Vol. 15(4), pp. 194-202, April, 2020
DOI: 10.5897/ERR2020.3929
Article Number:1959D2F63503
ISSN: 1990-3839

http://www.academicjournals.org/ERR

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Educational Research and Reviews

Full Length Research Paper

Gender differences in achievement, interest and retention of students' exposed to fabrication and welding engineering craft practice through cognitive apprenticeship instructional technique in Nigeria

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Received 17 February, 2020; Accepted 25 March, 2020

The study was a pre-test, post-test, non-equivalent control group quasi-experiment, involving students in intact classes. Three research questions and three hypotheses guided the study. The population and sample for the study consisted of all 64 National Technical Certificate (NTC) II students of fabrication and welding engineering craft practice in Ekiti State. These comprise 53 males and 11 females. The instruments used for data collection were the fabrication and welding achievement test and fabrication and welding interest inventory. The instruments were subjected to face and content validation by three experts. The reliability coefficients of the instruments are 0.79, 0.75 and 0.82 respectively. Mean was used to answer research questions, while ANCOVA was used to test the hypotheses. The mean score of girls was not significantly different from those of boys in the achievement test. There was a significant difference in the mean interest and retention scores of students based on gender.

Key words: Cognitive apprenticeship, gender, cognitive achievement, interest, retention, fabrication and welding.

INTRODUCTION

Providing quality education leads not only to improved enrolment but also ensures that boys and girls are fully able to realise the benefit of education. Adopting an approach that takes into account the relationship and interaction between males and females according to the United States Agency for International Development (USAID), (2008) will address four dimensions: equality of access; equality in the learning process; equality of educational outcomes and equality of external results. Gender refers to a psychological term, which describes behaviours and attributes expected of individual on the basis of being a male or a female (Uwameiye and Osunde, 2005). In most societies, gender role has relegated females to the side-lines, preventing them from participating in and benefiting from educational and development efforts (Ogbuanya and Owodunni, 2015).

In recent times, the gender factor has assumed prominence in science vocational and technical education

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discourse. It has been documented that disparity exists between male and female students' performance. Several studies such as Zaharim et al. (2013), Akpotohwo and Ehimen (2014) and Okwelle et al. (2018) have shown differential performance in activities as a result of gender in favour of boys. According to UNESCO (2012), the noticed disparity in achievement between genders may be as a result of conformity with certain traditions in some countries which regard technical and vocational education as predominantly for boys only. Other research findings have attributed the reasons for the disparity in students' performance based on gender to include that male and female genders are different in several respects such as the rate of brain development (Jiang et al., 2019), brain lateralization (Marco et al., 2019), brain tasks execution strategies (Gomez et al., 2011), seeing and hearing endowed capabilities (Naomi, 2018), classroom learning climatic conditions (Hodgins, 2008) and learning strategies or styles (Mahmud and Nur, 2018).

Opare (2011) also noted the effects of stereotyped belief notion that science and technology subjects are unfeminine and that women who study those courses are unattractive; the apparent perception of "low factor of safety" in some courses as well as "strength requirement" are some of the major factors that undermine the level of attendance and performance of female students in vocational education related trades, inclusive of fabrication and welding engineering craft practice. Each or all of these factors poses constraint to academic performance of students based on gender if left unchecked.

One probable cause of this disparity may also not be unconnected to teaching methods employed by instructors to teach the students which were described by the National Business and Technical Examination Board (NABTEB) chief examiners report (2017) as obsolete in most technical colleges. Sharma and Kumar (2018) opined that the continued use of the chalk-and-talk traditional teaching methods to teach in our schools may not provide students with valuable skills and may also lead to students not retaining knowledge. The methods are based on the learning theory of behaviorism. They thus encourage students to be passive, direction followers and product-oriented. Fabrication and Welding Engineering craft practice is one of the mechanical related trades offered in technical colleges in Nigeria. The goal of Fabrication and Welding Engineering craft practice according to the National Board for Technical Education NBTE (2001) is to give training and impart the necessary skills leading to the production of craftsmen, technicians and other skilled personnel who will be enterprising and self-reliant. This goal can, however, be achieved only when vital components of the trade such as structural steelwork, sheet metal work and importantly, welding work are appropriately and effectively taught to learners in other to fit into the 21st-century workplace, high proficiency is required of the trainee in carrying out the processes of metal arc welding in a well-structured teaching/learning processes and environment. This is as against the traditional apprenticeship system of imparting knowledge which has existed from ancient times till now.

In modern times, apprenticeship has largely been replaced by an alternative model of instruction that is accessible within the framework of formal schooling. It is a model of instruction that goes back to apprenticeship but incorporates elements of schooling. This model is referred to as "cognitive apprenticeship" propounded by Collins et al. (1989). A cognitive apprenticeship employs a constructive learning theory. It is much like a trade apprenticeship, with learning that occurs as experts and novices interact socially while focused on completing a task; the focus, as implied in the name, is on developing cognitive skills through participating in authentic learning experiences. Francesca (2015) succinctly described it as "learning-through-guided-experience on cognitive and metacognitive, rather than physical, psychomotor skills and processes in traditional apprenticeship. Cognitive Apprenticeship Instructional Method (CAIM) is a framework outlining the methodology for teaching complex cognitive tasks through guided learning (Collins et al., 2004).

In CAIM, the teacher, expert or more knowledgeable peer need to deliberately bring his/her thinking to the surface to make it visible. The teachers' thinking must be made visible to the students and students' thinking must be made visible to the teacher. The aim is to get the thinking process out into the space between teachers (experts) and students (novice) where they can both literarily see it. Ertmer and Newby (2005) explained that applying apprenticeship techniques to largely cognitive skill requires the externalization of processes that are usually carried out internally. By bringing this tacit process into the open, students can observe, enact, and practice them with help from the teacher and from other students. The challenge in CAIM is to present a range of tasks varying from specific to diverse and to encourage students to reflect and articulate the elements that are common across tasks (Collins et al., 1991). As teachers present the targeted skill to students, they can increasingly vary the context in which those skills are used. The goal, according to Collins et al, is to help students generalize the skill or knowledge so that it could be transferred and applied independently to different settings. Collins et al. (1989) developed six teaching methods necessary in a CAIM class. These include modeling, coaching, scaffolding, articulation, reflection and exploration.

One important role of the teacher is to order and structure the learning environment and use of motivational techniques to secure and sustain the attention and interest of learners Accordingly, Judith et al. (2016) see interest as a powerful motivational process that energizes learning, guides academics and career

trajectories and essential to academic success. Interest does not come as a result of force; it is as a result of an individual`s eagerness to learn. Therefore, interest as an affective behaviour can be aroused and sustained in teaching and learning through appropriate teaching strategy. Ogwo and Oranu (2006) and Ngwoke (2004) emphasized that unless the teacher stimulates students' interest in learning, students' achievement will be minimal. Fabrication and welding engineering craft practice is an integral part of vocational and technical education. In order to facilitate teaching and learning, and also increase both male and female interest in the trade, retention of learnt knowledge by students is a relevant factor.

Retention has to do with the ability to remember and apply previously learnt behaviour. Accordingly, Andriotis (2017) maintained that retention of learning is the process by which new information is transferred from one short term to long term memory. It is a learning that lasts beyond the initial unit or lesson and it is assessed with a test administered in two or more weeks after the information has been taught and tested.

This implies that a learner who repeats an acquired piece of knowledge with less error is said to have retained the material taught. Martin et al. (1991) discovered that for long time retention of knowledge to be achieved, motivation and interest of the learners must be sustained through the usage of appropriate teaching method. Such method should be capable of equipping the students with critical thinking skills. Thus, the ability to retain learnt skills for a long period of time will enable a properly trained Fabrication and welding engineering craft personnel to remain relevant in today's world of work without being gender bias. Thus the purpose of this study is to investigate gender differences in the performance, interest and retention of FWECP trade students in technical colleges in Ekiti State, Nigeria when exposed to cognitive apprenticeship instructional technique. More so, the study is coming at a time when attention is paid to women education.

Statement of the problem

There have been persistent reports of disparity in the performance of male and female students in Fabrication and welding engineering craft practice in technical colleges in Nigeria. This is evidence in the statistics made available by NABTEB which indicates that only 25% of the female students that did the exam passed at credit level and above in year 2016 while 92.7% of male students had credit pass. In year 2017, 30% female student passed at credit level while 81% of male students passed at credit level and above in NABTEB conducted examinations. This persistent disparity in achievement may be as a result of the use of inappropriate teaching methods adopted by teachers (Oyenuga, 2010; NABTEB, 2017).

Research questions

The research questions raised to guide the study are:

(1) Would there be any difference in the achievement mean score of male and female students exposed to FWECP with CAI strategy?
(2) Would there be any difference in the interest mean score of male and female students exposed to FWECP with CAI strategy?
(3) Would there be any difference in the retention mean score of male and female students exposed to FWECP with CAI strategy?

Hypotheses

The null hypotheses tested at 0.05 significant levelformulated to guide the study are:

H_{01}: There will be no significant difference in the cognitive achievement score mean of male and female students in FWECP when exposed to CAI strategy.
H_{02}: There will be no significant difference in the interest score mean of male and female students taught fabrication and welding engineering craft practice with CAI strategy
H_{03}: There will be no significant difference in the mean of retention scores of students taught fabrication and welding engineering craft practice with CAI strategy based on gender.

METHODOLOGY

A quasi-experimental design with a pre-test and post-test non-equivalent comparison group design was adopted. The use of intact non-randomized classes makes the design very suitable for the study. This is because there was no plan to disrupt the schools' calendar. The study was carried out in Ekiti State, Nigeria. The population and invariably the sample for this study was all 64 year two FWECP students in Ekiti State government-owned technical colleges offering FWECP. These comprised 53 male and 11 female students. The simple random sampling technique was adopted for randomly assigning the two technical colleges that offer FWECP to both experimental group and the conventional group in the study.

Instruments for data collection

The instruments used for data collection were the Fabrication and welding achievement test (FWCAT),) and Fabrication and welding interest inventory (FWII). The FWCAT items were adapted from the National Business and Technical Examination Board (NABTEB) 051-1 (sheet metal/structural steelwork, CFW 11 and 14) past question papers. The FWCAT instrument contained 30 test items. The items therein covered only the content aspects of this research study (Welding machines and accessories; Welding joints in all position; Arc welding ferrous and non-Ferrous metals; Building up worn metallic parts using arc welding; Arc cutting of metal).

The Fabrication and Welding interest inventory (FWII) was developed by the researchers to test students' interest in

Fabrication and Welding works. The items were based on a four-point Likert scale of Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD). It contains twenty-five (25) items. Scores obtained in both instruments were converted to percentages (%). The CAIM lesson plans were developed by the researcher for the use of teaching experimental group; this was to ensure standardization and control invalidity that could be caused by teacher variability. The CAIM lesson plan has all six instructional strategies: modelling, coaching, scaffolding, articulation, reflection and exploration built into it.

The FWCAT instrument has been validated by the National Business and Technical Examination Board (NABTEB). NABTEB is an examination body that uses expert test developers and subject specialists in setting their questions and thereafter subject the developed items to various stages involved in validation and standardization of test. In addition, face and content validation were conducted on both instruments viz FWCAT and FWII by three experts from the Department of Vocational and Technical Education, Ekiti State University and two Fabrication and welding engineering craft practice teachers from Technical Colleges in Ekiti State. There suggestions were incorporated into the instruments. The reliability of the instruments was established by testing them on a group of fifteen (15) year 2 (13 males and 3 females) Fabrication and welding engineering craft practice trade students in a Government Technical College, outside the sample space. The internal consistency of the FWCAT was established with the use of Kudder-Richardson Formula 20 (K - R.20); the internal consistency estimate gives a measure of the homogeneity of the items in the instrument. An internal consistency estimate of 0.79 was calculated for the FWCAT. Since the FWCAT was going to be used as a retention test, it was deemed necessary to establish an estimate of temporal stability, using the test-retest reliability technique. A time lag of two weeks between the test and the retest was allowed. The scores of the students on the two different administrations of the test were correlated using Pearson's Product Correlation technique. 'The coefficient of stability computed for the FWCAT was 0.75. Cronbach Alpha was used to determine the internal consistency of fabrication and welding Interest Inventory items by also tried testing it on the students. The reliability coefficient computed for the FWII was 0.83.

Experimental procedure

The study was conducted in four phases: The first phase was the pre-test stage. It was the phase in which the FWECAT and FWII were administered on the subjects in both the experimental and control groups. This phase of the study was done in the first week of the experiment. This exercise provided baseline data on cognitive achievement and interest inventory. The second phase which is the experimental or test phase featured the teaching of the experimental group with the developed CAIM teaching method lesson plan while at the same time, the conventional group was taught the same topics using the usual format, teaching methods and lesson plan as developed by the respective teachers handling the classes.

Fabrication and Welding Engineering craft practice teachers in the experimental school used the researchers' developed lesson plans to teach their group. During the treatment, the control group received no new treatment. In all four major topics were covered in this study, that is Welding machines and accessories; Welding joints in all position; Arc welding ferrous and non-Ferrous metals; Building up worn metallic parts using arc welding; Arc cutting of metal. Teaching for the experimental group was designed to provide a broad-based contextual understanding within which meaningful exploration and constructivists learning could occur.

The experimental groups' methodologies were designed specifically to employ the CAIM elements described earlier. Each laboratory learning activities were deliberately sequenced through modelling, coaching and scaffolding. Also consistent with the CAIM methodology approach, the experimental group students were methodically stimulated to participate in practical classes by sharing ideas on areas of difficulties and defining problems to be solved. For instance, as students identify parts and accessories of welding machines, they were asked by their teachers or more knowledgeable peers to visualize the functions of the parts and accessories. Throughout this process, they were encouraged by their instructor or more knowledgeable peers to verbalize their thoughts on how the machines, components and various categories of accessories function in an arc welding cycle and also explain what could happen when there is components' failure. Furthermore, the fact that the experimental group conducted their practical activities as a team and cooperatively, there is thus active interaction among the students both within and across the teams. This enables the students to reflect on, that is, Arc welding of various ferrous and non-Ferrous metals, taking into consideration different factors and properties of the metals. Regular reflective debriefing sessions were conducted following each exercise. Students were asked to operate different types of welding machines including the usage of the accessories; depending on the topic being treated this allowed them to develop the necessary skills (cognitive and psychomotor). If assistance was needed at any time, the instructor coached them through several checks. The sequencing pattern was followed for all the content area of the instruction. The treatment for this research lasted for ten weeks, while each lesson lasted for 90 min (double periods).

The third phase was the post-test phase. A post-test was administered on both groups using the two instruments by the Fabrication and Welding Engineering craft teachers and their assistants after the treatment. The exercise provided post-test data for the dependent variables (cognitive achievement, and interest) after the treatment. The fourth phase was the administration of the FWCAT version administered on the students during the pre-test phase exactly two weeks after the post-test phase. This was to determine the retention capacity of learnt knowledge by the students. The data obtained from the students' scores were analysed by the use of mean to answer research questions and the usage of analysis of covariance (ANCOVA) for testing the hypotheses.

RESULTS AND DISCUSSION

Research question 1: Would there be any difference in the achievement mean score of male and female students exposed to FWECP with CAI strategy?

Table 1 shows that male students taught FWECP with cognitive apprenticeship instructional method had a mean score of 20.32 and standard deviation of 4.25 in the pre-test and a mean score of 73.41 and standard deviation of 6.19 in the post-test making a pre-test, post-test mean gain in the male students taught with cognitive apprenticeship instructional technique to be 53.09. Female students taught FWCP with cognitive apprenticeship instructional method had a mean score of 19.75 and standard deviation of 2.98 in the pre-test and a post-test mean of 72.00 and standard deviation of 4.83, with a pre-test, post-test mean gain of 52.25. With these results male students taught FWECP with cognitive apprenticeship instructional method had a slightly higher mean score than female students in the cognitive

Table 1. Mean and standard deviation of pre-test and post test scores of male and female students taught FWECP in the cognitive achievement test

	Cognitive apprenticeship instructional method						Conventional method					
	N	Pretest	$\overline{X}$ SD	Posttest	$\overline{X}$ SD	Mean gain $\overline{X}$	N	Pretest	$\overline{X}$ SD	Posttest	$\overline{X}$ SD	Mean gain $\overline{X}$
Male	29	20.32	4 .25	73.41	6.19	53.09	24	20.23	2.82	48.60	8.61	28.37
Female	06	19.75	2.98	72.00	4.83	52.25	05	18.00	2 .00	41.00	2.65	23.00

achievement test. In the same vein, male students taught FWCP with conventional method had their mean scores to be higher than the female students in the Fabrication and Welding Cognitive Achievement Test (FWCAT). This therefore indicates that there was an effect of gender Thus, there is an influence attributable to gender (male and female) on the skill performance of students taught FWECP.

Research question 2: Would there be any difference in the interest mean score of male and female students exposed to FWECP with CAI strategy?

The data presented in Table 2 shows that males had a mean score of 72.41 in the post-test and a mean score of 70.71 in the test for retention with a mean gain of -1.7. The female also had a mean score of 65.25 in post-test and a mean score of 67.00 in the test for retention. The female also had a mean gain of +1.75.The result indicates that though males had higher mean score, the females performed better than male students in the test for retention of learning with a positive mean gain.

Research question 3: Would there be any difference in the retention mean score of male and female students exposed to FWECP with CAI strategy?

Table 3 indicates that male students taught FWECP with cognitive apprenticeship instructional method had a mean score of 27.48with a standard deviation of 6.82 in the pre-test and a mean score of 73.16 and standard deviation of 7.65 in the post interest inventory, making a pre-test, post-test mean gain in the male students taught with cognitive apprenticeship instructional technique to be 45.68. Female students taught FWECP with cognitive apprenticeship instructional method had a mean score of 23.50 and standard deviation of 4.43 in the pre-test and a post-test mean of 90.50 and standard deviation of 3.11, with a pre-test, post-test mean gain of 67.00. Thus female students taught FWECP with cognitive apprenticeship instructional method had their mean scores higher than males in the Fabrication and welding Interest Inventory (FWII).This implies that there was an influence ascribed to on the interest of students taught FWECP.

H_{01}: There is no significant difference in the mean cognitive achievement scores of male and female students in FWECP when exposed to CAI strategy.

Table 4 shows that the F-value for treatment is 68.003 with significant P at 0.000, which is less than 0.05. The null-hypothesis was rejected at .05 level of significance. Thus there was a significant difference between the mean scores of students taught FWECP trade with CAI technique and those taught using conventional teaching method. The calculated F- value (6.453), significant P (0.014) also indicated that there was a significant difference between the main effects of gender (male and female) on students' achievement in the cognitive achievement test. Thus the null hypothesis of no difference is rejected.

H_{02}: There is no significant difference in the mean interest scores of male and female students taught fabrication and welding engineering craft practice with CAI strategy

Table 5 shows that the F-value for treatment is 123.244, with significant P at 0.000, which is less than 0.05. The null-hypothesis was rejected at 0.05 level of significance. Thus there was a significant difference between the mean scores of students taught FWECP trade with CAI technique and those taught using conventional teaching method in the interest inventory. The calculated F- value (8.231), significant P (0.006), also indicated that significant difference existed in students' achievement based on gender (male and female) in the Fabrication and Welding Interest Inventory (FWII).Hence, the rejection of the null hypothesis.

H_{03}: There will be no significant difference in the mean of retention scores of students taught fabrication and welding engineering craft practice with CAI strategy based on gender.

Table 6 shows that the F-value for treatment is 19.941, with significant P at 0.000, which is less than 0.05. The null-hypothesis was rejected at 0.05 level of significance. Thus there was a significant difference between the mean scores of students taught FWECP trade with CAI technique and those taught using conventional teaching method in the test for retention. The calculated F- value

Table 2. Mean and standard deviation of posttest and retention scores of male and female students taught FWECP.

	Cognitive apprenticeship instructional method						Conventional method					
	N	Posttest	$\overline{X}$ SD	Retention	$\overline{X}$ SD	Mean gain $\overline{X}$	N	Posttest	$\overline{X}$ SD	Retention	$\overline{X}$ SD	Mean Gain $\overline{X}$
Male	29	72.41	6 .19	70.71	5.82	- 1.7	24	48.73	8 .61	51.58	7.79	2.85
Female	06	65.25	2 .25	67.00	4.08	1.75	05	46.00	2 .65	45.67	10.07	- 0.33

Table 3. Mean and standard deviation of pre-test and post test scores of students (male and female) taught FWECP in the fabrication and welding interest inventory.

	Cognitive apprenticeship instructional method						Conventional method					
	N	Pretest	$\overline{X}$ SD	Posttest	$\overline{X}$ SD	*Mean Gain* $\overline{X}$	N	Pretest	$\overline{X}$ SD	Posttest	$\overline{X}$ SD	*Mean Gain* $\overline{X}$
Male	29	27.48	6 .82	73.16	7.65	45.68	24	28.92	7 .41	53.00	7.07	24.08
Female	06	23.50	4 .43	90.50	3.11	67.00	05	25.33	3 .78	49.67	.58	24.34

Table 4. Summary of analysis of covariance (ANCOVA) for test of significance of three effects: Treatments, gender and interaction effect of treatments and gender on students' cognitive achievement in FWECP.

Source of variation	Sum of squares	DF	Mean square	F	Sig of F
		Dependent variable: Posttest			
Corrected Model	9228.548[a]	4	2307.137	44.829	0.000
Intercept	6192.742	1	6192.742	120.329	0.000
pretest	0.962	1	0.962	0.019	0.892
treatment	3499.768	1	3499.768	68.003	0.000
sex	332.099	1	332.099	6.453	0.014
treatment * sex	0.461	1	0.461	0.009	0.925
Error	3036.452	59	51.465		
Total	249434.000	64			
Corrected Total	12265.000	63			

a. R Squared = .752 (Adjusted R Squared = 0.736)
b. Computed using alpha = 0.05.

(1.158), for gender with significant P (0.286),shows that no significant difference existed in the achievement of students based on gender (male and female) in the test for retention; hence, the acceptance of the null hypothesis.

DISCUSSION

Table 2 provides data for answering research question two. The finding indicates that male students taught fabrication and welding engineering craft practice with CAI technique had higher mean scores than female students in FWCAT. This thus implies that there was an effect of gender on the achievement of students taught fabrication and welding engineering craft practice CAI techniques. In the testing of hypothesis one, as indicated in Table 5, Analysis of covariance (ANCOVA) was employed at confidence level of .05 and calculated F-value (91.03). It was revealed that there was a significant difference in the achievement of students based on gender in FWECP. This implies that cognitive achievement of students in FWECP is gender sensitive

This finding is similar to that of Animasahun (2015) who discovered that male students significantly performed better than females in her study titled 'the effects of

Table 5. Summary of analysis of covariance (ANCOVA) for test of significance of three effects: Treatments gender and interaction of treatment and gender on students' interest in MVMW.

Source of variation	Sum of squares	DF	Mean square	F	Sig of F
Dependent variable: Posttest					
Corrected Model	9356.224[a]	4	2339.056	49.417	0.000
Intercept	12259.456	1	12259.456	259.005	0.000
pretest	241.224	1	241.224	5.096	0.028
treatment	5833.481	1	5833.481	123.244	0.000
sex	389.619	1	389.619	8.231	0.006
treatment * sex	660.569	1	660.569	13.956	0.000
Error	2792.636	59	47.333		
Total	282159.000	64			
Corrected Total	12148.859	63			

a. R Squared =0.770 (Adjusted R Squared = 0.755); b. Computed using alpha = 0.05.

Table 6. Summary of Analysis of Covariance (ANCOVA) for test of significance of three effects: Treatments, gender and interaction effect of treatments and gender on students' retention in FWECP

Source of variation	Sum of squares	DF	Mean square	F	Sig of F
Dependent Variable: Retention					
Corrected Model	5804.050[a]	4	1451.013	30.706	0.000
Intercept	3075.512	1	3075.512	65.083	0.000
pretest	1.341	1	1.341	0.028	0.867
treatment	942.298	1	942.298	19.941	0.000
sex	54.703	1	54.703	1.158	0.286
treatment * sex	1.006	1	1.006	0.021	0.884
Error	2788.059	59	47.255		
Total	252011.000	64			
Corrected Total	8592.109	63			

a. R Squared = 0.676 (Adjusted R Squared = 0.654); b. Computed using alpha = 0.05.

cognitive apprenticeship and critical exploration teaching strategies on basic science students' learning outcomes in selected secondary schools in Osun State, Nigeria'. This also affirms Dorine et al. (2018) and Mwaba et al. (2015) findings that show that disparity exists in the performance of students based on gender in the sciences and related fields, in most cases favouring boys. Generally, male students have been consistently observed to achieve higher than females on vocational and technical achievement trades. This suggests that male students apparently possess greater vocational skills than female students. Male superiority in vocational skills was also established in studies conducted by Ibrahim et al. (2013) and Umunadi (2011).

Furthermore, the data presented in Table 4 provided answer to research question four. It was observed that female students taught Fabrication and welding engineering craft practice with CAI techniques had higher mean scores than male students in the Fabrication and Welding Interest Inventory (FWII). This indicates that there is an effect attributable to gender on the interest of students taught FWECP with CAI techniques. However, Table 6 indicates that there was no significant difference in the mean interest scores of students based on gender (male and female) when subjected to ANCOVA. Thus the difference noticed in the mean of the students (male and female) interest scores was statistically insignificant. Interestingly, the provision of opportunities to interact with course material through the use of appropriate real live tools and equipment cooperatively tends to change the course from a competitive endeavour to one that is more student-centred, and focused on the construction of knowledge in the students (Carol, 2003). Hence, one means of constructing knowledge is to create meaning by doing. Creating support for knowledge construction within the students is a critical component to the success of developing self-motivated, intellectually stimulated learners (Yurdagül et al., 2012).

The data presented in Table 3 provided answer to research question three. Finding revealed that female

students taught FWECP with CAI techniques had higher retention scores than male students in the test of retention. Thus, there is an effect attributable to gender in the test of retention of students taught FWECP with CAI techniques. The employment of analysis of covariance for the testing of hypothesis 3 as indicated in Table 6 at an F-value (11.46), significance of F (0.00) and 0.05 confidence level revealed a significant difference in the retention of knowledge of male and female students exposed to FWECP. This finding further confirmed that the difference observed in the main effect of the retention scores of students based on gender was statistically significant, not due to chance and favouring female students. Thus gender influence affects subjects in the experimental group. The female students tended to be superior to their male counterparts in the retention of FWECP concepts. This finding is at variance with that of Malau-Aduli et al. (2013) who observed a significant gender influence on science concepts in favour of male students in their study titled "Retention of knowledge and perceived relevance of basic sciences in an integrated case-based learning (CBL) curriculum".

On the other hand, the result corroborates the study of Ajai and Imoko (2015) whose findings indicated that female students performed significantly higher than male in the retention test in their study titled "Gender Differences in Mathematics Achievement and Retention Scores: A Case of Problem-Based Learning Method". This study is also in line with that of Lu-Fang (2011) in his study titled 'Gender Differences in L2 Comprehension and Vocabulary Learning in the Video-based Call Program'. The statistic results from the study showed among other findings that, regardless of videotext difficulty, females achieved higher percentage scores than males in comprehension, vocabulary immediate, and vocabulary retention tests.

Quality achievement, retention and Interest in vocational education are essential elements of an educational strategy, method or technique designed to ensure that boys and girls maximize their full potentials (United States Agency for International Development (USAID), (2008). To this therefore, the use of appropriate teaching method and strategies such as CAI technique that will ensure high quality education and success of millions of male and female students is necessary not only in Nigeria but the world at large.

Conclusion

The study revealed that there was significant difference in the achievement and retention of boys and girls in Fabrication and welding Craft Practice Work when exposed to Cognitive apprenticeship Instructional Technique. The difference in achievement was in favour of boys while the difference in interest and retention was in favour of girls.

Recommendations

The following recommendations are hereby made based on the findings: Technical College teachers should inject cognitive apprenticeship instructional technique to the teaching of FWECP. Government agencies responsible for coordinating the activities of technical colleges should organise workshops, seminars and conferences on regular bases for teachers in the colleges on the usage of cognitive apprenticeship instruction and other contemporary student centred teaching methods.

CONFLICT OF INTERESTS

The author has not declared any conflict of interests.

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