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The Effects of Peyton'S Four-Step Model on Students' Learning Retention of Brick/Blocklaying and Concreting in Technical Colleges in Northeast, Nigeria

Akeem Usman*

School of Secondary Education (Technical), Federal College of Education (Technical), Gombe, Nigeria

Corresponding Author: akeemfcegombe@gmail.com

ABSTRACT

Brick/Blocklaying and Concreting (BBC) is a course offered in Technical Colleges in Nigeria that involve the exhibition of practical skill acquired by a learner. This study examined The Effects of Peyton's Four-Step Model on Students' Learning Retention of Brick/Blocklaying and Concreting in Technical Colleges in Northeast, Nigeria.The research employed quasi experimental research design with pre-test, post-test non-equivalent group design. The population for the study comprised 319 respondents National Technical Certificate (NTC) II students of BBC, from 19 Technical Colleges. Six technical colleges were selected in the zone using purposeful sampling technique; the sample size for the study was 103 NTC students. Instruments for data collection were Brick/Blocklaying and Concreting Cognitive Achievement Test (BBCCAT), and Brick/Blocklaying and Concreting Psychomotor Achievement Test (BBCPAT). The instruments were validated by experts. The data collected was analyzed in line with the research questions and hypotheses. The mean gain was used to answer research questions, while Analysis of covariance (ANCOVA) was used to test the null hypotheses at 0.05 level of significance, with the use of Statistical Package for Social Sciences (SPSS). The study found out that Peyton's Four-step model: demonstration, reconstruction, comprehension and performance were significantly more effective in improving students' retention in Brick/Blocklaying and Concreting than conventional method. The researcher recommends that: Peytons' Four-step model should be incorporated into the content and methodology course of NTC programme of Brick/Blocklaying and Concreting, and should be extended to other vocational areas after its effect have been determine in those areas.

Keywords: Peyton's Four-step Model, Brick/Blocklaying and Concreting, Academic Achievement, Retention.

INTRODUCTION

Technical colleges in Nigeria are designed to produce craftsmen at the craft level and master craftsmen at the advance craft level. The courses offered at the technical colleges lead to the award of National Technical Certificate (NTC) as contained in National Board for Technical Education (NBTE) Curriculum (2001). The curriculum of technical colleges according to Federal Republic of Nigeria (FRN, 2014) is grouped into related trades. These trades include; the computer trades, electrical/electronic trades, mechanical trades and building construction trades. Building construction trades embody: painting and decorating, plumbing and pipe fitting, machine woodworking, carpentry and joinery, furniture making and upholstery, bick/blocklaying and concreting (BBC), (FRN, 2014).

BBC is a course offered in technical colleges in Nigeria that involve the exhibition of practical skill acquired by a learner. BBC is aimed at giving students adequate knowledge and skills for securing jobs, (Tafida, Ali, and

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Buba, 2018). BBC activities in the technical college curriculum involve the skills required in accomplishing given tasks in mixing of mortars by hand, moulding of blocks, laying of blocks, rendering of walls, wall tiling, pointing top walls and laying of curved walls (arches). It also involves workability test on concrete (slump test), placing of concrete, application of admixture to concrete, compaction, curing of concrete and fixing of concrete joint materials, (Usman, 2021). The students perform these activities using tools and necessary equipment while teachers or examiners assess their academic achievement based on their skills.

Academic achievement connotes academic performance in school subject as symbolised by a score or mark on an achievement test. Barowski and Carter (2021) stated that academic achievement is the amount of academic content a student learns in a specific period. This can be any way a student has achieved short-term or long-term academic goals within an academic setting. Kenni (2020) remarked that students' academic achievement is a major yard stick for job placement and evaluating school performance and teaching methods. Kenni further observed that lack of suitable teaching approaches resulted to low academic achievement of the learners in schools especially, females in technical colleges.

In the same view, Ahmed (2014) reported that during the pre-accreditation resources inspection of some technical colleges in North-east by experts from NBTE, they clearly specified in clear terms the rate of poor performance of students in academic achievement in North-eastern Nigeria. Ahmed further revealed that only 1,979, about 26% of the 7,517 students that sat for West African Examination Council (WAEC) and National Business and Technical Examination Board (NABTEB) examinations in 2012/2013 session, scored five credits for admission into the Universities and other degree awarding institutions. The percentage pass was too low especially that of the females, that even parents have started withdrawing their female students for early marriage and this trend seem not to have change. The probable reason for this poor performance could be due to lack of trained teachers, instructional strategy among others, (Medugu, 2017). According to NABTEB 2014 and 2015 chief examiners' report, the poor achievement in BBC was due to poor response to practical questions by candidates. Research study conducted by Tafida, Ali, and Buba, (2019), affirmed that regular poor academic achievement by the majority of students is fundamentally linked to application of ineffective (or unsuitable/inappropriate) teaching methods by teachers in process of imparting knowledge to learners. However, Peyton's four-step model has been proven to be effective in skills training of technical skills (krautter et al, 2011), hence student-centered approach to teaching that can foster critical thinking.

Peyton's four-step model by Rodney Peyton of the Royal College of Surgeon is an instructional strategy to teach technical skills to learners, (Peyton in Usman, 2021). Peyton' Four-Step model consist of: (1) Demonstration: The teacher performs the skill in normal speed with little or no explanation. (2) Deconstruction: The teacher performs every step slowly with full explanation, encouraging students to ask questions. (3) Comprehension: The teacher performs the skill for the third time, with the students providing the explanation of each step and being questioned on key issues. The teacher provides necessary corrections. This step may need to be repeated several times until the teacher is satisfied that the learner fully understands the skill. (4) Performance: The student now carries out the skill under close supervision describing each

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step before it is taken. The four-step model ensures that the teacher breaks the process into manageable steps, asks the student to vocalize the steps, and provides repetition to reinforce the students' responses and correct mistakes. However, the shortcomings of the present conventional teaching methods partly accounted for the poor performance of BBC students in the NTC Examination due to low retention of topics learnt.

Retention has to do with recalling and retaining of the learned knowledge. According to Safo, Ezenwa and Wushishi (2013), retention is the ability to keep or retain the knowledge of what is learnt and be able to recall it when it is required. Retention is one of the factors that could affect student's academic achievement. It is the process by which a student stores the modeled information in memory for use at a later time. Ngwoke and Eze (2010) observed that retention is one of the processes involved in observational learning. Retention is the preservative factor of the mind, (Ukpoh and Samuel, 2021). Whatever touches consciousness leaves trace or impression and is retained in the mind in form of images. A student's retention rate in BBC depends on ability to code or organize information in a manner that will ensure easy recall. For example, in practical lesson, the content of the topic is setting out of a building. If the students are grouped into two, one group adopts 3:4:5 method of setting out while the second group uses builder's square method, any student who participated in the work will be interested in setting out and will always remember the processes involved in setting out. The teacher should make teaching meaningful because meaningful activities in BBC create interest and motivation and aids retention of what is learnt. It is against this background that the study is on the effects of Peyton's Four-Step model on the learning retention of BBC Students in technical colleges in Northeast, Nigeria. It therefore becomes necessary that empirical investigation be carried out to determine the difference in the retention of students when exposed to the instructional model.

Research studies conducted strongly relate academic achievement of students to the methods of teaching adopted by the teachers. Retention is one of the factors that could affect student's academic achievement in BBC. The common used teaching methods by teachers of technical colleges are lecture and demonstration methods which are teacher – centred and often create frustration and learning difficulties for students. The shortcoming in the teacher-centred method of teaching could be responsible for poor academic achievement of BBC students in examinations.

National Business and Technical Education Board (NABTEB) May/June Chief Examiners' report of 2002 indicated that shortcomings of using inappropriate teaching strategy partly accounted for the low academic achievement of students in vocational courses in the NTC examination. According to the NABTEB (2014; 2015 and 2016), the performance of BBC students in NTC examination was poor. The report showed that the low level of achievement in vocational courses was lower than expectation. The low academic achievement of students in brick/blocklaying and concreting might be as a result of not using modern instructional methods by the technical teachers

Consequently, the need arises to find out with aid of empirical data the most effective teaching strategies that will enhance students' achievement in BBC. Therefore, the study is designed to determine if this teaching approach, Peyton's four- step model will better assist in enhancing students'

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achievement and retention in BBC in technical colleges in Northeast, Nigeria.

Research Questions

(1) What is the effect of Peyton's four-step model on students' cognitive achievement in Brick/Blocklaying and Concreting (BBC)?

(2) What is the effect of Peyton's four step model on students' psychomotor achievement in Brick/Blocklaying and Concreting (BBC)?

(3) What is the effect of and Peyton's four step model on students' retention of knowledge in BBC?

(4) What is the effect of Peyton's four step model and gender on students' retention in Brick/Blocklaying and Concreting?

Hypotheses

HO_1: There will be no significant difference between the mean retention scores of students taught BBC with Peyton's four step model and those taught with Conventional teaching method.

$H0_2$**:** There will be no significant interaction effect of Peyton's four-step model and gender on students' retention in Brick/Blocklaying and Concreting.

Theoretical Framework

Brunner's Theory of Instruction

The theory of instruction propounded by Brunner (1966) postulated that any subject can be taught effectively in some intellectually honest way to a learner at any stage of development provided the teacher knows what to teach and can break the learning experiences to the level of the learner. This theory emphasizes, the use of one's hands and mental process to discover and practice some concepts and then incorporate it with the already existing experiences. Brunner believes that teaching is helpful only if the learner can act it out. Thus, learning occurs by doing, acting, imitating and manipulating objects.

The theory has a close relationship with the study in that Peyton's four-step model is patterned in such a way that learners can embark on the activities presented to them in sequential order. The skills in BBC are arranged in sequence to enable learners acquire the step-by-step activities in observable manner towards the intended learning outcomes. BBC which is one of the vocational subjects taught at the technical colleges is still being taught with methods which are based on the behavioural learning theories. These methods do not provide for student adverse disposition and encourage rote memorization, which does not promote retention of learning.

MATERIALS AND METHODS

This study adopted a quasi-experimental design. The research used pretest, posttest non-equivalent control group design. This was considered suitable for this study because intact classes were assigned to treatment and control groups. The design is symbolically illustrated below:

Group A: 0_1 X_I $0_{2,}$ 0_3 (Experimental group)

Group B: 0_1 - $0_{2,}$ 0_3 (Control group)

Where key: 0_1 - Pre-test for both groups

0_2- Posttest for both groups

0_3 -Retention test for both groups

X_1 – Experimental group taught with Peyton' four-step model)

- Control group taught with Conventional teaching method)

The study was carried out in Northeast technical colleges that offer BBC which comprised the following geographical areas: Adamawa, Bauchi, Borno, Gombe, Taraba and Yobe States. The population for this study

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comprised of 319 (NTC II) students of BBC from 19 technical colleges in the North-east Nigeria. The data for 2022/2023 session was obtained and the reason for choosing year two (NTC II) student's class was that the selected topic for the study is in the content of NTC II curriculum. Six technical colleges were selected in the zone using purposeful sampling technique; simple random sampling technique was use in selecting 3 intact colleges as experimental and 3 intact colleges as control groups. The sample size for this study was 103 NTC II BBC students; comprising 29 male and 17 female constituted the experimental group, while 57 students made up of 35 male and 22 female formed the control group. The instrument for data collection in this study was Brick/Blocklaying and Concreting Cognitive Achievement Test (BBCCAT), and Brick/Blocklaying and Concreting Psychomotor Achievement Test (BBCPAT). The stability of the instrument was established using test re-test method. Scores analyzed using the Pearson Product Moment Correlation to get the correlation coefficient of 0.75. The mean gain was used to answer research questions, while Analysis of covariance (ANCOVA) was used to test the null hypothesis at 0.05 level of significance, using Statistical Package for Social Sciences SPSS (Version, 23).

RESULTS

Research Question 1

What is the effect of Peyton's four-step model on students' cognitive achievement in Brick/Blocklaying and Concreting (BBC)?

Table 1: Mean of Pre - test and Post - test Scores of Experimental and Control Groups in the Cognitive Achievement Test

Group	N	Pre – test $\overline{X}$	Post – test $\overline{X}$	Mean Gain
Experimental	46	12.06	25.35	13.29
Control	57	9.06	14.23	5.17

The data presented in Table 1 shows that the experimental group taught Brick/Blocklaying and Concreting (BBC) with Peyton's four-step model had a mean cognitive achievement score of 12.06 in the pre - test and a mean cognitive achievement score of 25.35 in the post - test making a pre-test, post-test mean gain in experimental group to be 13.29. The control group taught BBC with conventional method had a mean cognitive achievement score of 9.06 in the pre - test and a post - test mean cognitive achievement score of 14.23 with a pre-test, post-test mean gain of 5.17. With this result, the students in the experimental group performed better in the cognitive achievement test than the students in the control group.

Research Question 2

What is the effect of Peyton's four-step model on students' psychomotor achievement in Brick/Blocklaying and Concreting (BBC)?

Table 2: Mean of Pre - test and Post - test Scores of Experimental and Control Groups in the Psychomotor Achievement Test

Group	N	Pre – test $\overline{X}$	Post – test $\overline{X}$	Mean Gain
Experimental	46	30.21	61.03	30.82
Control	57	25.99	40.52	14.53

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The data presented in Table 2 shows that the experimental group taught Brick/Blocklaying and Concreting (BBC) with Peyton's four-step model had a mean psychomotor achievement score of 30.21 in the pre - test and a mean psychomotor achievement score of 61.03 in the post - test making a pre-test, post-test mean gain in experimental group to be 30.82. The control group taught BBC with conventional method had a mean psychomotor achievement score of 25.99 in the pre - test and a post - test mean psychomotor achievement score of 40.52 with a pre-test, post-test mean gain of 14.53 With this result, the students in the experimental group performed better in the psychomotor achievement test than the students in the control group.

Research Question 3

What is the effect of and Peyton's four step model on students' retention of knowledge in BBC?

Table 3: Mean Achievement Scores of Experimental and Control Groups in the Post - test and Test for Retention of Knowledge

Group	N	Post – test $\overline{X}$	Test for Retention $\overline{X}$
Experimental	46	25.17	23.19
Control	57	14.24	11.91

Table 3 shows that students in the experimental group taught BBC with Peyton's four step model had a post - test mean achievement score of 25.17 and a mean achievement score of 23.19 in the test for retention of knowledge, while the students in the control group taught BBC with conventional teaching methods had a post - test mean achievement score of 14.24 and a mean achievement score of 11.91 in the test for retention of knowledge. The result therefore indicates that students taught BBC with Peyton's four step model retained their learning better than those taught with the conventional teaching methods.

Research Question 4

What is the effect of Peyton's four step model and gender on students' retention in Brick/Blocklaying and Concreting?

Table 4: Mean of Male and Female Students Taught BBC with Peyton's four step model in the Cognitive Achievement Post - test and Test for Retention of Knowledge

Group	N	Post – test $\overline{X}$	Test for Retention $\overline{X}$
Male	21	27.38	26.19
Female	25	23.32	20.68

Data in Table 4 reveal that male students had a mean cognitive achievement score of 27.38 in the post - test and a mean score of 26.19 in the test for retention of knowledge. The female students also had a mean cognitive achievement score of 23.32 in post - test and a mean score of 20.68 in the test for retention of knowledge. The result indicates that the male students taught BBC with Peyton's four step model performed better than female taught BBC in the test for retention of knowledge.

$H0_1$: There will be no significant difference between the mean retention scores of students taught BBC with Peyton's four step model and those taught with Conventional teaching method.

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$H0_2$: There will be no significant interaction effect of Peyton's four-step model and gender on students' retention in Brick/Blocklaying and Concreting.

Table 5: Summary of Analysis of Covariance (ANCOVA) for Test of Significance between the Mean Scores of Experimental and Control Groups and Interaction Effect of Treatment given to Students and their Gender with Respect to their Mean Scores in the BBC Test for Retention of Knowledge

Source	Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	3617.472[a]	3	1205.824	26.891	.000
Intercept	31565.343	1	31565.343	703.935	.000
GENDER	306.818	1	306.818	6.842	.010
GROUPS	3384.037	1	3384.037	75.467	.000
GENDER * GROUPS	104.263	1	104.263	2.325	.130
	72.447	1	72.447	1.607	.208
Error	4439.286	99	44.841		
Total	37654.000	103			
Corrected Total	8056.757	102			

Table 5 shows that the F-value for group is 75.467 with significant of F at .000, which is less than .05. The null-hypothesis was therefore rejected at .05 level of significance. With this result, there was significant difference between the mean scores of students taught BBC with Peyton's four step model and those taught using conventional teaching method in the test for retention. F value for interaction effect (Group*Gender) is 2.325 with significance of F at .130 which is greater than .05. Therefore, the null hypothesis was accepted. This indicates that there was no significant interaction effect of treatment given to students and their gender with respect to their mean scores in the test for Retention of learning.

DISCUSSION

The data presented in Table 1 provided answer to research question one. Finding reveals that students taught Brick/Blocklaying and Concreting (BBC) with Peyton's four step model had a higher mean cognitive achievement score than those students taught using the conventional teaching method in the cognitive achievement test. The implication of this finding is that Peyton's four step model is more effective than conventional teaching methods in enhancing students' cognitive achievement in BBC. The finding is also in consonance with the finding of Joda, (2019) who conducted a study on effects of instructional scaffolding strategy on senior secondary biology students' academic achievement and retention in Taraba State, Nigeria. Who found out that the students taught with instructional scaffolding strategy have a significantly higher academic achievement than those taught with lecture method.

This finding agreed with the finding of Ilojeme (2013) who found that that computer simulation has significant effect on students' cognitive achievement in building construction, in a study on the effect of computer tutorial and simulation on students' academic achievement and interest in building construction in technical colleges in Rivers State.

The data presented in Table 2, found that students taught Brick/Blocklaying and Concreting with Peyton's four-step model had a higher mean psychomotor scores than those

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students taught using the conventional teaching method in the psychomotor achievement test.

The finding indicates that Peyton's Four-step model is more effective in stimulating students' psychomotor achievement in BBC than the conventional teaching methods. The result of the study is in line with Grange (2013) who observed that models of teaching open the door to educational theories that are likely to give an active role of the learner in the developmental process of skills acquisition.

The result of this study regarding students' psychomotor achievement could be explained by the fact that BBC teachers' adoption of authentic instructional strategy in learning group, where (development of reasoning strategies and development of effective self-directed learning strategies) the students engaged in higher order thinking tasks such as analysis synthesis and evaluation. This improved the students' problem solving abilities in BBC. Burris (2014) noted that authentic instruction fosters higher order thinking skills in students. Burris explained that higher order thinking requires students to manipulate ideas in ways that transform their meaning and applications. The manipulation of information and ideas allows students to discover solution to problems (Afolabi and Akinbobola 2009). It implies that students in this group could have problem solving skills. In addition, practical activities in Peyton's four-step model group, aimed at addressing and developing students' skills, consequently, improved students' technological understanding by applying theoretical principles to real life situations. This, therefore, also enhanced their manipulative skills and mastery of problem-solving strategies which led to their considerable psychomotor achievement.

The data presented in Table 3, reveal that the students taught BBC with Peyton's four-step model retained their learning better than those taught with the conventional teaching methods. The finding is in tandem with Adegunle (2016) who found that students taught metalwork with suggestopedia had a higher mean score than those students taught using the traditional teaching method in the test for retention of learning, in a study on the effect of suggestopedia instructional technique on academic achievement, interest and retention of metal work students of technical colleges.

Analysis of covariance was used to test the first hypothesis, Table 5, at the calculated F-value (75.457), significance of F (.000) and confidence level of .05 there was a statistically significant difference between the mean scores of the group taught with Peyton's Four-step model and those students taught using the conventional teaching methods in the test for retention of learning. The finding indicates that Peyton's Four-step model is more effective in enhancing students' retention of learning in BBC than the conventional teaching methods. The findings of this study also support the view of Miller (2006) that teachers with good instructional methods challenge students to work at higher intellectual level which helps to increase achievement scores, improves transfer and retention of learning. When students are actively engaged in their learning, they have a longer concentration span; complete work on time; stay on-task and have better retention rate.

Analysis of covariance was used to test the second hypothesis, Table 5, at the calculated F-value (2.325), significance of F (.130) and confidence level of .05 There was no significant interaction effect of Peyton's four-step model and gender on students' retention in BBC. This result showed that the effectiveness of treatments on students'

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retention in BBC does not depend on the level of gender.

The data presented in Table 4, the study revealed that there was no significant interaction effect of Peyton's four-step model and gender on students' retention in BBC. The implication of this finding is that the effectiveness of Peyton's four-step model on students' retention of learning does not depend on level of gender.

The interactive nature of Peyton's four-step model helps learners to develop a suitable intellectual curiosity in learning for both sexes and enable them to analyse problems from different angles (Olaitan, Nwachukwu, Onyemachi, Igbo, and Ekong, 1999). When students interact with each other, they explain and discuss each other's prospects, which lead to greater understanding of the material to be learned. The struggle to resolve potential conflicts during situated learning activity results in the development of higher levels of understanding (Slavin, 1990).

CONCLUSION

BBC is a course in technical colleges to equip students with knowledge, skills and attitudes for self-reliance. However, the performance of graduates and learning outcomes of the students in BBC over the years is not encouraging. In order to proffer everlasting solution to the identified problem, a study was set up to investigate the The Effects of Peyton's Four-Step Model on the Learning Retention of BBC Students in Technical Colleges in Northeast, Nigeria. The investigation therefore reveals that teaching BBC to students using Peyton's four-step model is better than employing other conventional teaching methods.

Recommendations

Based on the findings, the following recommendations were made:

1. Peyton's Four-step model should be incorporated into the content and methodology courses of NABTEB certificates (NTC) of BBC and should be extended to other vocational areas after its effect have been determine in those areas.

2. BBC teachers in technical colleges should adopt the use of the Peyton' four-step model to teach BBC to students

3. Facilities that could encourage the use of Peyton' four-step model should be provided to BBC teachers in technical colleges

4. Workshop and seminar should be organised for BBC teachers on the effective use of Peyton' four-step model.

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