Effects of Mind-Mapping Teaching Strategy on Building Trade Students' Academic Performance and Retention in Government Technical Colleges of Borno State, Nigeria

Volume 1
Number 2
Nov. 2025

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ABSTRACT

The main purpose of this study was to investigate the effects of mind-mapping teaching strategy on Building Trade students' academic performance and retention in government technical colleges of Borno state, Nigeria. Bricklaying, Blocklaying and Concreting (BBC) is a subject of Building Trade program that is designed to provide both knowledge and skill that enable learners to efficiently perform in all aspect of brick/block layer's work and become self-reliant. Two research questions and two null hypotheses were set. The study employed quasi-experimental research design. The experiment was carried out on all 103 NTCII BBC students at Government Technical Colleges of Borno state. The study consisted of experimental group and control group each treated independently. The experiment lasted for a period of 6 weeks. The test instrument used was consisted of 40 multiple choice questions adopted from NABTEB past question papers and validated by experts form Department of Technology Education Modibbo Adama University, Yola. Mean and standard deviation was used to answer Research questions, while ANCOVA was used to test the null hypotheses at 0.05 alpha levels and Bonferroni post-hoc test was used to find out where the significance lies. The finding of the study revealed that Mind-mapping teaching strategy improved more academic performance of Building Trade students than demonstration teaching method with Mean difference of 6.83% margin at Government Technical Colleges in Borno state, Nigeria. The Experimental Group (taught using Mind-mapping teaching strategy) students retain more academic performance than their counterparts in the control group (without treatment) by 9.62% margin at Government Technical Colleges in Borno State, Nigeria. Additionally, the research underscores that there was significant difference among the mean scores of Building Trade students taught using mind mapping teaching strategy and demonstration teaching method at government technical colleges of Borno State, Nigeria. There was significant difference among the mean scores of Building Trade students taught using mind-mapping teaching strategy and demonstration teaching method in their retention test at government technical colleges of Borno State, Nigeria. The study among others recommends that government and ministry of education should encourage the use of mind-mapping strategies in teaching building trade in Government Technical Colleges of Borno State, Nigeria.

Key words: Mind Mapping Teaching Strategy, Academic Performance, Retention

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INTRODUCTION

Technical colleges are equivalent to the senior secondary school education. It is a form of education that is designed to prepare individuals to acquire practical skills, basic scientific knowledge and attitudes required as craftsmen in various trades (Samuel & Puyate, 2022). Gana, Ubale and Armaya'u (2023) viewed Technical colleges as educational institutions where students acquire skills for a variety of jobs through learning

and training processes that take place in both classroom and workshop learning and training contexts. According to Federal Government of Nigeria (2013) technical and vocational education is a form of education involving, in addition to general education, the study of technologies and related sciences and the acquisition of practical skills, attitudes, understanding and knowledge relating to occupations in various sectors of economic and social life. The main aim behind Technical Colleges is to prepare graduates to fulfill the future workplaces. The Technical college students should be skillful in operating, using and maintaining all kinds of tools and equipment within their management. They should be faster and better able to master their performance, operation and maintenance methods than their subordinates. At the end of the programme students should registered to take one or all of the examinations the National Business and Technical Examination Board (NABTEB), labor trade test III/II and federal craft certificate examination (Ayonmike, Okwelle, & Okeke, 2014).

Federal Government of Nigeria (2013) grouped programmes of technical colleges according to trades which include; computer trades, electrical/electronic trades, wood trades, mechanical trades and building trades. The curriculum of Building Trade include general subjects such as mathematics English language, physics, chemistry, social studies etc and has the core trade subjects to include; introduction to Building Construction, Construction Management, Land Surveying, Quantity Surveying, Technical Drawing, Building Drawing and Bricklaying, Blocklaying and Concreting (BBC). Bricklaying, Blocklaying and Concreting (BBC) subject leads to the acquisition of skills and techniques to enable individual earn a living. The purpose of the BBC subject is to give the fundamental information and skills necessary for student to operate successfully in all facets of brick-work in the construction business'' (Gana et al, 2023). BBC student learning is continuously measured during teacher instruction. Therefore, the teachers of BBC subject most have knowledge of many teaching methods at his or her disposal and can select the one that will be the most effective in teaching practical skill. BBC is offered at intermediate level in technical colleges aimed at training the students to acquire practical skills which requires the use of activity based instructional strategies such as; Inquiry Method, Project Based, Small Group Discussions, Simulations, Assignment, Practical, Hands On, Field Trip, Individualized Instruction, Online Instruction, Problem Based, Collaborative, Role Playing, Mobile Learning, Flipped Classroom Teaching, Cross Learning, Blended Learning, Tactile Learning, Mind Mapping among others.

Mind-Mapping Teaching Strategy is a learning technique which uses a non-linear approach that encourages the learner to think and explore concepts using visual-spatial relationships flowing from a central theme to peripheral branches which can be inter-related (Evangelin, 2017). A Mind-Map is a diagram used to visually organize information. It is hierarchical and shows relationships among pieces of the whole. It is often created around a single concept, drawn as an image in the center of a blank page, to which associated representations of ideas such as images, words and parts of words are added. Major ideas are connected directly to the central concept, and other ideas branch out from those. Mind-Maps can be drawn by hand, either as rough notes during a lecture, meeting or planning session, for example, or as higher quality pictures when more time is

available. Mind-Maps are considered to be a type of spider diagram used for presentation of information. It creates conditions for concepts to link with each other, supporting learners to understand more deeply and easily connect the ideas received (Thanh , 2025) Another strategy that is used in the transfer of knowledge is demonstration teaching method. Demonstration teaching method is a real-world method used by teachers to demonstrate a subject or skill to students in demo-based teaching. Demonstration means performing an activity so that learners can observe how it is done in order to help prepare learners to transfer theory to practical application. Moreover, the demonstration strategy involves the teacher showing learners how to do something (Kuamr 2022; Adekoya and Olatoye, 2011). This teaching method usually involves the teacher starting the lesson by introducing the topic, explaining it, give some worked examples and finally gives homework to the students have not been a learner centered (Longjohn, and Kenneth, 2022). The idea behind imparting knowledge and skills to learners is to enhance their academic performance and prepare them for future job (Hoyle, 2020). The idea behind imparting knowledge and skills to learners is to enhance their academic performance and prepare them for future job (Hoyle, 2020).

Academic performance is a measurement of a degree of success in performing specific tasks in a subject or area studied by a student after a learning experience (Kumur et al, 2019). It is a result obtained through study. It should be understood to be a complex system that defines the competence a student develops throughout their educational journey, thus reflecting the academic knowledge acquired during that period (Lourenço & Paiva, 2024). Academic performance is assessed quantitatively through routine tasks, tests, and exams in which students demonstrate, through their responses, what they have learnt during classes. It simply refers to learning that is ultimately achieved through teaching, development, and learning, which is obtained through performance tests (Zheng & Mustappha, 2022). Suleiman (2023) asserted that performance outcomes are what indicate a person's level of progress in specific goals of activities in instructional settings. Academic performance represents outcomes that indicate the extent to which a person has accomplished specific goals that were the focus of activities in instructional environments. Good academic performance of students and retention of learning in technical colleges are essential for their future jobs.

Retention refers to the ability of a mind to retain taught information. It is the preservation of the aftereffects of experience and learning that makes a recall or recognition possible (Valderama & Oligo, 2021). In education, learning retention plays a vital role for a learner to successfully learn the concepts taught inside or outside the classroom. Retention is a process by which long-term memory preserves learning so that it can be located, identified, and retrieved accurately in the future (Akpan, Notar, & Beard, 2019). The Block/bricklaying and concreting (BBC) trade teachers should be able to choose a teaching strategy that will improve knowledge and skill retention on the part of the learner. According to Pillado, Futalan, and Comighud (2020), students' retention of learning can be improved through effective teaching strategies and learning activities and by setting goals and accomplishing them and personalizing the learning. Therefore, this study tries to determine the effects of mind-mapping teaching strategies on student's

academic performance and retention in government technical colleges of Borno State, Nigeria.

Statement of the Problem

There is declined in academic performance among students in technical subjects in Nigerian technical colleges (Eze et al, 2015). This is of great concern to technical educators because of its relevance to individual self-reliance and the national development (technological and industrial). The government technical colleges in Borno state are not exception, the shortage of skilled workers and a decline in the quality of constructions projects are of great concern. Diraso, et al., (2015) reported that most of the students graduated from technical colleges had poor academic performance. This may be linked with the teachers' incompetence, teachers' methods of teaching, the inadequacy of training material, over the crowd of students in the classroom to mention. The traditional methods of teaching, which is used in these colleges, may not be effective in engaging students and promoting deep understanding of subject matter, leading to a lack of interests and motivation among graduates to pursue a career in the trade, (Tukur, Abba & Saidu, 2019). In an effort to address these challenges, this study explore alternative teaching strategies that can enhance student engagement and enhance academic performance, and retention.

Research Questions

i. What is the pre-test and post-test mean difference in the academic performance of Building Trade students taught using mind-mapping teaching strategy and demonstration teaching method in government technical colleges of Borno state, Nigeria?
ii. What is the mean difference in the academic performance of Building Trade students taught using mind-mapping teaching strategy and demonstration teaching method in their retention test in government technical colleges of Borno state, Nigeria?

Hypotheses

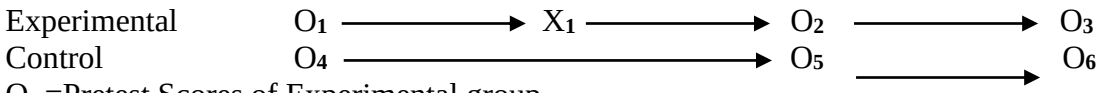
The following hypotheses were formulated and tested at 0.05 level of significant.

HO_1: There is no significance difference in the academic performance of Building Trade students taught using mind-mapping teaching strategy and demonstration teaching method in government technical colleges of Borno state, Nigeria.

HO_2: There is no significance difference in the academic performance of Building Trade students taught using mind-mapping teaching strategy and demonstration teaching method in their retention test in government technical colleges of Borno state, Nigeria.

METHODS

Quasi-experimental design research design was adopted for this study, specifically the pre-test post-test non-randomized control group research design. This type of design is aimed at determining whether there is cause and effect relationship between the variables under study. In this study students are grouped into independent experimental class and independent control class. The experimental class was treated using Mind Mapping teaching strategy while the control group were not given any treatment. This design is shown below.



O_1 =Pretest Scores of Experimental group
O_4 =Pretest Scores of Control group
$O_{2,}$ = Posttest Scores of Experimental group
O_5 =Posttest Scores of Control group
O_3 = Retention test Scores of Experimental group
O_6 = Retention test Scores of Control group
X_2 = Treatment (Mind Mapping teaching strategy) given to Experimental group

The instrument used for data collection was Bricklaying, Blocklaying and Concreting Performance Test (BBCPT). It is made up of 40 multiples choice lettered A-D adopted from National Business and Technical Examination Board (NABTEB) Bricklaying, Blocklaying and concreting past questions papers. The students will answer by circling the correct option. Each correct answer was marked 1 making 40 percent while the practical question marked 60 percent. The draft instrument was face and content validated by two experts, from the Department of Technology Education, Modibbo Adama University, Yola. The test items were administered to non-participating students of Building Trade in government technical college, the reliability of 0.71 obtained was determined using the Kuder–Richardson 21 (often abbreviated as KR-21).

The data was collected by the researcher and research assistant through the following experimental procedures as follow:

Step 1: Presentation of Introductory Letter
Step 2: Assigning Research Assistants to Experimental and Control Group
Step 3: Handling of Lesson Plan Notes to the Research Assistants
Step 4: Administration of Pre-Test
Step 5: Administration of Treatment
Step 6: Administration of Post-Test
Step 7: Administration of Retention Test

Step 1: Presentation of introductory letter

Prior to the commencement of the proper experimentation the researcher visit the technical colleges and introduce himself to the principals of the affected technical colleges and present the introduction letter seeking permission to carry out the research or data collection exercise.

Step2. Assigning research assistants to Experimental and Control Group

The researcher selected the research assistants and give them induction training on how to carry the out the research. The researcher assigned the technical colleges to experimental groups and control using simple random sampling.

Step 3: Handling of lesson plan and notes to the research assistants

Lesson plan notes were given to each research assistant based on teaching method planned for the group while the contents of the lessons are the same for both the experimental and the control.

Step 4: Administration of pre-test

Prior to the experimentation the researcher and research assistants administered the

pre-test to both the group in their respective technical colleges. The test papers were collected immediately after the time specified for the test is over.

Step 5: Administration of treatment

The experimental group was taught using mind mapping teaching strategy for the period of 4 weeks. While the control group taught using conventional demonstration method of teaching for the same period of 4 weeks, using the same contents as in experimental group.

Step 6: Administration of post-test

At the end of the experimentation of 4 weeks, the researcher and the research assistants conduct the posttest using the same but reshuffled performance test instrument used for pre-test. The test papers were collected immediately after the time specified for the test is over.

Step7: Administration of Retention Test

Two weeks later after completing the experiment, a Brick/Blocklying and Concreting Performance Test (BBCPT) was administered to both group which serve as retention test scores. The test papers were collected immediately after the time specified for the test is over.

The collected data was analyzed using a Statistical Package for Social Sciences (SPSS) version 23. Mean and standard deviation was used to answer the research questions while ANCOVA was used to test the null hypotheses at 0.05 alpha levels, the decision rule was if the p-value is found to be less than or equal to the level of significant, the null hypothesis is rejected otherwise are upheld. Bonferroni test post-hoc multiple comparisons analysis was used to find out where the significance lies.

RESEARCH RESULTS

The summary analysis of the data collected to investigate the various research questions and the hypotheses are presented here in a tabular form. Each table is accompanied with the relevant analysis of the data presented and ending with the conclusion(s).

***Table 1**: Mean Difference in the Academic Performance of Building Trade Students' Under Experiment and the Control Group*

Teaching Strategy	**n**	**Pre-test**		**Post-test**		**Mean Difference b/w Tests**	
		$\overline{X}$	**SD**	$\overline{X}$	**SD**	$\overline{X}$	**SD**
Mind-Mapping	49	10.63	2.79	31.63	4.28	21.00	**1.49**
Demonstration	54	12.52	2.08	26.69	2.37	14.17	**0.29**
Mean Difference b/w Group		**-1.89**	**0.71**	**4.94**	**1.91**	**6.83**	**1.20**

n = Number of students, $\overline{X}$= Mean and SD =Standard deviation

The data on Table 1 reveals that 49 Building Trade students taught using mind mapping teaching strategy (Experimental Group) scored a pre-test mean score of 10.63 with a corresponding SD of 2.79. The same set of students scored a Mean of score of 31.63 in their post-test with a corresponding SD of 4.28 recorded. Their counterparts' (54

students) taught using demonstration teaching method (Control Group) obtained a pre-test mean score of 12.52 with a corresponding SD of 2.08 and post-test Mean score of 26.69 with a corresponding SD of 2.37 obtained. Under row 4, the mean difference between the pre-test scores stood at 1.89 and post-test mean difference of 4.94 observed between the mind mapping teaching strategy and demonstration teaching method. This shows that the Building Trade students taught using mind mapping teaching strategy were weaker under the pretest scores but overtook the building trade students taught using demonstration teaching method after the experiment (Treatment) with Mean difference of 6.83.

The Mean difference within each group across the pre-test and posttest scores shows that the mind mapping group improved more than the Demonstration group by 6.83 percent margin. Based on the data resented so far it is clear that the mind mapping teaching strategy improved the academic performance of Building Trade students at Government Technical Colleges in Borno state, Nigeria.

***Table 2**: Mean Difference in the Retention Test of Building Trade Students' Under Experiment and the Control Group*

Teaching strategy/method	**N**	$\overline{X}$	**SD**
Mind-Mapping	49	33.27	**5.53**
Demonstration	54	23.65	**3.94**
Mean difference b/w Group		**9.62**	**1.59**

n = Number of students, $\overline{X}$= Mean and SD =Standard deviation

The data on Table 2 reveals that 49 Building Trade students taught using mind mapping teaching strategy (Experimental Group) scored a retention test mean score of 33.27 with a corresponding SD of 5.53. Their counterparts' (54 students) taught using demonstration teaching method (Control Group) obtained a retention test mean score of 23.65 with a corresponding SD of 3.94. Under row 4, the mean difference between the retention test mean scores stood at 9.63. This shows that the Building Trade students taught using demonstration teaching method retain less than their counterparts taught using mind mapping teaching strategy.

The Mean difference between the group across the retention test scores shows that the Experimental Group 2 (mind mapping) students retain more academic performance than their counterparts in the control group (Demonstration) by 9.62 percent margin. Based on the data presented so far it is clear that the students taught using mind mapping teaching strategy retain more academic performance than Building Trade students taught using demonstration teaching method at Government Technical Colleges in Borno state, Nigeria.

Hypotheses

***Table 3:** Summary of Analysis of Covariance (ANCOVA) For Test of Significant Difference in the academic Performances of Building Trade Students Taught Using Mind-Mapping and Demonstration*

Source	**Type III Sum of Squares**	**Df**	**Mean Square**	**F**	**Sig.**
Corrected Model	750.056[a]	4	187.514	17.40	.000
Intercept	2570.927	1	2570.92	238.63	.000

Pretest	77.749	1	77.74	7.21	.008
Teaching Strategy/method	740.849	1	740.84	68.76	.000
Error	1055.789	98	10.77		
Total	88661.000	103			
Corrected Total	1805.845	102			

a. R Squared = .415 (Adjusted R Squared = .391)

The data on Table 3 reveal that the f(df=1, 103) = 68.76, p = 0.000 tested at 0.05 level of significance. The computed p-value is less than the alpha-level. Hence, we have good reason to reject Ho_1.

Thus, conclude that, there was significant difference among the mean scores of Building Trade students taught using mind mapping teaching strategy and demonstration teaching method at government technical colleges of Borno State, Nigeria. Therefore, multiple comparisons analysis was run to precisely identify the teaching strategy that was responsible for the difference.

Table 4: *Bonferroni Multiple Comparisons Post Hoc Analysis between mind-mapping and demonstration*

(I) Teaching Strategy	**(J) Teaching Strategy**	**Mean Difference (I-J)**	**Std. Error**	**Sig.[b]**	**95% Confidence Interval for Difference[b]**	
					Lower Bound	**Upper Bound**
mind mapping	demonstration	5.817*	.701	.000	4.425	7.209
Demonstration	mind mapping	-5.817*	.701	.000	-7.209	-4.425

The data on Table 4 reveal that the Building Trade students taught using The Building Trade students taught using Mind Mapping Teaching Strategy recorded a higher Mean score compared with their counterparts taught using demonstration teaching method with a mean merging of 5.81.

Based on the data presented so far it is clear that the mind-mapping teaching strategy improved more academic performance of Building Trade students than demonstration teaching method at Government Technical Colleges in Borno state, Nigeria.

Table 5: *Summary of Analysis of Covariance (ANCOVA) For Test of Significant Difference among the Performances of Building Trade Students Taught Using Mind Mapping and Demonstration Teaching in their Retention Test*

Source	**Type III Sum of Squares**	**Df**	**Mean Square**	**F**	**Sig.**
Corrected Model	2876.937[a]	6	479.490	20.738	.000
Intercept	6246.776	1	6246.776	270.176	.000
Pretest	.487	1	.487	.021	.885
Teaching Strategy	2373.299	2	1186.649	51.323	.000
Error	3630.014	157	23.121		
Total	146410.000	164			

Corrected Total	6506.951	163

R Squared = .442 (Adjusted R Squared = .421)

The data on Table 5 reveal that the f(2, 163) = 51.0323, p = 0.000 tested at 0.05 level of significance. The computed p-value is less than the alpha-level. Hence, we have good reason to reject Ho_2.

Thus, conclude that, there was significant difference among the mean scores of Building Trade students taught using mind-mapping teaching strategy and demonstration teaching method in their retention test at government technical colleges of Borno State, Nigeria. Therefore, Bonferonni multiple comparisons analysis was run to precisely identify the teaching strategy that was responsible for the difference.

Table 6: *Bonferonni Multiple Comparisons Post Hoc Analysis among Building Trade Students performance taught using three-step interview, mind mapping and demonstration teaching Strategy in their retention test*

					95% Confidence interval for Diff[b]	
(I) Teaching Strategy	(J) Teaching Strategy	Mean Diff(I-J)	Std. Error	Sig.[b]	Lower Bound	Lower Bound
Mind Mapping	Demonstration	9.690*	1.003	.000	7.262	12.119
Demonstration	Mind Mapping	-9.690*	1.003	.000	-12.119	-7.262

The data on Table 6 reveal that Building Trade students taught using Mind Mapping Teaching Strategy recorded a higher Mean score in their retention test compared with their counterparts taught using demonstration teaching method with a mean merging of 9.690. Thus, conclude that, the Building Trade students taught using Mind-Mapping teaching strategy recorded a higher retention test mean score than their counterparts taught using demonstration teaching method at government technical colleges of Borno State, Nigeria.

DISCUSSION

For research question 1, the study revealed that Building Trade students taught using mind-mapping teaching strategy improved more academic performance than their counterparts taught using demonstration teaching method by 6.83 percent merging at government technical colleges of Borno state, Nigeria, Nigeria. This is in line with the findings of Qu (2023) who finds that compared with the traditional teaching method mind mapping teaching method is highly functional. It's also in variance with the finding of Onah et al (2022) who find out those students in the mind-mapping teaching approach had higher post-test mean achievement score than their counterpart in the guided discovery approach. It is also in tandem with the finding of Akanbi, Olayinka, Omosewo, and Mohammed (2021) whose study result showed that the performance of students taught Physics using the mind mapping instructional strategy was higher when compared to those exposed to the conventional method. However, this finding is not in agreement with the finding of Hamman (2023) who conducted a study on the Effect of Demonstration Method of Teaching on Students' Achievement in Building Construction in North East Nigeria,

Technical Colleges, his study revealed that the learning achievement of students taught Building Construction using demonstration method of teaching was high while those taught Building Construction using lecture method of teaching was low. Therefore the used of mind mapping teaching strategy being the effective strategy for teaching Building Trade students should be encouraged. Efforts should be invested by teachers to adopt mind mapping in teaching Building Trade in technical colleges.

For research question 2, the result shows that Building Trade students taught using mind-mapping teaching strategy retain more academic performance than their counterparts taught using Demonstration teaching method by 9.62 percent merging at government technical colleges of Borno state, Nigeria. This finding is in agreement with the finding of Hamman (2023) who revealed that learning achievement of students taught Building Construction using demonstration method of teaching was high than those taught Building Construction using lecture method. However, this is in agreement with the finding of Olayinka, Omosewo, and Mohammed (2021) who reported that students taught physics using the mind mapping instructional strategy retained physics concept more than those taught without it. It's in tandem with the findings of Abamba and Esiekpe (2021) who concluded that mind mapping and concept maps improve students' retention significantly better than lecture method. It is also in agreement with the study of Maureen (2023) who concluded that mind-mapping strategy promotes students' retention in Biology more than the lecture method.

For the hypothesis 1, the study shows that there was significant difference between the mean scores of Building Trade students taught using mind-mapping teaching strategy and demonstration teaching method at government technical colleges of Borno State, Nigeria. This is in line with the findings of Maureen (2023) who reveals that there was a significant difference in the mean achievement between students taught Biology using mind-mapping strategy and lecture method. It's also agreeing with the findings of Onah et al (2022) whose finding shows here is a significant difference between the mean achievement scores of the students taught motion and kinematics in secondary schools with mind-mapping teaching approach and those taught with guided discovery approach in favor of those in experimental group (mind-mapping teaching approach). Also agrees with Abamba, Efe and Esiekpe (2021) whose results showed a significant difference in all the three-methods concept map, mind mapping and lecture method employed on students' achievement. Also tandem with the result of Tafida, Abba and Saidu (2019) who reported that there is a significant difference in the performance of students taught bricklaying, blocklaying and concreting using project and demonstration teaching methods. It is in variance with the finding of Galceran and Mugot (2019) there was a significant difference on the students' posttest scores in science when taught using Three-step interview as a strategy and lecture method.

For the hypothesis 2, the study revealed that there was significant difference between the academic performance of Building Trade students taught using mind-mapping teaching strategy and demonstration teaching method in their retention test at government technical colleges of Borno state, Nigeria. This finding is in agreement with the finding of Abamba and Esiekpe (2021) who find out that there is a significant difference in the rate of

students' retention between lecture method, concept and mind mappings. This is in variance with the finding of Qu (2023) who finds that compared with the traditional teaching method mind mapping teaching method is highly functional. This collaborates with the study of Aristy et al(2019) who reported that three-step interview technique improve students' performance into a better situation. According to Woradechjumroen (2018) mind map improves learning performance.

Conclusion

This study addressed the critical research problem of determining the effects of mind-mapping teaching strategy on building trade student's academic performance and retention in government technical colleges of Borno State, Nigeria. The study focuses on improving student's academic performance and knowledge retention to minimize the shortage of skills workers and the growing decline in quality of construction projects in Borno state. The primary objective was to find out the teaching strategy that could improve academic performance and retention. The key findings of the study revealed that the mind-mapping teaching strategy improved the academic performance of building trade students more than demonstration teaching method, additionally, the research underscores that students taught using Mind-mapping teaching strategy retain more academic performance than their counterparts in the control group (without treatment). The implication of this study findings are profound, they underline the urgent need for teachers, students, curriculum planners, construction industries and researchers in the field of education. Integrating these strategies can enhance students' academic performance and retention and promote the quality of future construction professionals. Future research directions should focus on refining the effects of mind-mapping teaching strategy on academic performance to reduce poor performance and provide more precise predictions, investigations into region-specific, field-specific and to enrich the current understanding enabling more adaptation. In conclusion the shortage of skills workers and decline in the quality of construction workers demand immediate global attention, proactive and strategic responses, grounded in thorough research ensuring prosperity of the future generations.

Recommendations

The study recommends that:

1. Government and ministry of education should encourage the use of Mind mapping teaching strategy in teaching BBC in regular classes and other subjects as well in Government Technical Colleges of Borno State.
2. Ministry of Education and other professional bodies should organize a regular workshop and seminar on the use of mind mapping for BBC teachers.

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