Volume-4, Issue-2, February-2020: 47-54 P-ISSN: 2659-1561
International Journal of Recent Innovations in Academic Research E-ISSN: 2635-3040

Research Article

Effects of Cognitive Apprenticeship Instructional Method on Students' Achievement in Motor Vehicle Mechanics Work of Yobe State Technical Colleges

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Received: Feb 16, 2020 **Accepted:** Feb 24, 2020 **Published:** Feb 28, 2020

Abstract: This study was to find the effect of Cognitive Apprenticeship Instructional Method (CAIM) on Students' Achievement in Motor Vehicle Mechanics work in Government science and Technical Colleges of Yobe State. A pretest posttest non-equivalent control group quasi-experimental designed was employed for the study. The population of the study included all 91 NTC II MVM work students of all Government Science and Technical Colleges of Yobe State that offer MVM work as a trade subject. The sample consisted of 35 NTC II MVM work students. Random sampling was used to obtain the sample. Instrument used for the study was MVM work Achievement Test (MVMWAT) prepared from past NABTEB NTC examination. The instrument was validated by four experts, two from Modibbo Adama University of Technology Yola, one from Federal College of Education (Technical) Potiskum and the other from Yobe state University, Damaturu. The instrument was not subjected to any reliability test, since NABTEB examination is a standard testing instrument. The two groups involved in the study was subjected to pre-test before the treatment, after which; The experimental group was taught using CAIM of teaching, while the control group was taught using lecture method of teaching for the period of four weeks. After the treatment, post-test was administered to all the students using MVMWAT to determine the students mean achievement scores in MVM work. Scores obtained from MVMWAT were analysed using mean to answer the research questions, while the hypotheses were analysed using z-test and tested at 0.05 level of significance. The findings revealed, among others that the treatment had significant effect on academic achievement of students in MVM work. CAIM of teaching proved to be better than lecture method of teaching respectively. The lecture method of teaching had little effect on the students' academic achievement in MVM work. It was therefore recommended that, teachers should be trained and encouraged to develop and use CAIM for teaching.
Keywords: Cognitive Apprenticeship, Instructional method, Students' Achievement, Motor Vehicle Mechanics Work and Technical College.

Introduction

The quest for education effectiveness has always been the primary objectives of the teacher and the students. In order to achieve this effectiveness, it is important for the teacher to adopt an effective instructional method with the assistance of advanced technology that suites individuals learning style (Rahman, Tsoi, & Dattrick, 2010). According to Merrill, David, Leston and Jean in Arah (2016) effective instructional technique involves directing students

to appropriate learning activities; guiding students to appropriate knowledge; helping students rehearse, encode and process information; monitoring students' performance; and providing feedback as to the appropriateness of the student's learning activities and practice performance. Assisting the learner to learn is the ultimate goal of any instructional technique or activity in both formal and informal education setting of which cognitive apprenticeship is one of them.

Blomberg (2011) defined cognitive as the set of mental abilities and processes related to knowledge; attention and working memory, judgment and evaluation, reasoning and computation, problem solving and decision making as well as comprehension. While Apprenticeship according to Blomberg, is a form of training that teaches the skills and competencies necessary to perform tasks to an industrial standard.

According to Begi, (2017) apprenticeship training provides learners opportunity for their hands to be involved in learning under the direction of a certified person with the ability to earn while learning. From these we can say, cognitive apprenticeship is a method of teaching aimed primarily at teaching the processes that experts use to handle complex practical tasks.

Cognitive apprenticeship according to Anderson, Boyle and Reiser (2005) is an instructional innovation which was introduced to address the problem of inert knowledge. This approach is based on the underlying principle of apprenticeship learning and focuses on the use of strategies such as modelling of behaviour and coaching students to mimic exact skills. Cognitive apprenticeship methods include modelling, scaffolding, coaching, articulation, reflection and exploration (Anderson *et al.*, 2005).

Modelling involves an expert carrying out a task so that students can observe; Scaffolding is the support that master gives to apprentice in carrying out a task, it involves co-operative problem solving by teacher and students with the intention that the students will assume increasingly more of the task on their own as soon as possible; in Coaching, the teacher observe students as they try to complete tasks and provide hints and helps when needed. This simply means reminding the students of some aspect of the task that is known but has been temporarily overlooked.

Articulation includes any method of getting students to articulate their knowledge, reasoning or problem solving processes. It is verbalizing or demonstrating the knowledge and a cognitive process involved in the task or processes the student in learning.

Exploration involves pushing students into a mode of problem solving on their own. Through exploration, students learn how to set achievable goals and to manage the pursuit of goals. They learn to set and try out hypotheses, and to seek knowledge independently; Reflection involves expert letting students compare their own diagnostic skills with those of experts, (Collins and Brown, 2007). This is achieved through guided learning by an expert who chooses the appropriate instructional method and explains his/her action at every level of instruction. Instructional teaching method is described as the style by which an instructional module, instructional phase or an entire course is delivered (Nafees, Farooq, Tahirkheli & Akhtar, 2012). The most common teaching method is the conventional (lecture). Bimbola and Daniel (2010) described the conventional (lecture) teaching method as that in which the teacher is a sole information giver to passive students. This is an out dated approach when compared to what is happening in developed countries of the world today. The conventional methods of teaching which are teachers used for years is now producing poorer results when

compared with the modern and revolutionary teaching methods (Jackson, 2012). The negative attributes associated to the conventional teaching methods poses a challenge in the teaching and learning process in Technical Colleges today. Chinwe & Chinyere (2010) confirmed that studies on how students learn science and technology have started revealing innovative instruction approaches that have proven effective. Furthermore, Idris (2012) also stressed that this challenge necessitates a shift from the conventional, instructional approaches to a constructivist instructional approaches.

These narratives have informed the recommendation by United Nations Educational, Scientific and Cultural Organization (UNESCO) and International Labour Organization (ILO), (2012) that all technical and vocational education and training (TVET) system in the 21st century should be geared towards lifelong learning. This requires that schools should, in addition to academic skill, inculcate work place skill such as creativity, problem solving, collaborative skills and higher order thinking skills in order to increase the student's flexibility and job mobility which will make them adaptable to the present and envisaged changes (Hallack and Poisson, 2014). Also, according to Ukoha and Eneogwe (2006) there is lack of appropriate teaching methods in teaching MVM work in technical colleges in Nigeria and this leads to poor interest and poor academic achievements among students.

Academic achievement in MVM work is the quality and level of skills acquired and retained by students. Oyetunde (2010) describes Academic achievement as a method of expressing a student's scholastic performance. This can be regarded as course or subject grade, an average for a group of subjects in a programme of study. Oyetunde further disclosed that there are two dimensions to academic achievement: good academic achievement that leads to success and poor academic achievement that result to failure. Each of the achievement has been experienced by students in one form or another. According to Mbah (2002), academic achievement is dependent upon several factors amongst which are instructional techniques, the learning environment, as well as motivation. Therefore, the study seeks to determine the effect of Cognitive Apprenticeship Instruction Method on students' achievement, in MVM work trade in Yobe State technical colleges.

Statement of the Problem

The current advancement in technology and sophistication in automobile technology make teaching and learning easier especially Motor Vehicle Mechanics (MVM) work in developed and emerging countries. Hence, teachers in developed and emerging countries employed the modern methods in teaching their students. In Africa, particularly Nigeria, the teaching methods employed by most teachers in teaching MVM work in especially technical colleges, is mainly the conventional (lecture) method. This mode of teaching encourages rote memorization which leads to ineffective teaching and learning (Umar, 2017).

There has been a high rate of failure among graduates of technical colleges in Yobe State; this may not be unconnected with teachers, using the lecture method in teaching their students.

The records obtained from Yobe State science and technical school board (YSSTSB) disclosed that in the year 2012, 52% of MVM work students failed, in 2013, 58% failed, 2014, 60% failed, 2015, 67% failed, 2016, 65% failed and in 2017, 70% failed in MVM work NABTEB examination (YSSTSB, 2017) see appendix I. This rapid decline in students' achievement in MVM work in Yobe state has become a problem of concern to the students, teachers, management and government.

Purpose of the Study

The purpose of the study was to assess the effect of Cognitive Apprenticeship Instructional methods (CAIM) on Students' Achievement in Motor Vehicle Mechanics (MVM) Work in technical colleges of Yobe State Nigeria. The study specifically sought to:

- ✓ Determine students' academic achievement when taught MVM work using Cognitive Apprenticeship Instructional Method of teaching.
- ✓ Determine the students' academic achievement when taught MVM work using conventional (lecture) method of teaching.

Research Questions

The following research questions were used to guide the study:

- ✓ What is the post-test academic achievement of students when taught MVM work using Cognitive Apprenticeship Instructional Method of teaching?
- ✓ What is the post-test academic achievement of students when taught MVM work using conventional (lecture) method of teaching?

Hypotheses

The following null hypothesis was formulated and tested at 0.05 levels of significance:

HO_1: There is no significant difference between the mean achievement scores of students taught MVM work using CAIM and those taught with the conventional (lecture) method of instruction in Technical Colleges of Yobe State.

Methodology

The study employed simple two group pre-test post-test non-equivalent control group quasi experimental design. The two groups in the study were named group A (Conventional Apprenticeship Instructional Method CAIM of teaching) and group B (Conventional Lecture Method CLM of teaching). The study was carried out in Yobe State. Yobe State is situated in the north eastern region of Nigeria and it is located between latitude 11^{o} 30^{I} E and longitude 12^{o} 00^{I} N of the Greenwich meridian. Yobe State has seven Government Science and technical Colleges (GSTC). They are: GSTC Potiskum, GSTC Gashuwa, GSTC Nguru, GSTC Gaidam GSTC Dapchi, GSTC Damagum and GSTC Gujba.

The Population for the study were made up of all the 91 NTC II Motor Vehicle Mechanics MVM Work students in Yobe State GSTCs (Yobe State Post Primary Schools Management Board 2017/2018 academic session). Purposive sampling technique was used to select two GSTCs with total sample of 35 NTC II students. The two colleges were grouped into experimental and control groups that is 18 MVM work students from GSTC Potikum and 17 from GSTC Damagum. The instrument for the study, Motor Vehicle Mechanics Work Achievement Test (MVMWAT) was used to collect data on the students' academic achievement in MVM work.

After the pre-test and at the end of the teaching all the students were pooled together for the purpose of collecting data on students' achievement. The instrument was developed from past National Business and Technical Examination Board (NABTEB) question papers with 40 multiple choice questions, with each question carrying 2.5 marks, making a total of 100 per cent. Students' achievement was rated based on NABTEB standard, which has four points grading as follows: Distinction 70–100, Credit 50–69, Pass 40–49 and Fail 0–39.

The data collected were analysed with descriptive statistical tools usining micro soft exel. Percentage and mean were used to answer the research questions. Hypothesis formulated was tested at 0.05 significance level, using z-test. For the purpose of interpreting the students' achievement, their mean percentage score using the four points scoring grade specified by NABTEB was used. In order to draw statistical inferences on the hypothesis guiding the study, if the calculated z-value is greater than z-critical at 0.05 significant level the null hypothesis was rejected, but if otherwise null hypothesis was accepted.

Results

Research question 1: What is the post-test academic achievement of MVM work students when taught using CAIM. Data that answered this research question were analysed and presented in Table1.

Table 1. Mean Academic Achievement of MVM work Students Taught Using CAIM

Teaching method	Pre-test		Post-test		Mean gain	Remark
	N	x̄	N	x̄		
	18	21	18	60	39	Pass

Table 1 shows that MVM work students taught using CAIM had mean academic achievement scores of 21 per cent and 60 per cent in pre-test and post-test respectively. Thus there is a mean achievement gain of 39 per cent. This implies that MVM work students in the CAIM group passed at credit level as specified by NABTEB grading scale.

Research question 2: What is the Post-test academic achievement of MVM work students when taught using CLM of teaching? Data that answered this research question were analysed and presented in Table 2.

Table 2. Mean Academic Achievement of MVM work Students Taught Using CLM

Teaching method	Pre-test		Post-test		Mean gain	Remark
	N	x̄	N	x̄		
	17	22	17	51	29	Pass

Table 2 shows that MVM work students taught using lecture method of teaching had mean achievement scores of 22 per cent and 51 per cent in pre-test and post-test respectively, with mean gain of 29 per cent. From tables 1 and 2, the results of MVM work students in pre-test 21 and 22 per cent revealed that the students in CAIM and CLM groups were almost equivalent in their achievement in MVM work. Although the CLM group passed with mean score of 51 per cent in post-test, there is a clear difference in their mean achievement scores compared with the CAIM group who had 60 per cent. This implies that CAIM of teaching is more effective than the CLM of teaching.

Hypothesis 1: Significant difference does not exist between the mean achievement scores of students taught MVM work using CAIM and those taught with CLM of teaching. Data that were used in testing this hypothesis was analysed using z-test and presented in Table 3.

Table 3. z-Test Mean Difference in the Achievement Scores of MVM work students Taught Using CAIM and CLM

Teaching method	N	x̄	SD	df	z-cal	z-crit	Remark
CAIM	18	60.22	17.08	33	2.53	1.96	Rejected
CLM	17	51.29	17.50				

Table 3 shows that, z-test calculated is greater than the z-test critical. This means that there is statistical significant difference between the mean achievement scores of students taught MVM work using CAIM and CLM of teaching. Therefore the null hypothesis was rejected.

Findings

The following findings emerged based on the research questions and hypotheses tested at 0.05 level of significance:

- ✓ The students taught MVM work using CAIM of teaching obtained higher achievement mean scores in the experimental group than the students taught with conventional (lecture) method of teaching in the control group.
- ✓ There was a significant difference in the achievement mean scores of students taught MVM work using CAIM of teaching and those taught with the lecture method of teaching.

Discussion of Findings

The discussion of the findings of the study was done in line with the research question and hypothesis of the study. The findings from the pre-test and post-test on MVIM work students' academic achievement reviled that, there is significant effect of treatment on student academic achievement. CAIM had the highest mean achievement score (mean = 60) against CLM (mean = 51). Result from the hypothesis testing further confirmed that there is a significant effect of treatment and students' academic achievement, with (z-cal. = 2.53) against (z-crit. = 1.96). This finding is in line with the findings of Duncan (2008), who found that cognitive apprenticeship instructional method significantly more effective than conventional lecture method in classroom instruction, in reading, writing and mathematics for improving students' thinking skills and knowledge at secondary school level.

Conclusion

The findings reveled that cognitive achievement of students were enhanced and stimulated using CAIM of teaching. Consquently, CAIM of teaching has the potential to enhance learning by actively involving students in the learning process and minimising teacher;s involvement in the teaching processes. The use of CAIM of teaching has positive effect on students' achievement in MVM work at Technical College level.

Recommendations

Based on the findings from the study on the research questions and hypothesis these recommendations are made:

- ✓ Teachers especially those teaching MVM work should adopt CAIM of teaching to teach students at technical colleges and enhance student's cognitive achievements in MVM work.
- ✓ YSSTSB should organize seminars or workshops where technical college teachers would be exposed to effective ways of using CAIM to teach students of MVM work and technical courses, since this instructional approach tend to improves the academic achievement of the learner.
- ✓ Cognitive apprenticeship approach should be put up by the curriculum developers into curriculum of technical courses especially MVM work. These will, improve academic achievement of MVM work students'.

Conflicts of interest

The authors declare no conflicts of interest.

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Citation: Kumazhege, S.Z. and Abdulhamid, Umar. 2020. Effects of Cognitive Apprenticeship Instructional Method on Students' Achievement in Motor Vehicle Mechanics Work of Yobe State Technical Colleges. International Journal of Recent Innovations in Academic Research, 4(2): 47-54.