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ABSTRACT

The poor academic achievement of both male and female students in technical colleges in Nigeria has become worrisome to the researchers. It is believed that the use of the effective instructional methods in technical colleges would enhance students' academic achievement. It is therefore important that teachers in technical colleges would adopt instructional methods that could improve the academic achievement of students in technical colleges. The study therefore, ascertained the effect of cognitive apprenticeship instructional method on male and female students' academic achievement and retention of auto mechanics technology in technical colleges in Delta State. Two research questions guided the study, and two null hypotheses were tested at 0.05 level of significance. The study adopted the quasi-experimental research design. The pre-test post-test non-randomized control group experimental design was used. The population of the study comprised 237 vocational II auto mechanic students in the six technical colleges in Delta State. A sample of 114 was purposively selected for the study. Instrument for data collection was the Auto Mechanic Achievement Test (AMAT). The instrument was validated by three experts (two experts from the Department of Technology and Vocational Education and one expert from Measurement and Evaluation Unit of the Department of Educational Foundations), all in Nnamdi Azikiwe University Awka. The reliability coefficient of Auto Mechanics Achievement Test (AMAT) was established using Kunder Richardson 21 Formula, and the reliability coefficient of 0.75 was obtained. The arithmetic mean was used to analyze data relating to research questions, while analysis of covariance ANCOVA was used to test the null hypotheses. Findings revealed that male and female students taught auto mechanics technology using the cognitive apprenticeship instructional method achieved, and retained better than those who were taught using the demonstration method. Conclusion was drawn that the cognitive apprenticeship instructional method is an innovative and effective mode of instruction with capacity to improving both male and female students learning outcomes. Consequently, it was recommended among others that technical teachers should use cognitive apprenticeship instructional method in the teaching of auto mechanics trade to enhance both male and female students' academic achievement and knowledge retention in auto mechanics. It was also recommended that school administrators should provide opportunities for in-service training to equip technical teachers with the competencies needed in the use of the cognitive apprenticeship instructional method for teaching and learning auto mechanics trade in technical colleges.

Keywords: gender, cognitive apprenticeship, auto mechanic technology, academic performance and knowledge retention.

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I. INTRODUCTION

Gender refers to the biological and physiological reality of being male or female (Igbo, Onu & Obiyo, 2015). Igbo et al, described gender as a behaviour pattern and attitude perceived as a masculine and feminine within a culture. Furthermore, Uwameiye and Osunde (2005) described gender as a psychological term, which describes behaviours and attributes expected of individuals on the basis of being a male or female. It is a social and cultural construct which distinguishes the difference in the attributes of men and women, boys and girls and accordingly refers to the roles of men and women (Santrock, 2010). Over the years, education has focused on closing the enrolment gap between male and female students in technical colleges, while insufficient attention has been paid to the differences in their achievement. Adopting an approach that takes into account the relationship between male and female students in technical colleges will not only lead to improving equality of students' enrolment, but will also address equality of educational outcomes among male and female students in technical colleges. It will also ensure improved quality of both male and female students in auto mechanic trade.

Auto mechanics, according to FGN (2013), is one of the vocational trades offered at the technical college level as motor vehicle mechanics. The philosophy of the auto mechanics programme according to the National Board for Technical Education, NBTE (2009), is to produce competent craftsmen and technicians in auto mechanics trade for Nigeria's technological and industrial development. Auto mechanics craftsmen are expected to test, diagnose, service, and completely repair any fault relating to the conventional vehicles and also assemble main units and systems by following the manufacturers' specifications. The appropriate teaching and learning of auto mechanic trade will qualify both male and female students for the world of work. It will enhance their academic achievement and as well qualify them for the higher educational level that would enable them to become knowledgeable in the field of technology. The implication of this is that auto mechanic teachers especially in technical colleges should develop and employ instructional methods which should encourage both male and female students to participate actively in the learning process. Teachers should promote instructional methods which could bring about improved participation and interaction among male and female students. It is therefore hope that when these are achieved by auto mechanic teachers in technical colleges, it would challenge both male and female students to work at a higher intellectual level that would improve their academic achievement and retention of learning in technical colleges.

In general, students, irrespective of gender, could do well in all subjects if the appropriate instructional method is used in teaching the students. It is against this backdrop that researchers, such as Hadim and Esche (2002) Ogwo and Oranu (2006), Vincent and Akpan (2014) as well as Amaechi and Thompson (2016), recommend that demonstration teaching method could be used for teaching within the vocational education community. However, it has been observed that the few students that offer auto mechanics in technical colleges perform poorly in external examinations. The implication is that the demonstration method mostly used in teaching auto mechanic students in technical colleges seems not to be yielding the desired result. Therefore, it is pertinent that auto-mechanics teachers use teaching strategy which ensures the active involvement of students in learning irrespective of gender and also improve their academic achievement and knowledge retention. It is against this backdrop that researchers such as Abubakar, (2012); Maigida, (2013); Vanessa & Kerry, (2014); as well as Farzaneh, Rohani, and Ahmad (2015) recomended that cognitive apprenticeship instructional method be used to enhance students academic achievement in arts, social and physical sciences subjects, but no consideration has been made to ascertain the effects of cognitive apprenticeship instructional method (CAIM) on gender' academic achievement

and retention in auto-mechanic technology in Delta State. There is therefore a need for the study, to investigate the effect of CAIM on male and female academic achievement and retention in auto mechanics technology in technical colleges.

Academic achievement represents the outcome that indicates the extent to which a person has accomplished specific goals that were the focus of activities in instructional environments, specifically in schools. Tella (2010) posited that academic achievement is used to measure student's success in educational institutions or how well students meet the standard set out by examining bodies or the institution. Eze, Ezenwafor and Molokwu (2015) contended that student's academic achievement is dependent on several factors such as, learning environment, instructional methods, and teaching strategy, teachers' attitude, and enthusiasm, as well as students' attitude, and background. Among these factors, the instructional method used by teachers, challenge students to work at a higher intellectual level that would improve their academic achievement and retention of learning.

Retention of learning is simply the ability to remember what has been learnt. Eze et. al. (2015), stated that retention is the ability to retain the knowledge of what is learnt and to be able to recall it when it is required. Kundu and Totoo (2007) defined retention as the preservative factor of the mind. The authors posited that whatever touches consciousness leaves trace or impression and is retained in the mind in the form of images. This implies that for one to talk about retention, one must have been exposed to certain experiences or activities such as teaching. Retention is usually measured in collaboration with academic achievement. It is therefore seen as the achievement on a subject after a certain period of time. Retention helps in knowledge development. Knowledge development can be guaranteed when effective teaching methods are used in the teaching and learning process (Eze, Ezenwafor & Obidile, 2016). Ozden and Gultekin, (2008) contented that the use of appropriate instructional methods could enhance students' retention, which could in turn improve the academic achievement of students. The assumption is that when an effective method is employed for instruction, it aids students to internalize what they have been taught in order to correctly and successfully remember and apply it on a later date. Since it is presumed by the researchers that the cognitive apprenticeship instructional method could enhance students to learn, it is equally important to determine whether retention can be achieved. It is therefore pertinent that auto mechanic teachers use teaching strategy, which could improve academic achievement and knowledge retention among auto mechanics students irrespective of gender.

II. STATEMENT OF THE PROBLEM

The poor academic achievement of both male and female students in technical colleges in Nigeria has been a major concern to researchers. The use of the effective instructional method in technical colleges will enhance students' academic achievement irrespective of gender. This demands that teachers in technical colleges would adopt instructional methods that would improve the academic achievement of both male and female students in auto mechanics technology in technical colleges. To achieve this, various researchers have recommended that the demonstration instructional method could improve the achievement of male and female students in technical colleges in Nigeria. Despite the use of this method by teachers in technical colleges to ensure qualitative education at the technical colleges and bring about high quality products of both male and female students, there seems to be no improvement in the academic achievement of male and female students in auto mechanic trade in technical colleges in Nigeria. This is because there is still a persistent high failure rate among male and female students in technical colleges, as reported by NABTEB (2002; 2006; 2013, 2017). This has become worrisome to the researcher. Hence, the need for the study to determine the effect of Cognitive Apprenticeship

Instructional Method (CAIM) on Academic Achievement, Retention of male and female students in Auto Mechanic Technology in Technical Colleges.

III. PURPOSE OF THE STUDY

The purpose of the study was to determine the effect of cognitive apprenticeship instructional method on male and female students' academic achievement and retention in auto mechanics technology with regard to gender. Specifically, the study determined:

1. The difference in academic achievement mean scores of male and female students taught auto mechanics with the cognitive apprenticeship instructional method.
2. The difference in retention mean scores of male and female students taught auto mechanics with the cognitive apprenticeship instructional method.

IV. RESEARCH QUESTIONS

The following research questions guided the study.

1. What is the difference between the academic achievement mean scores of male and female students taught auto mechanics using the cognitive apprenticeship instructional method?
2. What is the difference between the retention mean scores of male and female students taught auto mechanics using the cognitive apprenticeship instructional method?

Null Hypotheses

The following null hypotheses were tested at 0.05 level of significance.

1. There is no significant difference between the academic achievement mean scores of male and female students taught auto mechanics using the cognitive apprenticeship instructional method.
2. There is no significant difference between the retention mean scores of male and female students taught auto mechanics using the cognitive apprenticeship instructional method.

V. SIGNIFICANCE OF THE STUDY

The findings of this study revealed the effects of demonstration and cognitive apprenticeship instructional method on male and female students' achievement and retention in the teaching of auto mechanics. Therefore, the findings of this study would be of immense benefit to auto mechanics teachers, auto mechanics students, curriculum planners, and educational researchers.

The findings of this study would guide the auto mechanics teachers in employing the effective method in order to enhance students' academic achievement, and knowledge retention in auto mechanics. The findings of the study would guide the auto mechanics students on how to effectively use the method that appears to be effective in the teaching and learning of auto mechanics.

Also, Curriculum planners would benefit from the findings of this study because it would help them to develop, and integrate effective teaching methods that could enhance students' academic achievement and knowledge retention. More so, knowledge of the finding of this study will not only enable the curriculum planner to recommend effective teaching methods, but also to plan, and conduct in-service training with regard to such method(s).

Finally, educational researchers would benefit from the findings of this study when carrying out similar research, and reviewing related literature. It would provide empirical data which could serve as a reference point for further research studies on the cognitive apprenticeship instructional method.

VI. SCOPE OF THE STUDY

The study focused on the effect of the cognitive apprenticeship instructional method on students' academic achievement and retention of auto mechanics. The study was delimited to vocational

II auto mechanics students in technical colleges in Delta State, Nigeria. The independent variables of the study were delimited to two groups (the demonstration and the cognitive apprenticeship instructional methods). Teaching in both groups covered the following areas of automobile instruction: identification of engine parts, dismantling of engine unit, the coupling of engine unit, identification of vehicle transmission parts, dismantling, and the coupling of the vehicle transmission system.

VII. METHOD

The study adopted the quasi-experimental research design. Specifically, the pre-test post-test non-randomized control group experimental design was used. The study was conducted in the six technical colleges in Delta State. The population of this study was 237 Vocational (VOC) II students studying automobile mechanics in all the six technical colleges in Delta State. The sample size of the study was 114 VOC II auto mechanics students. The purposive sampling technique was used to sample two schools from the six technical colleges that form the study population. The instrument for data collection was the Auto Mechanics Achievement Test (AMAT). The instrument was validated by three experts. Two experts from the Department of Technology and Vocational Education and one expert from the Measurement and Evaluation Unit in the Department of Educational Foundations, all in Nnamdi Azikiwe University Awka. The reliability of the instrument was determined using the Kuder – Richardson 21 (K-R21) formula, and reliability coefficient of 0.75 was obtained.

VIII. EXPERIMENTAL PROCEDURES

The researcher sought and obtained permission from the authorities concerned for the involvement of their colleges, teachers, and students in the study. The study lasted for nine weeks (one week for pre test and briefing of teachers involved, six weeks for treatment, and two weeks extra for the retention test). The teaching was conducted during the normal lesson periods of the schools using intact classes. The regular auto mechanics teachers taught their classes using the time-table of their various schools. The experimental group was taught using the cognitive apprenticeship instructional method while the control group was taught using the demonstration method. Teaching for the experimental group was designed specifically to employ the CAIM elements. The instructional activities were deliberately sequenced through modelling, coaching, and scaffolding. Students in the experimental groups were systematically encouraged to engage in articulation, reflection, and exploration during each teaching and learning experience by sharing ideas on areas of difficulties and defining problems to be solved.

At the end of the treatment, a post-test was administered on both groups using AMAT test items by the auto mechanics teachers and their assistants. The exercise provided the post-test data for each of the dependent variables. The AMAT was re-administered as a retention test after two weeks interval, but with the original test questions reshuffled. The researcher marked the students' responses of the test and statistically analyzed the data.

The data collected were analyzed using mean scores and analysis of covariance (ANCOVA). The mean was used to answer the research questions while Analysis of Covariance (ANCOVA) was used to test the null hypotheses at 0.05 level of significance. In the test of the null hypotheses using ANCOVA, when the p-value was less or equal to the level of significance (0.05), the null hypothesis was rejected. Also, when the p-value was greater than the level of significance (0.05), the null hypothesis was not rejected.

IX. RESULTS

Table 1: Mean and Standard Deviation for Academic Achievement Scores of Male and Female Students in Experimental Group

	Groups		Pretest Achievement	Post Achievement	Mean gain
Experimental	Male	Mean	20.02	73.84	53.82
		N	45	45	
		Std. Deviation	3.88	8.59	
	Female	Mean	21.62	63.69	42.07
		N	13	13	
		Std. Deviation	5.14	4.96	

Table 1 shows that male students had a higher academic achievement mean scores in the experimental group. The male mean gain is 53.82 while the female mean gain is 42.07.

Table 2: Mean and Standard Deviation for Retention Scores of Male and Female Students in Experimental Group

	Groups		Retention Scores
Experimental	Male	Mean	69.33
		N 45	
		Std. Deviation	
	Female	Mean	60.15
		N 13	
		Std. Deviation	

Table 2 shows that male students had higher retention mean scores in the experimental group. The male retention mean score is 69.33 while the female retention mean score is 60.15.

Table 3: ANCOVA for Differences in Female and Male Students' Achievement Mean Scores in Experimental Group

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	529.145[a]	2	174.573	2.421	.026
Intercept	1247.418	1	2247.418	31.539	.000
pretestinterest	155.994	1	235.994	3.465	.027
Genderexp	156.887	1	156.887	2.164	.055
Error	4289.476	55	66.990		
Total	233192.000	58			
Corrected Total	3838.621	56			
a. R Squared = .113 (Adjusted R Squared = .061)					

Table 3 shows that there is no significant main effect of treatment in the post test achievement mean scores of male and female students in the experimental group $F(1, 113) = 2.164$, $p > 0.05$. This means that there was no significant difference in the achievement mean scores of male and female students in the experimental group. Therefore, the hypothesis that there is no significant mean difference in the achievement mean scores of male and female students in the experimental group is not rejected.

Table 4: ANCOVA for Differences in Female and Male Students' Retention Mean Scores in Experimental Group

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	1094.822[a]	2	547.411	9.961	.000
Intercept	1676.371	1	1676.371	30.505	.000
Posttest	174.429	1	174.429	3.174	.080
Genderexp	392.762	1	392.762	7.147	.010
Error	2967.494	54	54.954		
Total	262353.000	57			
Corrected Total	4062.316	56			
a. R Squared = .270 (Adjusted R Squared = .242)					

Table 4 shows that there is significant main effect of treatment in the retention mean score of male and female students in the experimental group $F(1, 113) = 7.147$, p < 0.05. This means that there is significant difference in the retention mean scores of male and female students in the experimental group. The hypothesis that there is no significant mean difference in the retention mean scores of male and female students in the experimental group is therefore, rejected.

X. DISCUSSION OF RESULTS

Findings of the study revealed that the academic achievement of male and female students taught auto mechanics using CAIM did not differ significantly in post test mean scores. This indicated that CAIM was effectives and has the potential of improving students' academic achievement in auto mechanics technology irrespective of gender. This result revealed that if female students are given the same opportunity as their male counterpart, they could do better.

Findings of the study also revealed that male and female students taught auto mechanics using CAIM differ slightly in retention ability in favor of male students. This indicated that CAIM was effectives and has the potential of improving students' retention ability in auto mechanics technology irrespective of gender.

XI. CONCLUSION

Based on the findings of the study, it was concluded that cognitive apprenticeship instructional method is an effective method for improving male and female students' academic achievement and retention in auto mechanics technology.

XII. RECOMMENDATIONS

Based on the findings of this study, it is recommended that;

1. The cognitive apprenticeship instructional method should be formally adopted as a method of instruction in technical colleges.
2. Teachers of auto mechanics technology should acquire the knowledge and skills for using the cognitive apprenticeship instructional method through in-service training, conferences, seminars and workshops.

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