and 17.147 respectively. AT the drills & Practice study group, posttest and Post-Post scores are 37.109 and 33.146 respectively.

1. methods in orthographic projection drawing concepts of building engineering drawing in technical colleges in Kaduna state in favour of posttest.

Discussion of Findings

The purpose of this study is to determine the effects of drill and practice on students' performance and retention in orthographic projection concept of building engineering drawing in technical colleges in Kaduna state, Nigeria. It was established at pretest that; both the two groups had equivalent knowledge of orthographic 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 drill and practice instructional packages (CSDPIP) given to experimental group at post posttest, and the control group has less effect in terms of performance of students.

The findings of the research question one shows that significant difference existed between the performances of Pretest and the post test performance of the Drills and practice instructional strategy and conventional teaching method (control study groups) Reasons being that at the Groups versus the Tests scores before and after treatment in favour of after treatment in technical colleges in Kaduna State. This shows that the treatment given is effective and when maintained very good performance on students in building engineering drawing would be maintained and drill and practice 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 Okwuduba (2018) who reported that drill and practice should be employed in chemistry teaching as a means of improving students' achievement in the subject and providing a real life experiment for dangerous chemistry practical's, this is also in conformity with the findings of Lanre (2021) It also concluded that the effectiveness of each of the treatment was not dependent on academic ability and finally that each treatment was effective in improving students' performance. Mamamn and Garba (2019) also recommended that teachers should be trained on development and utilization of

multimedia facility in their teaching through seminar, workshop and conference; Teachers should be encourage to adopt the use of appropriate multimedia facilities that will arouse student's interest.

The finding of the analysis of the research question two shows that significant difference existed between post posttest scores of conventional teaching methods (control group) and post posttest scores of student's exposed to drill and practice instructional strategy in orthographic projection drawing concepts of building engineering drawing in technical colleges in Kaduna state in favour of in favour of those taught using drill and practice. The Retention ability of students taught orthographic 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 microcomputers in special education like music in Tutorial, Drill and Practice methods of CAI

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.

Summary of Findings

The following are the Summary of Findings of the Study:

1. There was significant differences existed between academic performances of students taught orthographic projection drawing concepts of building engineering drawing using drill and practice instructional strategy before and after treatment and conventional teaching methods (control group) in technical colleges in Kaduna State. In favour of drill and practice instructional strategy.

There was significant difference existed between posttest scores and post posttest scores of student's exposed to drill and practice instructional strategy and conventional teaching

Conclusion

The use of drill and practice instructional strategy improve the performance level of technical college students taught orthographic projection drawing concepts of building engineering drawing, the intervention of drill and practice instructional strategy improve the academic performance of technical college students taught orthographic projection drawing

concept 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 conventional teaching methods (control group),

Recommendations

The researcher put forward the following recommendations

1. Teachers' should use of drill and practice learning strategy in teaching building engineering drawing improved the performance of students in present study; therefore building engineering drawing teachers should endeavor to use drill and practice as an alternative strategy or incorporate this instructional technique 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 drill and practice for effective performance. Through encouragement by Government 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 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 Drill and practice for teaching building engineering drawing that will increase students retention performance and retention, Teachers' should lay emphasis on the teaching using Drill and practice since retention rate on students in drill and practice is higher when teaching using simulation, Drill and practice instructional strategies, this will make the students perform better in external examinations such as NANT

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