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Effect of problem-based teaching method on students' academic performance in electrical installation and maintenance works in technical colleges in Edo State

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Abstract

The need to improve students' academic performance in electrical installation and maintenance works necessitated this study. The study investigated the effects of problem-based teaching method (PBTM) on students' academic performance in electrical installation and maintenance works (EIMW) in Government Science and Technical Colleges (GSTC) in Edo State. Three research questions guided the study and three null hypotheses were formulated and tested at 0.05 level of significance. Quasi experimental research design of non-randomized control groups was the method used to carry out the study. Population of the study was 180 NTC II electrical installation and maintenance works students. Sample of 86 was purposively selected and studied. Instrument for data collection was Electrical Installation and Maintenance Works Achievement Test (EIMWAT). The instrument was validated by three experts with a reliability coefficient of 0.81. Mean ($\bar{x}$) was used to answer the research questions while Analysis of Covariance (ANCOVA) was used to test the null hypotheses. Findings revealed that students taught electrical installation and maintenance works with problem-based teaching method performed better with higher post-test mean scores than those taught using lecture-demonstration teaching method. Also, findings indicated that problem-based teaching method improved the academic performance of high and low achieving students in EIMW. However, findings also revealed that the effect of using problem-based teaching method on the academic performance of male and female students in EIMW does not significantly different from the effect of using lecture-demonstration teaching method. Consequently, it was recommended among others that electrical installation and maintenance works teachers should use PBTM in teaching electrical installation and maintenance works so as to enhance students' academic performance and mastery in the subject.

Keywords: Lecture-Demonstration; Teaching Method, Edo State

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1. Introduction

Technical College, now known as Government Science and Technical College (GSTC) is a specialized institution of learning where trades and modular courses are offered in addition to general education and science subjects. It is a post basic institution established by Federal and State Governments to implement vocational education programmes at that level. The graduates of GSTC are expected to be equipped with knowledge, understanding and skills that would make them to either be employable in the industry or be self-employed. The establishment of GSTC was not only to improve the skill acquisition but also to encourage occupational development (Ugwu, 2007). According to Pugate (2010) the future of any nation lies on the knowledge, skills, and abilities which the citizens are expected to acquire from technical education.

Electrical installation and maintenance works (EIMW) is one of the trade subjects offered in technical colleges. It is an aspect of Electrical and Electronics Technology and has three subjects grouping; (i) domestic and industrial installation; (ii) cable jointing correct battery charging and repair; (iii) winding of electrical machines (NABTEB, 2007).

Upon completion of Electrical Installation and Maintenance Works (EIMW) course in the technical colleges, students' academic performance will be determined by their ability to install and maintain electrical and electronic devices; equipment and appliance and their ability to carry out major and minor domestic and industrial wiring.

These expectations are in line with the objectives of electrical installation and maintenance works as stated by the National Board for Technical Education (NBTE, 2007). The NBTE stated that graduates of this course should be able to carry out with expertise: domestic and industrial electrical installation works; detect and repair faults in domestic/industrial appliances; carry out the various tests on new and existing electrical installation; install and rewind electrical machines and other portable electrical devices and interpret electrical working drawing and manuals.

Academic performance of students in EIMW is the measure of their achievement in both theory and practical. Students' academic performance is determined by an achievement test which should cover the three domains of learning, namely: cognitive, psychomotor and affective. Student's level of academic performance is of a great concern to stake holders in education. Students' academic performance in a particular subject is usually interpreted as low or high according to the letter grades assigned to the raw score obtained by the students. For example, if a student's examination result shows several 'As' and 'Bs' grades, people tend to conclude that such a student is intelligent and as such is a high academic achiever, whereas those whose scores are below these grades are regarded as less intelligent and are low academic achievers. Many authors have proved in their studies that intelligence is not the only determinant factor responsible for students' academic performance. Personality and cognitive abilities are other factors that can be useful predictors of students' academic performance (Busato et al., 2000; Chamorro-Premuzic and Furnham, 2003). This assertion seems to be true for all subjects offered in GSTC such as electrical installation and maintenance works.

In electrical installation and maintenance works, students' assessment is based on both theory and practical abilities. That is, students who are classified as high academic achievers are those who demonstrated high level

of cognitive and psychomotor skills. According to Samia and Mahmood (2013) students whose performance scores are in the range of 75th percentile and above are considered as high academic achievers whereas those whose scores are below 75th percentile are regarded as low academic achievers. It means that student could be classified as high or low academic achievers by using frequency polygon graph. Such classifications usually show two categories of students: High academic achievers (75th percentile and above), and low academic achievers (below 75 percent). Also, some authors classified students into high and low academic achievers according to their average percentage performances in six compulsory subjects. According to Renu (2014) students whose average percentage performance is 60% and above are regarded as high achieving students whereas those who average percentage performance is below 60% is considered as low achieving students. The teaching method employed by the teacher could be a strong determinant of students' level of academic performance. For example, technical teachers including EIMW teachers are fond of using one or a combination of two conventional teaching methods. Example of such method is lecture-demonstration teaching method.

Lecture-demonstration method is commonly used by technical teachers including EIMW teachers, probably because they are not aware or familiar with modern teaching such as problem-based. Lecture-demonstration teaching method is an instructional method whereby the teacher combines lecture and demonstration teaching methods. The use of combination of teaching methods is common with technical teachers. In support of this, Ndagama (2000) posited that there is no single method that can be considered as the best. The interest of the learners and the objectives to be achieved should determine the most suitable method that will not only motivate students but hold their attention long enough for learning to take place. It means that none of the many methods known can be adopted in isolation. In lecture-demonstration method, the teacher does all the talking and the learners only listen and try to jot down some points. The teacher uses the chalk board and textbooks as the teaching aids. It sets the teacher as the active participant in the class while the students are mere observers, who watch the teacher.

There are some merits of lecture-demonstration teaching method. According to Sharma (2006) lecture-demonstration teaching method is especially useful where the apparatus is expensive, the experiment involves some danger, the apparatus is sensitive to break. The author added that this teaching method is economical, it promotes useful discussion and it could be effective in handling large class size.

Despite these merits of lecture-demonstration teaching method, it may not be effective because of its several disadvantages. Asogwa (2011) posited that lecture-demonstration method encourages laziness, rote memorization and could eventually kill students' interest and attitude towards the subject. According to Tella et al. (2010) teacher-centred methods are associated with inadequate stimulation of students' innovative capacities, shallow intellectual thinking, cramming of facts, poor knowledge, poor retention and dependency of students on their teachers. In support of this claim, Adeola (2004) noted that teacher-centred method encourages students to cram facts, which are easily forgotten and not retained. Both authors agreed that teacher-centred methods often result in students not enjoying lessons and missing the benefits of intellectual discovery.

Records available revealed that there has been a persistence poor academic performance of technical college students in electrical installation and maintenance works. For instance, the percentage students failure

in electrical installation and maintenance in NABTEB examination in 2012 was 96 and it increases to 100 in 2014. This could be as a result of the predominant use of lecture-demonstration teaching method by EIMW teachers. The continual use of lecture-demonstration teaching method seems to be responsible for students' poor performance in EIMW in GSTC in Edo State. The use of lecture-demonstration teaching method for EIMW might not be very effective due to non- active participation of students in the teaching learning process. According to Eze et al. (2016), student-centred methods could improve students' academic performance in different subjects better than teacher-centred methods. The authors stressed further that student-centred teaching methods are characterized by active involvement of students in teaching learning process. Examples of student-centred teaching methods include problem-based method, guided discovery method and inquiry method.

Problem-Based Teaching Method (PBTM) is one of the student-centred teaching methods and it begins with the assumption that learning involves an active, integrated, and constructed process (Hal, 2001). It means that this method of teaching involves students' active participation and social interaction of students in the group such that individual students are able to construct knowledge and skills. That is, students must learn to be conscious of what information they already know about the problem, what information they need to know to solve the problem and the strategies to use to solve the problem. This process of learning will create in the students the skills that would make them to become problem-solvers and to learn independently.

The role of the teacher in this teaching method is to guide the students as they work in groups. The use of PBTM could be very effective for teaching EIMW since it involves practical exercises in the workshop. Working in groups and sharing tools and consumables could bring about self- motivation of individual group member and could also generate healthy competition among group members. However, PBTM has some limitations. According to Wood (2003), PBTM is resources intensive, information overload and complex to evaluate.

In studying students' academic performance, gender cannot be ignored. In fact, difference in academic performance due to gender is of paramount importance to the educationists. According to Lee (2001), gender is an ascribed attribute that socially differentiates feminine from masculine. It connotes male and female or boys and girls in a given group of students. There is a general belief that boys are superior to girls in terms of cognition and logical reasoning as a result of certain factors and even superior in academic reasoning (Anigbogu, 2002). But Ojikutu (2005) disagreed with this claim. The author posited that difference in academic performance between male and females students does not exist. For instance, Okeke (2003) identified sex role stereo-type, masculine nature of science, female inability to withstand stress, as causes of difference in academic performance between male and female students. The influence of these factors seems to be more evident in sciences and science related courses. In support of this fact, Njoku (1997) posited that sex-role, stereo-typing could be the origin of the difference in performance between males and females in technical and science education. Apart from investigating the effect of problem-based teaching method on students academic performance in EIMW, this study is designed to also examine the influence of gender on the academic performance of technical college students in electrical installation and maintenance works when the PBTM is used as a teaching method.

1.1. Statement of the problem

There will not be effective teaching and learning of electrical installation and maintenance works without the use of the right instructional methods and facilities. A visit to technical colleges in Edo State revealed that electrical installation and maintenance works teaching and learning facilities are obsolete, inadequate and not digitally friendly. Also, most EIMW teachers seem to be using teacher-centred teaching methods probably because they are not familiar with modern teaching method such as problem-based teaching method. Lecture-demonstration teaching method that is commonly used by EIMW teachers over the years seems to have inadequately equipped the students for NTC examination hence the persistent poor performance of students in EIMW over the years.

If EIMW teachers continue to use teacher-centred teaching methods such as lecture-demonstration, it is likely that technical college students in Edo State may not improve on their academic performance in EIMW examination; they may not be able to gain admission into higher institutions. Also, the graduates may end-up roaming the streets looking for white collar jobs because they are not likely to acquire skills. Problem-based teaching method which is student-centred could be an effective teaching method for technical subjects. This teaching method could be more effective than lecture-demonstration method and could improve on students' learning process in EIMW because it involves students' active participation through sharing of ideas, knowledge and skills (Ayano, 2013).

It was not clear to the researcher whether the use of problem-based teaching method could improve students' academic performance in electrical installation and maintenance works in technical colleges in Edo State hence the need for this study.

The main purpose of this study was to determine the effects of the use of Problem-based teaching method on students' academic performance in electrical installation and maintenance works in technical colleges. Specifically, the study intends to ascertain whether:

1- There is difference in academic performance of students taught EIMW with problem-based teaching method and those taught with lecture-demonstration teaching method;
2- There is difference in academic performance of male and female students taught EIMW with problem-based teaching method and those thought with lecture-demonstration teaching method.
3- There is difference in academic performances of high and low achieving, students taught EIMW with problem-based teaching method and those thought with lecture-demonstration teaching method.

1.2. Research questions

The following research questions guided the study.

1- What is the difference between the academic performance of students taught EIMW with problem-based teaching method and those taught with lecture-demonstration teaching method?
2- What is the difference between the academic performance of male and female students taught EIMW with problem-based teaching method and those thought with lecture-demonstration teaching method?

3- What is the difference between the academic performances of high and low academic achieving students taught EIMW with problem-based teaching method and those thought with lecture-demonstration teaching method?

1.3. Hypotheses

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

1- There is no significant difference between the academic performance of students taught EIMW with problem-based teaching method and those taught with lecture-demonstration teaching method.
2- There is no significant difference between the academic performances of male and female students taught EIMW with problem-based teaching method and those thought with lecture-demonstration teaching method.
3- There is no significant difference between the academic performances of high and low achieving students taught EIMW with problem-based teaching method and those thought with lecture-demonstration teaching method.

1.4. Significance of the study

The findings of this study are of immense benefit to all students including electrical installation and maintenance works students, technical teachers, government, curriculum planners, educational administrators, parents, employers of labour and the society in general.

The students will acquire relevant knowledge, ability and skills in EIMW through their active involvement in EIMW lessons. This will make them to become creative, reflective, competent, resourceful and self-confident. Students' achievement if enhanced will, thus, reduce persistence failure in public examinations and teacher - made test.

Similarly, the findings of this study, if implemented, will benefit the technical teachers. It is expected that if the technical teachers developed mastery in the utilization of the lesson plan for instruction, it will improve their skills in the use of student-centred approach such as Problem-Based Instruction (PBI). In so doing, it will assist to arouse the interest of the students to become confident and trust their ability in performing practical work in electrical installation and maintenance works.

Moreso, government, curriculum planners and educational administrators stand to gain from the findings of this research work. The information provided could be employed by the government via the assistance of the curriculum planners to facilitate the development of vocational and technical education in Nigeria. The findings from this research work will equally benefit the industries, as there will be quality and competent EIMW graduates with requisite skills to perform, take decision and solve complex problems in the workplace. The money expended by the industries for retraining of graduates before their assumption of duties will be saved.

In the same vein, the society in general will also benefit from the findings of this research. There would be availability of competent, skilled and employable EIMW technicians to run our industries. The standard of living of the populace will improve because there will be improvement in the standard of good product. This

will resultantly boost the overall technological growth of the nation. When youths become employed, desperation and idleness will be minimized, and crime rate will drastically be reduced in the society.

Finally, the findings of this study will bring succor to the parents as their children will become skilled EIMW graduates who can secure good jobs or be self-employed, instead of being a liability to their parents after graduation. By extension, the standard of livehood will improve among the people and the state of the economy also improved.

1.5. Scope of the study

This study focused on the effects of problem-based teaching method on students' academic performance in electrical installation and maintenance works (EIMW) in technical colleges in Edo State. The study was delimited to technical college NTC II students. It covered four topics: namely: Methods of terminating cable; Classes of winding insulating materials; methods of testing installation and protective devices. The variables considered included: teaching methods (Lecture-demonstration and problem-based), students' academic performance, and gender.

2. Methods

The research was carried out using quasi-experimental design of pre-test, post-test non-randomized control group. It involved two groups (problem-based teaching method and lecture-demonstration teaching method) and there were pre-test and post-test for both groups. According to Nworgu (2015) quasi experimental study does not allow for randomization of subjects to experimental and control groups. This design was considered suitable for the study because there was no room for randomization. Intact classes were used to avoid disruption of normal class lesson.

The population of the study was 180 technical students (NTC II) offering electrical installation and maintenance works in the four technical colleges in Edo State. (153 males and 27 females). The NTC II students were chosen because they are the prospective candidates for NTC public examination conducted by NABTEB.

The sample of the study was 86 EIMW students. Purposive sampling technique was used to select two technical colleges for the study based on willingness of EIMW teachers to participate in the study as research assistants.

- From the four technical colleges, two intact classes in the two technical colleges were used. One technical college is for the experimental group because it has the facilities for using problem-based teaching method. The other college was used as control group. The experimental class consisted of 24 students (18 males and 06 females) and the control class consisted of 62 students (44 males and 18 females).

The instrument used for data collection was EIMW achievement test. The test contained 40 multiple choice test items with options (A – D) and adapted by the researcher based on NABTEB past questions between 2006 and 2015. The instrument was validated by three exports. Delta state. Kunder-Richardson formula 20 was used to calculate the reliability coefficient and it yield 0.81.

3. Results

Table 1. Summary of Pre-test and Post-test Performance mean scores of GSTC students taught EIMW with problem-based method and those taught with lecture-demonstration method

Treatment method	N	Pre-Test Mean ($\overline{x_1}$)	Post-Test Mean ($\overline{x_2}$)	Mean Gain	Decision
*PBTM	24	31.67	67.75	35.08	Effective
**LDTM	62	27.34	33.34	5.67	
Difference		4.33	34.41	30.08	

**Problem-based Teaching Method.*

***Lecture-demonstration Teaching Method*

Table 1 reveals that the pre-test mean scores for the PBTM and LDTM groups are 31.67 and 27.34 respectively; while the post-test mean scores for the PBTM and LDTM groups are 67.75 and 33.34 respectively. The mean difference in the post-test between the PBTM and LDTM group is 34.41. Since the post-test mean score of the PBTM group is higher than that of the LDTM group, the treatment given to the experimental group is considered effective. This implies that the students taught with PBTM group is 34.41 better than the students taught with LDTM group in terms of their post-test scores after the treatment.

Table 2. Summary of Post-test performance mean scores of male and female GSTC students taught EIMW with problem-based method and those taught with lecture-demonstration method

Treatment method	N	Male	N	Female	Mean Gain	Decision
*PBTM	18	43.29	6	41.00	2.29	
**LDTM	44	29.15	18	25.33	3.72	To low to be significant
Difference		14.14		15.67	1.43	

**Problem-based Teaching Method.*

***Lecture-demonstration Teaching Method*

The results presented in table 2 shows that the post-test mean scores of male and female students taught EIMW with PBTM are 43.29 and 41.00 respectively. Similarly, the post-test mean scores of male and female students taught EIMW with lecture-demonstration teaching method 29.15 and 25.33 respectively. The table reveals that the difference in post- test mean score between male and female students taught EIMW with PBTM is 2.29. Whereas the difference in the post-test mean score between male and female students taught EIMW with lecture-demonstration teaching method is 3.72. The difference in the mean gain is 1.43. This indicates that the difference is insignificant.

Data presented in table 3C depicts that the post-test mean scores of high and low academic achieving students taught EIMW with PBTM are 62.92 and 39..36 respectively. The difference in their post-test mean scores is 23.56. Also, the table reveals that the post-test mean scores of high and low academic achieving students taught EIMW with LDTM are 37.08 and 27.15 respectively. The difference in their post- test mean

scores is 9.93. The mean difference between the two teaching methods is 13.63 in favour of PBTM group. That is high and low academic achieving students taught EIMW with PBTM scored 13.63 more than high and low academic achieving students taught EIMW with LDTM method in the post-test. Therefore problem-based teaching method is more effective in teaching low and high academic achieving students EIMW.

Table 3. Summary of pre-test and post-test, academic performance mean scores of high and low academic achieving students taught EIMW with PBTM and those taught with LDTM

Treatment method	N	High Achievers	N	Low Achievers	Mean Gain	Decision
***PBTM**	**7**	**62.92**	**17**	**39.36**	**23.56**	**Effective**
****LDTM**	**6**	**37.08**	**56**	**27.15**	**9.93**	
Difference		**25.84**		**12.21**	**13.63**	

**Problem-based Teaching Method.*

***Lecture-demonstration Teaching Method*

Table 4. Summary of ANCOVA on the academic performance in the post-test mean scores of GSTC students taught EIMW with problem-based teaching method and those with lecture-demonstration method

Source of variance	Type III Sum of Squares	df	Mean Square	F-value	P-Value	Decision
Corrected Model	22511.155[a]	2	11255.577			
Intercept	3917.808	1	3917.808			
Post-test RQ1	2022.833	1	2022.833			
group	15778.989	1	15778.989	536.403	.000	Rejected
Error	2441.555	83	29.416			
Total	183537.000	86				
Corrected Total	24952.709	85				

Table 4 presents the summary of the ANCOVA results on the academic performance of students taught EIMW with problem-based teaching method and those taught with lecture-demonstration teaching method. The table reveals that at 0.05 level of significance for 1 df, the P-value is 0.000. Since the p-value is less than .05, the null hypothesis rejected. Thus, there is significant difference between the academic performance of students taught EIMW with problem-based teaching method and those taught with lecture-demonstration teaching method.

Table 5 depicts the sex difference in academic performance between students taught EIMW with problem-based and lecture-demonstration methods. The table shows that at 0.05 level of significance for 1 df, the p-value is 0.594. Therefore testing at alpha value of .05, the null hypothesis is retained since the p-value is greater than .05. Thus, there is no significant difference between the academic performance of male and female students taught EIMW with problem-based teaching method and those taught with lecture-demonstration teaching method.

Table 5. Summary of ANCOVA on the academic performance in the post-test mean scores of male and female GSTC students taught EIMW with PBTM and those taught with LDTM

Source of variance	Type III Sum of Squares	df	Mean Square	F-value	P-Value	Decision
Corrected Model	4427.402[a]	2	2213.701			
Intercept	530.180	1	530.180			
Post-test RQ2	4336.642	1	4336.642			
sex	67.210	1	67.210	.287	.594	Retained
Error	19444.133	83	234.267			
Total	180316.000	86				
Corrected Total	23871.535	85				

Table 6. Summary of ANCOVA on the academic performance in the post-test of high and low achieving students taught EIMW with PBTM and those taught with LDTM

Source of variance	Type III Sum of Squares	df	Mean Square	F-value	P-Value	Decision
Corrected Model	8444.319[a]	2	4222.159			
Intercept	1946.302	1	1946.302			
Post-test RQ3	2315.551	1	2315.551			
Achievers	2010.540	1	2010.540	10.703	.002	Rejected
Error	15592.111	83	187.857			
Total	182449.000	86				
Corrected Total	24036.430	85				

Data presented in Table 6 indicates the summary of ANCOVA on achievers differences in academic performance between students taught with problem-based and lecture-demonstration teaching methods. The table shows that at 0.05 level of significance for 1 df, the p-value is .002. This means that the F-value is significant at p-value of .002. Hence the null hypothesis is rejected since the p-value is less than .05. Thus, there is significant difference between the academic performance of high and low achieving students taught EIMW with problem-based teaching method and those taught with lecture-demonstration teaching method.

4. Discussion of results

Students taught electrical installation and maintenance works using problem-based teaching method performed significantly higher in their post-test scores than those taught electrical installation and maintenance works with lecture-demonstration teaching method.

This is in agreement with the findings of; Eze, Ezenwafor and Obidile (2016) who reported that PBTM had significant effect on the post-test achievement scores of students. This could be as a result of students' active involvement in the teaching and learning process is when PBTM is \used.

Male and female students taught electrical installation and maintenance works did not perform significantly higher in their post-test score than those taught electrical installation and maintenance works with lecture-

demonstration teaching method. This finding agreed with the report of Ojikutu (2005) who posited that difference in academic performance between male and female students does not exist. However, this finding is not in agreement with the report of Anigbogu (2002) who posited that boys are superior to girls in terms of cognition logical and academic reasoning as a result of certain factors.

High and low academic achieving students taught electrical installation and maintenance work with problem-based teaching method performed significantly higher in the post-test than those taught with lecture-demonstration teaching method. The high level of improvement in academic performance of low achieving students taught EIMW with PBTM could be as a result of self- motivation of learners created by the teaching method. However, the report of Sontakey cited in Samia (2013) disagreed with the finding of this current study. The author posited that academic achievement in examination is not influenced by motivating factors but a function of students' study habit.

The difference in the effectiveness of problem-based teaching method on the academic performances of male and female students' in EIMW is not significant. In agreement with this finding, Eze, Ezenwafor and Obidile (2016) reported that problem-based teaching method could create significant improvement on the academic performance of all categories of students.

The difference in the effectiveness of problem-based teaching method on the academic performances of high achieving and low achieving GSTC students in EIMW is significant. In support of this finding, Ojikutu (2008), Ogwo and Oranu (2006) found out that there is no significant difference between the academic performance of male and female students in any subject irrespective of the teaching approach used.

The difference in the effectiveness of lecture-demonstration teaching method on the academic performances of male and female GSTC students in EIMW is not significant. In agreement with this finding, Eze, Ezenwafor and Obidile (2016) reported that problem-based teaching method could create significant improvement on the academic performance of all categories of students. In the current study problem-based teaching method was found to be more effective in improving the academic performance of low achieving students. Mishra, cited in Raon (2000) opined that the low academic achievers are those not motivated towards studies and have not perceived academic learning as being useful. Therefore, low academic achievers could hardly improve on their academic performance. The present study has proved that assertion wrong. The significant improvement noted in the performance of low achievers could be as a result of one of the advantages derivable from using problem-based teaching method. That is, its ability to create self -motivation in the learners. It means if low academic achievers are motivated; whether internal or external, they can improve on their academic performance significantly as found in this study.

5. Conclusion

Based on the findings of this study, it was concluded that problem-based teaching method (PBTM) is an effective method in the teaching of Electrical Installation and Maintenance Works (EIMW). Therefore, problem-based teaching method could be used in the teaching and learning of electrical installation and

maintenance works to enhance students' performance, mastery of electrical installation and maintenance works knowledge and skills.

6. Recommendations

From the findings of this study, the following recommendations were made:

1- Electrical installation teachers in Government Science and Technical Colleges (GSTC) should use PBTM in teaching electrical installation and maintenance works to enhance students mastery and academic performance.

2- Electrical installation and maintenance works students should be encouraged to use PBTM in the learning of electrical installation and maintenance works since it enhances academic performance of even the weak or low academic achieving students.

3- Government Science and Technical College administrators should provide instructional facilities for using PBTM. Also, EIMW teachers should be given opportunities for in-service training to equip them with the skills required in the use of PBTM for teaching electrical installation and maintenance works.

4- Curriculum planners should incorporate strategy for using PBTM into teachers' education curriculum. This will equip the electrical installation teacher with competencies needed for using PBTM effectively.

References

Adeola, K.L. (2004), "The effect of peer tutoring on student's academic achievement in business studies", *Unpublished M.Ed. Project*, Department of Vocational and Technical Education, University of Benin, Benin City.

Anigbogu, M.A (2002), "Educating the girl child psychology", *News,* Vol. 1 No.3, pp. 17-18.

Asogwa, E.E. (2011), "Transforming Nigeria undergraduate through information competency, information impact", *Journal of Information and Knowledge Management,* Vol. 2 No.3 pp. 60.

Ayano, A.S. (2013), "*Effects of cooperative learning methods on students' academic achievement in basic technology in Oyo-East Local Government, Oyo State", Unpublished M. Ed. Project.* Department of vocational and technical education. University of Benin, Benin City.

Busato, V.V., Prins, F.J., Elshout, J.J. and Hamaker, C. (2000), "Intellectual ability, learning style, achievement motivation and academic success of psychology students in higher education", *Personality and Individual Differences,* Vol. 29, pp. 1057-1068.

Chamorro-Premuzic, T. and Furnham, A. (2003), "Personality predicts academic performance. Evidence from two longitudinal studies on university students", *Journal of Research in Personality,* Vol. 37 No.2, pp. 319-338.

Eze, T.I., Ezenwafor, J.I. and Obidile, I.J.2 (2016), "Effects of problem-based teaching method on students' academic performance and retention in financial accounting in technical colleges in Anambra State", *Scholars Journal of Arts, Humanities and Social Sciences*, Vol. 4 No. 6A, pp. 634-639.

Hal, W. (2001), "Creating problem for Problem-based learning", *Standford University Newsletter on Teaching*, Vol. 2, No.1, pp. 34–46.

Lee, I. and Uhao, M. (2001), "Inter use this for the rest retrieved from internet state variations in rural students achievements and schooling conditions", available at http://www.criedegest.org/2003-3/interstate.htm. (accessed 27August, 2009)

Mishra, K.N. (2000), "A comparative study of achievement motivation and scholastic achievement in relation in self- concept", *The Indian Journal of Social Work*, Vol. 53 No. 1, pp. 139-142.

National Board for Technical Education (NBTE) (2007), *Institutional accreditation for technical colleges and similar technical institutions*, Kaduna - Nigeria.

National Business and Technical Examinations Board (NABTEB) (2007), *ETF, intervention in TVET syllabus for engineering trades examinations based on national board for technical examination modular curriculum*.

Ndagama, B.L. (2000), *The use of library and information technology,* Lagos, Parakeet publisher.

Nworgu, B.G. (2015), *Educational research: Basic issues and methodology,* Ibadan, Wisdom publishers.

Okeke, E.A.C. (2003), *Gender, science and technology in Africa: A challenge to education*, Harvard, Harvard University Press.

Pugate, S.T. (2010), "Influence of learning environment on academic performance and learning of introductory technology in Ona-Ara L.GA of Oyo State", *Journal on Education*, RSUST, Port-Harcourt, Vol. 2 No. 2, pp. 4-10.

Renu, B. (2014), "Values and adjustment problems of high achievers and low achievers", *International Journal of Educational Planning & Administration*, Vol. 4 No. 2, pp. 113-118.

Samia, J. and Mahmood, A.K. (2013), "A study on need achievement of high and low achievers", *Journal of Education and Practice, available at* www.iiste.org. (accessed 7 December 2016)

Tella, J., Indoshi, F.C. and Othuon, L.A. (2010), "Relationship between students' perspectives on the secondary school English curriculum and their academic achievement in Kenya", *Journal of Educational Research,* Vol. 1 No. 9, pp. 382-389.

Ugwu, C.J. (2007), *Secretaryship. A practical approach Lagos,* Tivolic Publishing Company Ltd.

Wood, O. (2003), "ABC of learning and teaching in Medicine: Problem-based Learning", *British Medical Journal,* No. 326, pp. 328-330.