

Effects of Cognitive Behaviour Therapy-Embedded Lectures on Performance and Retention of Business Mathematics Students in Colleges of Education in Bauchi State, Nigeria

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Abstract

The study determined the effects of cognitive behaviour therapy embedded lectures on performance and retention of business mathematics students in colleges of education in Bauchi state, Nigeria. Three specific objectives, three research questions and three null hypotheses guided the study. Quasi-experimental research design was adopted for the study. The population of the study was 338 business mathematics students and two intact classes of 84 students were used for the study. The instrument for data collection was validated Business Mathematics Achievement Test (BMAT). The reliability coefficients of the achievement test was determined using test retest method and PPMC was used to calculate the reliability index of 0.82. Data collected from the study were analyzed using Statistical Package for Social Sciences (SPSS) 25. The SPSS was employed to run mean score, standard deviation, and mean difference for research questions while an Independent Samples t-test was used to test the hypotheses at the 0.05 level of significance. The study disclosed that Cognitive Behaviour Therapy embedded lectures positively affect the performance and retention of business mathematics students in Colleges of Education in Bauchi State, Nigeria. It was concluded that adopting CBT integrated lectures would help improve the retention capacity of business mathematics students and increase their academic performance. The study recommended among others that, upon entrance, college counseling units should organize counseling intervention orientation for newly admitted students to help them overcome learning difficulties and cognitive barriers that affect retention. Furthermore, business education lecturers should adopt CBT embedded lecture instructional strategies in Business Mathematics.

Key words: Cognitive, Behaviour, Therapy, Retention, Performance

Introduction

Business mathematics is one of the core courses for business education students in tertiary institutions in Nigeria (Kior, *et al.*, 2021). Through the knowledge of business mathematics, students are expected to acquire skills and attain competencies in numerical courses such as Economics, Elements of Finance, Business Statistics, Taxation, and Auditing. Business mathematics skills and knowledge are critical factors in the success of students in Accounting, Statistics, and Financial Statement Analysis. This therefore suggests that a solid foundation in business mathematics skills and knowledge will facilitate students' understanding and long-term retention of related courses. Despite the significance of Business Mathematics to business education students, the academic achievement and knowledge retention of students in the subject are discouraging. Studies conducted by Adamu, Jibrin, and Bashir (2014) and Adamu, Bashir, and Haruna (2015) revealed that the academic achievements and retention levels of business education students in the subject had been relatively low over the years. The problem of students' achievement and retention in business mathematics is not limited to business education students alone; research findings have confirmed that even mathematics students who offer the course as an elective mostly find themselves completely at a loss during lectures, tests, and examinations (Adamu & Jibrin, 2017). There are several factors affecting students' academic achievement include teacher and student factors. Specifically, attributes learning

challenges to cognitive and psychological hurdles. Michael (2015) has shown that cognitive processing blocks and low retention capacity have actual effects on brain functions, negatively impacting the ability to complete mathematics tasks and retain concepts over time. This is obvious as most people intuitively know that when one experiences cognitive overload, mental fatigue, or low retention, they tend to have a hard time mastering and recalling complex mathematical principles. The author further opined that poor cognitive retention can lead to negative outcomes such as the avoidance of college mathematics courses and majors or the avoidance of careers that involve frequent mathematics use.

Retention in education refers to the ability of learners to retain, recall, and apply knowledge, concepts, and skills acquired over a specific instructional period (Zouhra, *et al.*, 2015). In education, poor retention is a major challenge facing college students, often resulting in difficulties during the manipulation of numbers and the solving of mathematical problems in both everyday life and academic situations (Michael, 2015). The prevailing problem of low retention as it affects academics calls for Cognitive Behavioural Therapy to restructure negative cognitive patterns and enhance information retention. Cognitive behaviour therapy (CBT), as defined by the California Evidence-Based Clearinghouse for Child Welfare as the treatment of persons with cognitive or psychological barriers that impede learning and cognitive processing. Common symptoms of cognitive block or distress may include excessive worry, panic, irritability, difficulty concentrating, muscle tension, restlessness, fatigue, and poor memory recall. According to Liana Lowenstein (2017), CBT is a treatment provided to individuals to help ameliorate negative student attitudes toward learning so as to become successful in their academic achievements and memory retention.

Cognitive-behavioral therapy is an effective intervention for changing automatic thinking, self-criticism, and patterns of behavior that bring about poor cognitive retention and academic failure. Cognitive behavioral interventions have been tested and shown to be effective in improving the mental processes and educational outcomes of individuals suffering from learning stress (Adina, *et al.*, 2017; Alor & Agbakwuru, 2017). In another study, cognitive behavior therapy showed that it enhances memory retention and increases the academic achievement of students in schools (Ali, 2014). In Nigeria, although there are studies on the effects of cognitive factors on the academic performance of students, none of the studies investigated the effect of Cognitive Behavior Therapy on retention and academic achievements of Business Mathematics students.

Research Objectives

The main objectives of the study is to determine the effects of cognitive behaviour therapy-embedded lectures on performance and retention of business mathematics students in colleges of education in Bauchi State, Nigeria. The specific objectives are set to:

1. Examine the difference between the pretest mean performances of business mathematics students exposed to Cognitive Behaviour Therapy embedded lectures and those exposed to the conventional lecture method in Colleges of Education in Bauchi State, Nigeria
2. Find out the difference between the posttest mean performances of business mathematics students exposed to Cognitive Behaviour Therapy embedded lectures and those exposed to the conventional lecture method in Colleges of Education in Bauchi State, Nigeria
3. Determine the difference between the post-treatment mean retention of business mathematics students exposed to Cognitive Behaviour Therapy embedded lectures and those exposed to the conventional lecture method in Colleges of Education in Bauchi State, Nigeria

Research Questions

The following research questions guided the study:

4. What is the difference between the pretest mean performances of business mathematics students exposed to Cognitive Behaviour Therapy embedded lectures and those exposed to the conventional lecture method in Colleges of Education in Bauchi State, Nigeria?
5. What is the difference between the posttest mean performances of business mathematics students exposed to Cognitive Behaviour Therapy embedded lectures and those exposed to the conventional lecture method in Colleges of Education in Bauchi State, Nigeria?
6. What is the difference between the post-treatment mean retention of business mathematics students exposed to Cognitive Behaviour Therapy embedded lectures and those exposed to the conventional lecture method in Colleges of Education in Bauchi State, Nigeria?

Research Hypotheses

The following null hypotheses were formulated and tested at the 0.05 level of significance:

1. There is no significant difference between the pretest mean performance of business mathematics students exposed to Cognitive Behaviour Therapy embedded lectures and those exposed to the conventional lecture method in Colleges of Education in Bauchi State, Nigeria.
2. There is no significant difference between the posttest mean performance of business mathematics students exposed to Cognitive Behaviour Therapy embedded lectures and those exposed to the conventional lecture method in Colleges of Education in Bauchi State, Nigeria.
3. There is no significant difference between the pre-treatment mean retention of business mathematics students exposed to Cognitive Behaviour Therapy embedded lectures and those exposed to the conventional lecture method in Colleges of Education in Bauchi State, Nigeria.

Research Methodology

The study adopted a quasi-experimental design, specifically a non-equivalent control group design, to examine the effects of cognitive behavior therapy on the academic performance and retention of business mathematics students. Because school authorities would not permit the researcher to disrupt normal institutional scheduling for random group assignment, existing intact classrooms were utilized. The population of this study comprised 338 NCE II students who offered Business Mathematics across the six Colleges of Education in Bauchi State, Nigeria, during the 2022/2023 academic session. Two intact classes comprising a total of 84 students from two institutions were selected for the study through a random sampling technique. To ensure equal representation among the six Colleges of Education offering business education in Bauchi State, the institution names were written on separate slips of paper, rolled, placed in a container, and drawn by an independent person. The first selected institution, consisting of 37 students, was assigned as the control group, while the second institution, consisting of 47 students, constituted the experimental group.

The instrument utilized for data collection was the Business Mathematics Achievement Test (BMAT), adapted from Aliyu, *et al.*, (2021). The BMAT was administered in two phases as a Pre-test and a Post-test. The pre-test established the baseline academic achievement of the students prior to the treatment, while the

post-test measured academic achievement following the intervention. Each test version contained 30 multiple-choice questions. The instrument was validated by three experts, whose feedback and suggestions were incorporated into the final draft. To determine reliability, a pilot test was conducted at the Federal College of Education (Technical), Gombe, using 30 students. Data collected from the pilot study were analyzed using the test retest method, yielding a high reliability coefficient of 0.82 calculated using PPMC.

The researcher engaged two co-opted research assistants who were business mathematics lecturers at the participating institutions. Prior to the intervention, the research assistant assigned to the experimental group underwent specialized training on utilizing CBT-embedded lesson plans for instructional delivery. In the initial stage, the pre-test achievement test was administered to baseline the students' retention levels and academic achievement prior to treatment. During the second stage, the research assistants instructed the respective student groups over a three-week period. The experimental group was taught using the conventional lecture method integrated with CBT strategy guided by structured lesson plan. This approach encouraged active student participation, allowing learners to express emotional and cognitive challenges regarding numerical problem-solving. Conversely, the control group received traditional instruction through standard lectures without CBT integration, involving conventional teacher-centered engagement.

At the end of the intervention, the post-test achievement test was administered immediately while the retention test was administered two weeks after. The student scripts were graded by the researcher using standardized marking schemes. The entire data collection process spanned five weeks. The collected data were analyzed using the Statistical Package for Social Sciences (SPSS) version 25. Descriptive statistics, including mean scores, standard deviations, and mean differences, were computed to answer the research questions. Hypotheses were tested using Independent Samples t-tests at the 0.05 level of significance. A p-value equal to or less than 0.05 (0.05) led to the rejection of the null hypothesis, whereas a p-value greater than 0.05 ($p > 0.05$) warranted the retention of the null hypothesis.

Results

Research Question One: What is the difference between the pretest mean performances of business mathematics students exposed to Cognitive Behaviour Therapy embedded lectures and those exposed conventional lectures method in Colleges of Education in Bauchi state Nigeria?

The research questions was answered using mean, standard deviations and mean difference as seen in Tables 1.

Table 1: Mean and SD of the Pre-Test Mean Performance Score of Students in Experimental and Control Groups

Grouping	N	Mean	Std. Deviation	Mean Difference	Remark
Experimental	47	32.32	7.62	0.19	Trivial
Control	37	32.51	6.66		

The pre-test mean performance of the 47 students in experimental group documented in Table 1 was 32.32 with the standard deviation of 7.62. The students in control group had the mean of score 32.51 with the standard deviation of 6.66. The mean difference between the two groups of students was 0.19 in favour of students in control group. The mean difference was found to be under the scale of trivial, hence it was concluded that there was a trivial difference between the pre-test mean performance of students in the experimental and control groups in Colleges of Education in Bauchi State.

Research Question Two: What is the difference between the posttest mean performances of business mathematics students exposed to Cognitive Behaviour Therapy embedded lectures and those exposed conventional lectures method in Colleges of Education in Bauchi state Nigeria?

Table 2: Mean and SD of Post-Test Performance of Students in Experimental and Control Groups

Grouping	N	Mean	Std. Deviation	Mean Difference	Remark
Experimental	47	51.70	12.80	21.08	LD
Control	37	30.62	10.10		

Analysis of difference between the post-test mean performance of students in experimental and control groups in Colleges of Education in Bauchi state is as presented in Table 2. From the Table, the mean scores were 51.70 and 30.62 for students in experimental and control groups with standard deviations of 12.80 and 10.10 respectively. The mean difference was 21.08 which falls under the benchmark of Large Difference (LD) in favour of students in experimental group.

Research Question Three: What is the difference between the retention mean performances of business mathematics students exposed to Cognitive Behaviour Therapy embedded lectures and those exposed conventional lectures method in Colleges of Education in Bauchi state Nigeria?

Table 3: Mean and SD of Retention Score Students in Experimental and Control Groups

Grouping	N	Mean	Std. Deviation	Mean Difference	Remark
Experimental	47	48.50	11.40	20.70	Large Difference
Control	37	27.80	9.25		

The results presented in the table 3 address the research question regarding the difference between the retention mean performances of business mathematics students exposed to Cognitive Behaviour Therapy (CBT) embedded lectures and those exposed to the conventional lecture method. The data show that the experimental group, consisting of 47 students who received CBT-embedded instruction, achieved a higher mean retention score of 48.50 with a standard deviation of 11.40. In contrast, the control group of 37 students, taught via the conventional lecture method, recorded a lower mean retention score of 27.80 with a standard deviation of 9.25. Furthermore, the analysis yielded a mean difference of 20.70 favoring the experimental group, which is classified as a large difference. This indicates that students taught using CBT-embedded lectures retained significantly more knowledge and concepts of business mathematics over time compared to their peers who underwent traditional instruction.

Hypotheses One: There is no significant difference between the pretest mean performance of business mathematics students exposed to Cognitive Behaviour Therapy embedded lectures and those exposed conventional lectures method in Colleges of Education in Bauchi state Nigeria.

Table 4: Independent T-Test Pre-Test Mean Performance Scores of Students in Experimental and Control Groups

Grouping	N	Mean	Std. Deviation	T	df	p-value	Remark
Experimental	47	32.32	7.62	-0.11	82	0.91	Retained
Control	47	32.51	6.66				

The result in the test of null hypothesis one in Table 4 revealed the mean of 32.32 and 32.51 with standard deviations of 7.62 and 6.66 for students in experimental and control group respectively. The $t=-.118$ and $p=.907$. The obtained p-value obtained was greater than the level of significance ($.907>0.05$), the result suggested that no significant difference between the pre-test mean performance of students in the experimental and control groups Colleges of Education in Bauchi state. The hypothesis was retained.

Hypotheses Two: There is no significant difference between the posttest mean performance of business mathematics students exposed to Cognitive Behaviour Therapy embedded lectures and those exposed conventional lectures method in Colleges of Education in Bauchi state Nigeria.

Table 5: Independent T-Test on Post-Test Mean Performance Scores of Students in Experimental and Control Groups

Grouping	N	Mean	Std. Deviation	t	Df	p-value	Remark
Experimental	47	51.70	12.80	-8.44	82	0.00	Rejected
Control	37	30.62	10.10				

The finding of test of null hypothesis two presented in Table 5 disclosed the mean of 51.70 and 30.62 with standard deviations of 12.80 and 10.10 for students in experimental and control group respectively. The $t=-8.44$ and $p=.000$. The obtained p-value obtained was less than the level of significance ($.000>0.05$), the result suggested that there was significant difference between the post-test mean performance of students in the experimental and control groups Colleges of Education in Bauchi state. The hypothesis was rejected.

Hypothesis Three: There is no significant difference between the retention mean performance of business mathematics students exposed to Cognitive Behaviour Therapy embedded lectures and those exposed conventional lectures method in Colleges of Education in Bauchi state Nigeria.

Table 6: Independent T-Test on Post-Test Mean Retention Scores of Students in Experimental and Control Groups

Grouping	N	Mean	Std. Deviation	T	df	p-value	Remark
Experimental	47	48.50	11.40	-7.92	82	0.00	Rejected
Control	37	27.80	9.25				

The finding of the test of null hypothesis three presented in Table 6 disclosed a mean retention score of 48.50 for the experimental group and 27.80 for the control group, with standard deviations of 11.40 and 9.25, respectively. The resulting t-value was -7.92 with a p-value of .000. Because the obtained p-value was less than the alpha level of significance ($.000 < 0.05$), the result indicated a statistically significant difference between the retention mean performance of students in the experimental and control groups in Colleges of Education in Bauchi State. Consequently, the null hypothesis was rejected.

Discussion of Findings

The result of research question one disclosed that there is no much difference between the pre-test mean academic achievements of students in the experimental and control groups Colleges of Education in Bauchi state. The finding therefore indicated that the two groups of the students that were involved in the study had

the same mean academic achievement before the treatment. The outcome was the same with the submission of Inuwa (2018) reported that financial accounting achievement among secondary school that no significant difference between the pre-test mean achievement score of cooperative learning students and conventional approach students. similarly, the study of Adamu and Jibrin (2017) reported that, there was no significant difference between the mean performance of students in experimental and control groups prior to the treatment. Likewise, the study of Adamu and Kusa (2018) titled effect of peer tutoring method on academic financial accounting students indicated that no significant difference between the mean scores of experimental and control groups of students prior to receiving treatment. The finding gave the impetus that the students had equivalent academic achievement in their pre-test.

The findings of research question two and test of corresponding null hypothesis suggested that significant difference exist between the post-test mean academic achievement of students in experimental and control groups Colleges of Education in Bauchi state. The find found to be similar with that of Fayowole, (2018) who posited that many students are blocked from professional and technical job opportunities because they fear or perform poorly in Mathematics. Fayowole added that most of these adults are brain capable of learning more Mathematics; it is not a failure of intellect, but of nerve. Choudhury and Sharma (2020) also maintained the premised that anxiety is considered to be a major predictor of the student's academic success. They continued that there are numerous factors that have been found in the extant literature, which shows a negative relationship between anxiety level and academic achievement.

The results of the research question three and the corresponding hypothesis revealed a substantial difference in knowledge retention favoring the experimental group exposed to Cognitive Behaviour Therapy (CBT) embedded lectures compared to the control group taught via the conventional lecture method. Specifically, the experimental group recorded a higher mean retention score, whereas the control group scored considerably lower, resulting in a large mean difference of 20.70. This finding indicates that integrating CBT strategies into instructional delivery effectively enhances students' long-term recall and mastery of business mathematics concepts. This outcome is in agreement with previous research highlighting the efficacy of cognitive and psychological support mechanisms in educational environments. For instance, Adina, *et al.*, (2017) noted that cognitive-behavioral interventions positively restructure learning patterns, which helps improve cognitive performance and stability among learners. Similarly, Alor and Agbakwuru (2017) emphasized that implementing structured psychological and counseling support significantly reduces learning anxieties and reinforces cognitive retention in academic settings.

Conclusion

The outcome of the study suggested the CBT embedded lecturers reduces anxiety and increase the academic performance of students in Business mathematics. Going by the outcome of the study, it therefore means that apart from cognitive factor, none cognitive factors from students also affect their performance in Business mathematics in Colleges of Education in Bauchi state. The study therefore concluded that adopting CBT integrated lecturers would help to reducing the anxiety level of students and increase their performance business mathematics which have been one of the major problems affecting the CGPA and graduation of business education students in Colleges of Education in Bauchi state.

Recommendations

Based on the outcome of the study, the following recommendations were made:

1. On entrance, college counselling units should organize counselling intervention orientation to newly admitted business education students, this would help them to remove fear and worry that would affect them in business mathematics.
2. Business Education lecturers should adopt CBT embedded lectures instructional strategy in Business mathematics.
3. Business mathematics lecturers should create enabling environment that would motive student to actively participate in classroom interaction to business education students.

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