

# Proceedings:

*The 19th Academic Conference of Hummingbird Publications and Research International on Third World Nations for Development Communities in 21st Century. Vol. 19 No.2, 13th September, 2019 at Baayero University, BUK, Old Side Campus, Kano, Kano State, Nigeria*

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## **EFFECT OF PRACTICE BASED INQUIRY (PBI) CYCLE ON STUDENTS' PSYCHOMOTOR ACHIEVEMENT AND INTEREST IN WELDING AND FABRICATION ENGINEERING CRAFT PRACTICE IN KANO STATE**

**MUAZU, MURTALA ZAHRADEEN, DR. I. Y. UMAR AND DR. C. O IGWE**

*Department of Industrial and Technology Education, Federal University of Technology Minna, Niger State.*

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### **Abstract**

*The study investigated the effect of practice based enquiry cycle on students' psychomotor achievement and interest in welding and fabrication engineering craft practice in Kano state. The study had four objectives, answered for research questions and tested for null hypothesis at 0.05 significant level. A quasi-experimental, the pre-test, post-test, non-experimental control group design was employed for the study. Three technical colleges in Kano state were used. The sample for the study consisted of 160 National Technical Certificate II (NTCII) Students from two intact classes. The classes were randomly assigned to experimental and control groups. The instrument used for the study was Welding and Fabrication Craft Practice Achievement Test (WFCPAT) and welding and fabrication interest inventory (WFII). Pearson Product Moment Correlation (PPMC) formula was used for WFCPAT and alpha cronbach was used for WFII reliability coefficient of 0.88 and 0.80 respectively. Mean and Standard Deviation were used to answer research questions and ANCOVA was used to test hypotheses. The findings of this study showed that there was significant difference in the psychomotor achievement student-taught welding and fabrication engineering craft practice using base enquiry cycle and does taught using demonstration method and there was no significant difference in the interest level of students thought welding and fabrication engineering craft practice using practice based enquiry cycle based on gender. The strategy therefore, was recommended to be used by the technical college teachers in teaching of welding and fabrication engineering craft practice and metal work in general. Also, Government should provide tools and equipment needed to teach the state - of-the-art of metal work in the technical colleges.*

**Keywords:** *Psychomotor achievement, Interest, Welding and Fabrication Engineering craft practice, Gender, Technical College.*

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## **BACKGROUND TO THE STUDY**

Technological advancement environmental and social changes have increased the need for Teachers as facilitators of knowledge have had to develop, modify, improve and refine their approach so as to effectively and efficiently deliver instruction adopt new methods of delivery instruction as the traditional approach which is a teacher-centered has made students passive listeners in the learning process (Al-Jarf, 2009). Active learning occurs when students are doing things and thinking about what they are doing and meaningful learning happens when students integrate new information into what they already know (Adodo, 2013). Through active learning students are engaged in series of activities such as reading, discussing and writing which also increases students motivation to learn. Students can receive immediate feedback from their instructors and

The strategy of teaching is a matter of much concern to analysts, educators and teachers in the institutions of learning (Abdu-Raheem, 2011). It was noted that traditional method is the commonly used method in Nigerian Schools and Technician Colleges the system have been discovered not to be satisfactory as the students are not given the chance to communicate with nature's domain and their school abilities are not maximally developed (Abdu-Raheem, 2011). Instructional methods are utilized as part of presentation of lesson to help the students to learn by guaranteeing the smooth conveyed of guideline. It is a system by which an instructional unit, instructional stage or an entire course is conveyed (Nafees, Farouk, Tahirkhel & Akhtar, 2012). Teaching method is the technique in which an educator conveys his or her topic to students, taking into account pre-stated goals, to promote learning. Several teaching methods have been surveyed by researchers to replace the commonly known conventional lecture method in order to improve the quality of instruction as well as the academic performance of the learner (Nafees, Farouk, Tahirkheli & Akhtar, 2012).

The determination of fitting instructional strategy guarantees the accomplishment of the expressed instructional goal viably. Instructional methods are utilized as part of the presentation of lesson to help the students learn by guaranteeing the smooth conveyance of guideline. It is a system by which an instructional unit, instructional stage or an entire course conveyed (Nafees, 2012). The strategy or methodology utilized in instruction is a matter of concern to analyses, educators and teachers (Abdu-Raheem, 2011). It is obvious that traditional teaching method is the most commonly used method in senior secondary schools in Nigeria, technical colleges are also included and the system have been discovered not to be so effective on the grounds that students are not given chance to communicate with nature's domain and their

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scholarly abilities are not maximally developed. (Abdu-Raheem, 2011) Without abandoning the traditional teaching method, it can be paired with contemporary teaching strategies such as Jigawa, Z-A, Guided-Discovery e.t.c to enhance learning.

However, the effects of teaching strategies on students learning should be of interest to every intellectual. The method used in teaching is very important as the method used may promote or hinder learning. The methodology used in teaching has the capability of sharpening students' mental activities which are the bases of social power or may discourage initiatives and curiosity, thus making self-reliance and survival difficult (Ameh and Dantani, 2012). There are several innovative teaching methods/strategies that are used in Nigerian institutions of learning, today. They include Guided Discovery, Cooperative learning, individualized learning, Case Studies, Computer simulation, Z-A approach, Jigsaw strategies; practice based inquiry (PBI) cycle; to mention but a few. Practice based inquiry cycle is one of the newest innovative strategies that is not yet saturated in teaching.

The Practice Based Inquiry (PBI) cycle is an innovative learner-centered strategy, which allows for proper planning, evaluating and re-implementation in instruction, (Popham, 2012), the cycle consists of series of activities which technical teacher could adopt to enhance his planning for classwork and laboratory/workshop activities resulting in improving outcome after delivery, the glossary of (core module components four CC4). State Education Sector Project (SESP, 2019). Also the stages are to identify a problem, to plan a solution, to put the solution into practice and then to evaluate it again. This is the way of improving based on doing. The cycle consists of five basic stages starting from identification of the area that needs or the practical from the minimum standards, developing an action plan, implementing the action plan, evaluating the success of implementation again i.e (feedback) as a result of timing or the learning resources selected for the implementation. If successful the action plan is kept in the portfolio for future use referred to chapter two for more details. The approach helps make concepts clear stimulate students' interest in knowing the concept, boost their psychomotor achievement.

Achievement, in this context refers to the realization of the educational objectives of a student. It is usually denoted by a score, this score is obtained through testing. The type of testing employed for a discipline like welding and Fabrication Engineering Craft practice, measures psychomotor achievements. While psychomotor achievement defined by Raymond, Udafemhe and Shuaibu (2016) revealed how well the educational objectives in the psychomotor domain have been realized by a student. In the field of welding and Fabrication Engineering craft practice, psychomotor

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achievement are paramount. Since the goal of educational research such as this one is to improve academic achievement, it has been therefore emphasized that teachers should endeavour to adopt instructional techniques that incorporate resources that are capable of stimulating students' interests. (Onyekwerre, 2001).

Works (1999) defined interest as a social contrition developing within the dynamic relationship between the individual and the situation. Students interest in learning is linked with their anxiety to learn. It consists of feelings and tendencies towards a concrete matter. A characteristic feature of interest is a manifestation of a different preference towards actions, events or plans. A student's interest in academic achievement will induce him to behave and act in a certain way towards his studies (Ogbugnya and Owodunni, 2013). The use of practice based inquiry (PBI) cycle in the teaching of lap joints, forging work and sheet metal work could open new frontiers in the provision of a rich environment that would estimate interest among welding and fabrication engineering craft practice students in technical college. Hence, the psychomotor achievement and interest and gender based on science & technology students in welding and fabrication engineering craft practice vis-à-vis their exposure to learning is worthy to investigation.

Gender is a factor in every aspect of forma, non-formal and formal education, and has an impact on all participants: learners, teachers and administrators (Green, 2009). However, in reality, gender issues are not holistically addressed in the application of science and technology course based (Fontaine, 2000).

A number of studies have been conducted to investigate and evaluate the impact of science and technology based courses on male and female students in welding and fabrication engineering craft practice, both male and female students of high ability perform well while male and female students of low ability perform woefully in science and technology based courses, but low ability students perform better when they are exposed to [PBI] cycle as a method of teaching (Amosa, 2012).

Technical colleges are designed to lead the beneficiaries to self-employment, economic selfsufficiently, and employment generation through short or long-term training. This has led African countries including Nigeria to realize that training in technical colleges in ne necessary to alleviate poverty though skill acquisition (Amaechi, 2013). Amidst the numerous courses offered in these colleges e.g Auto mobile, Building Technology, Carpentry & Joinery, Electric & Electronic technology & welding and fabrication engineering craft practice trade course is one of them.

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Welding and Fabrication Engineering Craft Practice (WFECPP), is the craft practice that deals with the joining and fabricating of materials, usually metals thereby causing coalescence.

WFECPP at the technical college are offered at two levels, leading to the award of National

Technical Certificate (NTC) and Advanced National Technical Certificate (ANTC) for craftsmen and master craftsmen. The curriculum according to NBTE (2007) mentioned that the program suggested that the programme of WFECPP in Nigeria Technical Colleges is design to produce competent craftsmen for all types of metal work operations.

## **Statement of the Problem**

The desire to know the causes of poor performance in welding and fabrication engineering craft practice has been the focus of researchers over decades. It has been observed that poor performance in welding and fabrication engineering craft practice generally, and this attributed to poor quality of technical teachers, overcrowded classrooms, lack of suitable and adequate technical equipments, large class size, ill equipped laboratories/workshops, and poor teaching methods (Ahmed, 2008; Kareem, 2003; Onwirhiren, 2005). These factors encourage welding and fabrication teachers to resort to only lecture method most of the time. It is a well-known factor that the quality of education depends on the teachers and so the strategy they use in teaching matters a lot.

The analysis of chief examiner's report of National Board of Technical Education (2016) on students' performance in welding and fabrication engineering craft practice revealed that consistent fluctuation of performance rates below 50% for more than five years or more. Researchers have been conducting studies to find a lasting solution to the declining student's performance in welding and fabrication e.g. forging, sheet metal, and oxy-acetylene welding and arc welding most significantly, by exploring innovative strategies of teaching as enhance learning of technology in technical colleges. In view of this, the study is therefore, aimed at examining the effectiveness of using practice based inquiry (PBI) cycle teaching strategy on effect of practice based inquiry cycle on students' psychomotor achievement and interest in welding and fabrication engineering craft practice in Kano state.

## **Aim and Objectives of the Study**

The aim of the study determine the effect of practice based inquiry cycle on students psychomotor achievement and interest in welding and fabrication engineering craft practice in Kano state. Specifically the study determine the following objectives:

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1. The effects of practice based inquiry cycle and demonstration method on the psychomotor achievement of technical college students in welding and fabrication engineering craft practice.
2. The effects of practice based inquiry cycle and demonstration method on the interest of technical college students in Welding and Fabrication Engineering Craft Practice.
3. The effects of practice based inquiry and demonstration method on psychomotor achievement in Welding and Fabrication Engineering Craft Practice based on gender.
4. The effects of practice based inquiry cycle and demonstration methods on the interest of the students in based on gender.

## **Significance of the Study**

The findings of the study would be of great benefits to the following:

- Federal Ministry of Education, National Board of Technical Education, National Business and
- Technical Education Board (NABTEB), National Educational Research and Development Council (NERDC), Government, Educational Administrators, Teachers, Parents, Students and Non-governmental Organization (NGOs).

The findings of this study would be benefit to Federal Ministry of Education, government, educational administrators, teachers, parents and students as it would provide information to them on various factors resulting in poor academic achievement of students. This would spur their desire to strategize on how they could improve their students' academic performance in technical colleges. The findings of the study may assist in providing data and information for proper planning and decision by the technical colleges' administrators, ministry of education, NGOs, which would help in resolving the issues of poor performance and academic achievement . Also NBTE and NERDC this study will be significant to them, since the study will reveal the areas that needed to be enhanced in technical colleges programme e.g. curriculum e.t.c. The result of this study would also be useful to government through the Federal and State Ministry of Education and policy makers in planning school resources such as human, physical, financial and material by allocating and disbursing of funds to technical colleges in the country so that quality education would be given to the students which would result in their better psychomotor achievement and interest in Welding and Fabrication Engineering Craft Practice particularly. The findings of this study shall create awareness on the minds of Government and school

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administrators as regards of employing incompetent, unqualified and inexperienced teachers. Employment of teachers would be based on quality rather than favouritism so as to ensure students' better academic achievement.

The findings of this study would provide the information on the teachers quality factors which determine students' psychomotor achievement and interest in technical colleges. Finally, the outcome of this study would also be of importance to education stakeholders such as students, teachers, schools authorities and educational planners, researchers and parents as well as those who may wish to carry out a study on a related topic and make recommendations to policy makers.

## **Scope of the Study**

The study focused on the effects of practice based inquiry cycle on students psychomotor achievement and interest in welding and fabrication Engineering craft practice in Kano state. This study is delimited to technical college class 2 student (TC II) in welding and fabrication program. The third term scheme of work for National Technical Certificate II students in welding fabrication is used for the study. Other areas such as entrepreneurial skills and cognitive skills areas are not covered by this study due to the fact that there is significant improvement in those areas in Kano state. According to personal experience of the researcher and observational since a good number of technical colleges graduate are good in setting their own businesses in order to become self-reliant and be able to employ other people.

## **Research Questions**

The following research questions will be used to guide the study:

1. What is the effect of practice based inquiry cycle on the psychomotor achievement of technical colleges students in Kano state?
2. What is the practice based inquiry cycle on the interest of technical college students in welding and fabrication engineering craft practice in government technical colleges in Kano state?

## **Hypotheses**

The following hypotheses shall be tested at 0.05 level of significance.

1.  $H_{01}$  There is no significant difference in the psychomotor achievement of students taught welding and fabrication engineering craft practice using based inquiry cycle and those taught using demonstration method.

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2. H<sub>0</sub> There is no significant difference in the interest of students taught welding and fabrication engineering craft practice using practice based inquiry and those taught using demonstration method.

(c) **RESEARCH DESIGN**

- (d) The research design adopted was quasi-experimental. Specifically, the pre-test, post-test, nonequivalent control group design were used. Quasi-experimental design can be used when it is not possible for the researcher to randomly sample the subject and assign them to randomly sample the subject and assign them to treatment groups without disrupting the academic programmes of the schools involved in the study

(e)

(f) **Results**

- (g) The results are presented according to research question and nul hypotheses that guided the study.

(h) **Research Questions**

- (i) What is the effect of practice based inquiry cycle on the psychomotor achievement of technical colleges students in Kano state?

(j) **Table 4.1 Mean and Standard Deviation of pretest and posttest scores of Experimental groups and control group**

Group	N	Pretest		Posttest		Mean difference
		S.D	S.D	S.D	S.D	
Experimental	98	20.82	3.36	69.78	12.98	48.96
Control	62	19.66	2.97	56.48	12.26	36.82

Key: N=number of experimental and control group, = grand mean of experimental and control group, SD= Standard Deviation of experimental and control group,

Table 4.1 reveal the mean and standard deviation of pretest and posttest scores of students taught using practice based inquiry cycle on the psychomotor achievement of technical colleges students in Kano state and the students taught using conventional method at Pretest and posttest.

From the table those taught using practice based inquiry cycle has the highest mean score of 69.78 and Standard deviation of 12.98 in the post test making a pre-test, posttest gain in the experimental group to be 48.96. The control group had a mean score of 19.66 in the pre-test, Standard deviation of 12.26 and a post- test mean of



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56.48 with a pre-test, post-test gain of 36.82 . With this result, the students in the experimental group had a higher mean score than the control group.

## Research question two

What is the effect of practice based inquiry cycle on the interest of technical college students in welding and fabrication engineering craft practice in government technical colleges in Kano state?

S/N	Items	N	Mean	SD
1.	Welding and fabrication is easy to understand and practice	98	3.31	1.01
2.	Welding & fabrication practical helps me to understand welding & fabrication theory.	98	3.81	1.27
3.	Workshop activities in welding & fabrication help me to understand welding & fabrication concepts better	98	3.68	0.88
4.	Most students' can follow sheet – metal work practical lesson easily	98	2.12	1.16
5.	Most students' always enjoy reading my welding & fabrication book.	98	1.27	0.83
6.	Most students' always explain welding & fabrication concepts to my classmate.	98	2.97	0.54
7.	Students are always happy any time to see the welding & fabrication teacher coming to class.	98	4.23	0.79
8.	Students' always enjoying the lengthy forging practical's	98	3.18	1.24
9.	Most students' like to participate in welding & fabrication . discussion, quiz and debate comfortably.	98	4.02	0.39
10.	Welding & fabrication, sheet – metal work and forging courses are simple to understand	98	4.25	0.82
11.	When I am alone, I like reflecting about welding and fabrication work.	98	4.61	0.51
12.	Most students' like doing assignments in metalwork areas	98	3.81	0.84
13.	If welding and fabrication teachers fails to come to class on time, I can go to their office to call any one of them whose period is on.	98	3.92	0.34
14.	We take interest in anything involving welding and fabrication.	98	3.76	1.43
15.	we enjoy reading books on welding and fabrication	98	3.83	1.24
16.	Most students' always wish that lesson on welding and fabrication should continue even after it's time is up.	98	3.81	0.77
17.	I cannot engage in myself with other assignment during welding and fabrication lessons	98	3.89	1.21
18.	Most students' like mathematical aspects of welding and fabrication.	98	3.82	0.64
19.	I like to be a welder and fabricator in future.	98	3.84	1.46
20.	We use to ask questions during welding and fabrication class	98	2.53	0.50
21.	Most students' take interest in studying welding and fabrication component	98	2.53	1.00

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19.	I like to be a welder and fabricator in future.	98	3.84	1.46
20.	We use to ask questions during welding and fabrication class	98	2.53	0.50
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22.	I am always enjoy lengthy sheet metal practical class	98	4.05	0.82
23.	Carrying out sheet metal operation in the workshop is interested	98	2.12	0.24
<hr style="width: 10%; margin: 0 auto;"/>				
<b>Grand Mean( )</b>			<b>3.45</b>	

Key: N=number of experimental, SD= Standard Deviation of experimental group, Table 4.2 shows Mean rating and standard deviation of technical college students in welding and fabrication engineering craft practice in government technical colleges in Kano state. A total of 98 technical college students in welding and fabrication engineering craft practice in government technical colleges in Kano State responded to the questionnaire. 17 items out of 23 agree upon that Welding and fabrication is easy to understand and practice, helps them to understand welding & fabrication theory and have shown interest in learning when practice based inquiry cycle on welding and fabrication engineering craft practice is used as medium of instruction, while 6 items were disagree upon with the use of practice based inquiry in teaching. The average mean score showed 3.45 which falls between 3.00 – 5.00 on the rating scales which means almost all the students agreed that practice based inquiry cycle on welding and fabrication engineering craft practice should be used.

## **Hypotheses One**

There is be no significant difference in the psychomotor achievement of students taught welding and fabrication engineering craft practice using based inquiry cycle and those taught using demonstration method.

**Table 4.5** Summary of Analysis of Covariance (ANCOVA) of Posttest Scores of Experimental groups and control group

Source	Type III Sum of Squares	df	Mean Square	F	P.
Corrected Model	3394.297 <sup>a</sup>	2	1697.149	11.807	.000
Intercept	13484.120	1	13484.120	93.812	.000
Covariate(Pretest)	4.948	1	4.948	.034	.853
Main Effect(Treatment)	3393.437	1	3393.437	23.609	.000
Error	22566.447	157	143.735		
Total	576919.000	160			
Corrected Total	25960.744	159			

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**\*: Significant at  $P < 0.05$**

Table 4.5 showed the ANCOVA result of the comparison of posttest scores of students in Experimental groups and the control group. An examination of the table shows ( $F(1, 157) = 23.609, P < 0.05$ ). On this basis, hypothesis one was rejected. Therefore, there was significant difference in the psychomotor achievement of students taught welding and fabrication engineering craft practice using based inquiry cycle and those taught using demonstration method.

## **Hypotheses two**

There will be no significant difference in the interest of students taught welding and fabrication engineering craft practice using practice based inquiry and those taught using demonstration method.

**Table 4.6 Summary of Analysis of Covariance (ANCOVA) of Posttest interest Scores of Experimental groups and control group**

Source	Type III Sum of Squares	df	Mean Square	F	P
Corrected Model	78.126 <sup>a</sup>	2	39.063	2.119	.124
Intercept	4361.569	1	4361.569	236.634	.000
Covariate (pre-interest)	.054	1	.054	.003	.957
Main effects(Interest)	78.035	1	78.035	4.234	.041
Error	2893.774	157	18.432		
Total	878540.000	160			
Corrected Total	2971.900	159			

**\*: Significant at  $P < 0.05$**

Table 4.5 showed the ANCOVA result of the comparison of posttest Interest of students in Experimental groups and the control group. An examination of the table shows ( $F(1, 159) = 4.234, P < 0.05$ ). On this basis, hypothesis two was rejected. Therefore, there was significant difference in the interest of students taught welding and fabrication engineering craft practice using practice based inquiry and those taught using demonstration method.

## **Discussion of Findings**

Findings in Table 4.1 provide an answer to research question one, findings revealed that students taught in the experimental group had a higher mean score than the control

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group. In the same vein, the analysis of covariance presented in table 4.5 confirm that there is significant difference in the psychomotor achievement of students taught welding and fabrication engineering craft practice using based inquiry cycle and those taught using demonstration method. The significant difference is attributed to the treatment given to the experimental group. The findings indicated that inquiry cycle mode of instruction has a positive effect on student's psychomotor achievement in welding and fabrication engineering craft practice. Therefore, inquiry cycle mode of instruction is more effective than demonstration method. This findings is in line with the work of Ugwuadu (2010) who investigates the effect of guided inquiry and lecture method on students' academic achievement in biology in science secondary schools in Yola-North local government area of Adamawa State. The result shows that mean pre-test scores of the experimental and control groups used for the study are insignificant. The mean post-test scores show a wide difference. There is a significant difference between the achievement of students taught with guided inquiry and those taught with lecture method in favour of guided-inquiry. Guided inquiry proved more effective than lecture method in enhancing students' academic achievement in biology. Also, Jacinta (2011) determine inquiry method and students' academic achievement on biology, the study revealed that inquiry teaching method has a significant effect on students' achievements in biology and that of inquiry method favours the male more than the female in biology achievement.

Findings in Table 4.2 provide an answer to research question two, findings revealed that technical college students interest in welding and fabrication engineering craft practice in government technical colleges in Kano state and most students agreed that practice based inquiry cycle on welding and fabrication engineering craft practice should be used as medium of instruction.

## **Conclusion**

This study was to determine the effect of practice based inquiry cycle on psychomotor achievement and interest in welding and fabrication engineering craft practice in Kano State. The practice based inquiry cycle used in this study greatly affected the students learning of welding and fabrication engineering craft practice. This was reflected in the psychomotor achievement and interest and most students agreed that practice based inquiry cycle on welding and fabrication engineering craft practice should be used as medium of instruction. Female students had a higher mean score than their male counterpart and both male and female students agreed that practice based inquiry cycle on welding and fabrication engineering craft practice should be used as medium of instruction there was significant difference in the psychomotor achievement of

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students taught welding and fabrication engineering craft practice using based inquiry cycle and those taught using demonstration method. There was significant difference in the psychomotor achievement of students taught welding and fabrication engineering craft practice using practice based inquiry cycle based on gender and no significant difference between the interest of male and female students taught welding and fabrication engineering craft practice using practice based inquiry cycle. It is hope therefore, that if practice based inquiry cycle is taken into consideration in the teaching of Motor vehicle mechanics work in the technical colleges, craftsmen trained will graduate from Technical Colleges with knowledge, psychomotor skills and strong problem solving skills which will make them adaptable to the present and envisaged changes in the automobile industries occasioned by technological advancement.

## **Recommendations**

Based on the findings of this study, the following recommendations were made:

1. Technical College teachers should adopt the use of the practice based inquiry cycle approach to the teaching of welding and fabrication engineering craft practice and Metal work in general.
2. National Board for Technical Education (NBTE) should consider the review of curriculum for Metal work program with a view to incorporating the practice based inquiry cycle approach into the teaching of Metal work.

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