



Journal Website:
<https://theamericanjournals.com/index.php/tajet>

Copyright: Original content from this work may be used under the terms of the creative commons attributes 4.0 licence.

Effect Of Problem-Based Learning Method On Students' Academic Achievement In Computer Hardware Maintenance In Universities In Enugu State, Nigeria

Ifeanyi John Eneovo

Department Of Computer And Robotics Education, University Of Nigeria, Nsukka

Theresa Chinyere Ogbuanya

Department Of Industrial Technical Education, University Of Nigeria, Nsukka

ABSTRACT

The study investigated the effect of problem-based learning method on students' academic achievement in computer hardware maintenance in universities in Enugu state, Nigeria. The study adopted quasi-experimental research design. Pre-test, post-test of both treatment and control groups were analysed using Analysis of Covariance (ANCOVA). Findings from the study revealed that, there was a statistically significant difference in the academic achievement of students taught computer hardware maintenance with problem-based learning method and those taught with conventional method. Further analyses revealed that the male students had higher mean score than their female counterparts when taught with PBL method; however, there was no statistical significant difference in the mean achievement scores of students taught computer hardware maintenance with problem-based learning method and those taught with conventional method. It was therefore recommended among others that problem-based learning method should not be limited to teaching computer hardware maintenance, but should be extended to other computer education courses as well as other disciplines in other universities.

KEYWORDS

Problem-Based Learning, Computer Hardware Maintenance, Academic Achievement, Students, Universities.

INTRODUCTION

Nowadays, teaching innovations have brought about paradigm shift from teaching methods that does not involve active participation of

students to those that do. One such teaching method that involves active participation is Problem-Based Learning (PBL). PBL method is

a shift from the conventional didactic teaching method like lecturing. In PBL, the core knowledge discovery process lies almost entirely in the hands of the student rather than the lecturer (Yeo, 2005). PBL method according to Semerci (2006) is a learning method that places the students face-to-face with problems which the students could come across in the real world. Hoffmann-Longtin (2018) stated that PBL method is a student-centered pedagogy in which students learn about a subject by working in small groups to solve an open-ended problem. Open ended in the sense that PBL method need a problem with different ways of solving it, knowing that there is no one answer or solution. In the context of this study, PBL method is the transformation of a classroom from a passive learning environment to a more active one where students are given real life problems and shared into small groups for problem solving under the guidance of a facilitator.

The specific tasks of students in a PBL environment include: determining the problem; creating a problem statement; identifying information to understand the problem; defining the resources to gather information; producing possible alternative solutions; analyzing the solutions; and presenting the solutions orally or in written form (Kreger, 2005). That is, the students are supposed to take responsibility for their learning by working in teams to identify, analyse and solve problems using knowledge from previous courses and experiences, evaluate their own contributions and their peers', and provide the lecturer with immediate feedback about the course so as to improve it continuously. The responsibility of the lecturer in PBL method is to provide some

of the educational materials and guidance that facilitate learning.

PBL method is concerned with both what the students learn and how the students learn it. That is, PBL method emphasizes on the content to be learned and the learning process (Barrows in Ku & Ha, 2016). PBL ensures active participation of students in the learning process in order to ensure a significant improvement of student understanding and academic performance (Samad, Vasodavan, Ojeniyi and Oyetade, 2017). PBL method encourages students to take charge of their own learning (Lee, Mann, & Frank, 2010; Lekalakala-Mokgele, 2010). PBL method helps students achieve learning goals such as professional reasoning, integration of scientific and professional knowledge, and lifelong learning skills (Dunlap, 2005). PBL method has the potential to improve students' higher-order thinking skills, comprehension and application of knowledge, learning attitudes and motivation (Jerzembek & Murphy, 2013). PBL method as a learning approach helps to balance the mode of learning of students in computer hardware maintenance.

Computer hardware maintenance is one of the courses of study taught in computer education in Nigerian universities. Computer hardware maintenance is all about skill acquisition necessary to repair computer or replace its accessories. Study has revealed that the objectives of computer hardware maintenance is to help students learn how to identify common symptoms and faults associated with computer malfunctioning; isolate the source of problem through basic troubleshooting techniques; and solve the problem (Eneovo & Oleelewe, 2019). However, it has been observed

by the researchers that there is a decline in the academic achievement of students in computer hardware maintenance owing to monotonous adoption of conventional teaching method. In a conventional teaching method, the students often try to capture what is being said at the instant by the lecturer. That is, the students scramble to listen, understand and remember everything the lecturer has said. But the students cannot stop the lecturer in order to reflect or rather ponder on what is being said, hence the students may miss significant points as they try to transcribe the lecturer's words (Shi-Chun, Ze-Tian & Yi, 2014). Nevertheless, research has proven that PBL method offers the students countless long-term benefits than conventional learning, and most universities around the globe adopt PBL method in their respective courses. That is why these researchers deem it fit to adopt PBL method to observe its effect on students' academic achievement in computer hardware maintenance in universities in Enugu State, Nigeria.

STATEMENT OF THE PROBLEM

The persistent low academic performance of computer education students in computer hardware maintenance is a major worry to the researchers. One of the factors expected to be responsible for this poor academic achievement of students is the instructional (conventional teaching) method adopted by the computer educators in teaching computer hardware maintenance. This conventional method makes students bored, unmotivated and falling further behind in their knowledge and skills acquisition. The use of only conventional method is seen to be responsible for students' low interest; poor academic

achievement (Abidoeye, 2015); poor retention rate; and poor performance on the job. The students' poor academic achievement calls for urgent attention. Thus, learning paradigm must shift to student-centered by adopting PBL method that ensures mastering of the course content by the students. Therefore, this study sought to investigate the effect of problem-based learning method on students' academic achievement in computer hardware maintenance in universities in Enugu state, Nigeria.

PURPOSE OF THE STUDY

The main purpose of this study is to investigate the effect of problem-based learning method on students' academic achievement in computer hardware maintenance in universities in Enugu state, Nigeria. Specifically, the study sought to:

1. Determine the academic achievement of students taught computer hardware maintenance with problem-based learning method and those taught with conventional method.
2. Ascertain gender difference in academic achievement of students taught computer hardware maintenance with problem-based learning method and those taught with conventional method.

Research Questions

Two research questions were formulated in line with the specific purposes of the study to guide the research study:

1. What are the academic achievement of students taught computer hardware maintenance with problem-based

- learning method and those taught with conventional method?
2. What are the gender difference in academic achievement of students taught computer hardware maintenance with problem-based learning method and those taught with conventional method?

Research Hypotheses

The following null hypotheses were formulated to guide the study and were tested at 0.05 level of significance.

H01: There is no significant difference between academic achievement of students taught computer hardware maintenance with problem-based learning method and those taught with conventional method.

H02: Gender has no significant difference on academic achievement of students taught computer hardware maintenance with problem-based learning method and those taught with conventional method.

METHODOLOGY

The research was quantitative in approach and the study adopted quasi-experimental research design. The study was carried out between regular and sandwich undergraduate students of computer and robotics education department, University of Nigeria Nsukka during 2019/2020 academic session. Balloting was used to select the group for treatment and that of control so as to avoid bias. The regular students taught with problem-based learning method developed by the researchers served as treatment group while the sandwich students taught with conventional method served as control group.

The population for the study was 35 respondents (20 regular students and 15 sandwich students). Instrument used for data collection was “Computer Hardware Maintenance Achievement Test (CHMAT)” developed by the researchers. CHMAT is a 30-item multiple choice test for the purpose of obtaining respective data (scores) about the learning achievement of the students in both the experimental and control groups. Each question has four options lettered A - D. CHMAT was subjected to face and content validity by three experts from the Department of Computer and Robotics Education, University of Nigeria, Nsukka. Each of these experts was requested to use his or her expertise in determining the suitability, conformity, content, and language of the instrument for data collection. Corrections and suggestions made by the experts were used to improve the quality of the instruments. The reliability of the instrument was established using Kuder-Richardson K-R 21 test. A total of 20 respondents (students) from Ebonyi state University which was outside the study area, were used for the pilot study. The data collected was analyzed for internal consistency and yielded a reliability index of 0.89 which is very high.

The treatment group was divided into more four separate groups of five students per group comprising of both male and female students to avoid gender biasness. The size of the four smaller treatment groups was determined based on the number of work stations, accessories and facilitators available in the said department. Each treatment group conducts research, share ideas, identifies gaps in their knowledge, monitors each other's comprehension, mutually decides on the best

strategies to achieve desired goals, and present their findings. Pre-test was administered to both the treatment and control groups to assess their prior knowledge on the course after which proper teaching commenced by using the course outline. Each contact lasted for two hours per week and the course was taught or rather facilitated by the institutionally assigned lecturers using the course outline prepared by the researchers based on the National Universities Commission (NUC) curriculum. The treatment lasted for 6 weeks simultaneously with the control.

At the end of the treatment, the same questions administered during the pre-test was also re-administered for the post-test for the respective two groups, but the questions were reshuffled in terms of numbering and options. The reason for the rearrangement of the questions was to ensure that the students do not discover easily that the same questions

were used for the pre-test and post-test. Mean was used to answer each of the research questions, while standard deviation was used to determine the closeness or otherwise of the opinions of the respondents from the group mean. The pretest-posttest mean gain of each of the two groups was computed. Also, the null hypotheses formulated for the study were tested at 0.05 level of significance using Analysis of Covariance (ANCOVA). Thus, any F-value whose P-value level of significance is less than 0.05, then, the null hypothesis was rejected otherwise the null hypothesis was accepted.

RESULTS

Research Questions 1: What are the academic achievement of students taught computer hardware maintenance with problem-based learning method and those taught with conventional method?

Table 1: Mean and standard deviation of academic achievement of students taught computer hardware maintenance with problem-based learning method and those taught with conventional method

GROUP	N	PRE-TEST		POST-TEST		
		\bar{X}	SD	\bar{X}	SD	Mean Gain (Mg)
CONTROL	15	4.33	1.11	14.13	1.13	9.80
TREATMENT	20	4.35	0.93	26.25	2.15	21.90

Key: N = Number of Respondents, \bar{X} = Mean, SD = Standard Deviation, Mg = Mean Gain

The data presented in Table 1 show that the treatment group's achievement mean (Mg = 21.90, N = 20), was significantly higher than the control group (Mg = 9.80, N = 15). This result indicates that problem-based learning method is more effective than the

conventional method with respect to improving students' academic achievement in computer hardware maintenance.

Research Questions 2: What are the gender difference in academic achievement of students taught computer hardware maintenance with problem-based learning

method and those taught with conventional method?

Table 2: Mean and standard deviation of gender on academic achievement of students

GENDER	N	PRE-TEST		POST-TEST		
		\bar{X}	SD	\bar{X}	SD	Mean Gain (Mg)
FEMALE	21	4.38	1.12	20.14	6.34	15.76
MALE	14	4.29	0.83	22.43	6.31	18.14

Key: N = Number of Respondents, \bar{X} = Mean, SD = Standard Deviation, Mg = Mean Gain

Results in Table 2 show that male students' achievement mean (Mg = 18.14, N = 14), while female students' achievement mean (Mg = 15.76, N = 21). This result indicates that the male students had higher achievement mean than the female students. Hence, there is an effect attributable to gender with respect to students' achievement taught computer hardware maintenance.

taught computer hardware maintenance with problem-based learning method and those taught with conventional method.

Null Hypothesis 1: There is no significant difference between academic achievement of students taught computer hardware maintenance with problem-based learning method and those taught with conventional method.

Table 3: Analysis of Covariance (ANCOVA) on the mean achievement scores of students taught computer hardware maintenance with problem-based learning method and those taught with conventional method.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1265.57 ^a	2	632.79	205.96	0.00
Intercept	565.43	1	565.43	184.04	0.00
PRETEST	7.167	1	7.17	2.33	0.14
GROUP	1256.72	1	1256.72	409.04	0.00
Error	98.32	32	3.07		
Total	16883.00	35			
Corrected Total	1363.89	34			

a. R Squared = 0.93 (Adjusted R Squared = 0.92)

The result presented in Table 3 show that the F-calculated value for the treatment and control groups was significant $F(1, 32) = 409.04$, $p < 0.05$; at 95% Confidence Interval. Since the p-value is less than alpha value of

0.05, the null hypothesis is rejected; indicating that there was a statistically significant difference between the mean achievement scores of treatment group and control group in computer hardware maintenance.

Null Hypothesis 2: Gender has no significant difference on academic achievement of students taught computer hardware

maintenance with problem-based learning method and those taught with conventional method.

taught computer hardware maintenance with problem-based learning method and those taught with conventional method.

Table 4: Analysis of Covariance (ANCOVA) of gender on academic achievement of students

Type III Sum of					
Source	Squares	df	Mean Square	F	Sig.
Corrected Model	54.72 ^a	2	27.36	0.67	0.52
Intercept	606.08	1	606.08	14.81	0.00
PRETEST	10.84	1	10.84	0.27	0.61
GENDER	45.88	1	45.88	1.12	0.30
Error	1309.16	32	40.91		
Total	16883.00	35			
Corrected Total	1363.89	34			

a. R Squared = 0.04 (Adjusted R Squared = -0.02)

Table 4 show that F-calculated value for gender $F(1, 32) = 1.12, p > 0.05$; at 95% Confidence Interval. Since the p-value is greater than alpha value of 0.05, the null hypothesis is accepted; indicating that there was no statistically significant gender difference in the mean achievement scores of students taught computer hardware maintenance with problem-based learning method and those taught with conventional method.

DISCUSSION OF THE FINDINGS

The data presented on academic achievement of students taught computer hardware maintenance with problem-based learning method and those taught with conventional method revealed that the mean score of the treatment group (PBL method) was significantly higher than the mean score of the control group (conventional method). The findings of the study is in agreement with the

findings of Araz and Sungur (2007) who found out that students instructed by PBL method had higher mean scores on academic achievement and performance skills than their conventional method control group counterparts. The findings of the study further revealed that there was a statistically significant difference in the academic achievement of students taught computer hardware maintenance with problem-based learning method and those taught with conventional method. This finding is in line with Afolabi and Akinbobola (2009) who found out that student taught with problem based learning technique performed significantly better than those taught with conventional method. The findings being significance simply means that the students who were taught with problem-based learning method scored higher than those taught with conventional method. Similarly, Anyafulude (2013); Aidoo, Boateng, Kissi and Ofori (2016); Omega, Iji and Adeniran (2017); and Tugwell (2020) found out that problem-based learning method had a more

positive effect on students' academic achievement than the conventional method.

The findings revealed that the mean score of the male students was greater than the mean score of the female students. Furthermore, the findings also revealed that there was no statistically significant gender difference in the post-test mean achievement scores of students taught computer hardware maintenance with problem-based learning method and those taught with conventional method. The findings of the study were in conformity with the findings of Afolabi and Akinbobola (2009) who stated that there was no significant gender difference in the performance of students taught with problem based learning technique and those taught with conventional method. Similarly, Omega, Iji and Adeniran (2017) stated that although the male students had a higher mean score when taught with PBL approach than their female counterparts but the difference was not statistically significant.

CONCLUSION

Based on the findings of the study, the researchers concluded that students taught with problem-based learning method in computer hardware maintenance had a very high positive effect on academic achievement than those taught with conventional method. In other words, PBL method significantly enhanced students' academic achievement in computer hardware maintenance than the conventional method. Also, it was concluded by the researchers that the mean achievement score of male students was significantly greater than those of their female counterparts. This high achievement mean

gains recorded could be attributed to the treatments such as: working in smaller teams to identify the problems, analyze and contribute to the solutions.

RECOMMENDATIONS

The following recommendations were made based on the findings of the study:

1. Problem-based learning method should not be limited to teaching computer hardware maintenance, but should be extended to other computer education courses as well as other disciplines in other universities.
2. National Universities Commission (NUC) should revisit the curriculum to incorporate the adoption of problem-based learning method in teaching other courses in the university

REFERENCES

1. Abidoye, J. A. (2015). Effect of Multimedia-Based Instructional Package on Secondary School Students' Academic Achievement in Geography in Oyo State, Nigeria. *Journal of Research in National Development*, 13(1), 21-25. Retrieved on 28th June, 2021, from <http://www.transcampus.org/JORINDV13Jun2015/Jorind%20Vol13%20No1%20Jun%20Chapter3.pdf>
2. Afolabi, F. and Akinbobola, A. O. (2009). Constructivist Problem Based Learning Technique and the Academic Achievement of Physics Students with Low Ability Level in Nigerian Secondary Schools. *Eurasian Journal of Physics and Chemistry Education*, 1(1), 45-51.

3. Aidoo, B., Boateng, S. K., Kissi, P. S. and Ofori, I. (2016). Effect of Problem-Based Learning on Students' Achievement in Chemistry. *Journal of Education and Practice*, 7(33), 103-108.
4. Anyafulude, J. C. (2013). Effects of Problem-Based and Discovery-Based Instructional Strategies on Students' Academic Achievement in Chemistry. *Journal of Educational and Social Research*, 3(6), 105-111. Doi:10.5901/jesr.2013.v3n6p105.
5. Araz, G. and Sungur, S. (2007). Effectiveness of problem-based learning on academic performance in genetics. *Biochemistry and Molecular Biology Education*, 35(6), 448-451. DOI: 10.1002/bmb.97
6. Dunlap, J. C. (2005). Problem-based learning and self-efficacy: How a capstone course prepares students for a profession. *Educational Technology Research and Development*, 53(1), 65-83. DOI: 10.1007/BF02504858.
7. Eneovo, J. I. & Olelewe, C. J. (2019). Learning Management System: Imperatives for Digital Learning Environment in Nigerian Higher Education. *Computer Education Research Journal*, 6(1), 62-71
8. Hoffmann-Longtin, K. (2018). Problem-Based Learning (PBL). Retrieved on 31st January, 2020 from <https://faculty.medicine.iu.edu/let-us-help/teaching-resources/new-curriculum-resources/problem-based-learning-pbl/>
9. Jerzembek, G., & Murphy, S. (2013). A narrative review of problem-based learning with school-aged children: Implementation and outcomes. *Educational Review*, 65(2), 206–218. DOI: 10.1080/00131911.2012.659655.
10. Kreger, C. (2005). Problem-Based Learning. Retrieved on 1st June, 2021 from <http://methodenpool.uni-koeln.de/problembased/ETE%20Teacher%20Pages.htm>
11. Ku, T. K. and Ha, M. (2016). The Application of Problem Based Learning in Undergraduate Nursing Education: A Strategy for Curriculum Reform. *Journal of Biosciences and Medicines*, 4, 52-59. DOI: 10.4236/jbm.2016.46008.
12. Lee, Y. M., Mann, K. V. & Frank, B. W. (2010). What drives students' self-directed learning in a hybrid PBL curriculum? *Advances in Health Sciences Education*, 15(3), 425-37. DOI: 10.1007/s10459-009-9210-2.
13. Lekalakala-Mokgele, E. (2010). Facilitation in problem-based learning: Experiencing the locus of control. *Nurse Education Today*, 30(7), 638-642. DOI: 10.1016/j.nedt.2009.12.017.
14. Omega, J. O., Iji, C. O. and Adeniran, S. A. (2017). Effect of Problem-Based Learning Approach on Secondary School Students' Interest and Achievement in Electricity in Bauchi State, Nigeria. *Journal of Science, Technology & Education*, 5(1), 63-70.

15. Samad, S. A., Vasodavan, V., Ojeniyi, A. and Oyetade, E. M. (2017). The Influence of Problem Based Learning on Students' Generic Skill. *International Conference on Scholarship of Teaching and Learning*, 62-67.
16. Semerci, N. (2006). The effect of problem-based learning on the critical thinking of students in the Intellectual and Ethical Development Unit. *Social Behavior and Personality: An international journal*, 34(9), 1127-1136. DOI: 10.2224/sbp.2006.34.9.1127.
17. Shi-Chun, D., Ze-Tian, F. & Yi, W. (2014). The Flipped Classroom—Advantages and Challenges. *International Conference on Economic Management and Trade Cooperation*, 17-20. Retrieved on 28th June, 2021, <https://download.atlantispress.com/article/11721.pdf>
18. Tugwell, O. O. (2020). Effect of Problem-Based Learning on Students' Academic Achievement in Digital Electronics in Ken Saro-Wiwa Polytechnic, Bori, Rivers State, South-South, Nigeria. *Innovation of Vocational Technology Education*, 16(1), 62-75. DOI: 10.17509/invote.v16i1.23514.
19. Yeo, R. K. (2005). Problem-based learning: lessons for administrators, educators and learners. *International Journal of Educational Management*, 19 (7), 541-551. DOI: 10.1108/09513540510625581.