

Effect of Problem Based Study on Machine Related Skill Needs for Industrial Manpower Development amongst Technical Colleges in Rivers State

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Abstract

The study investigated the effect of problem based study on Machine related skill needs for industrial manpower development amongst technical colleges in Rivers State. Two purposes, research questions and hypotheses guided the study. This study adopted quasi-experimental design. The population for the study comprised 78 National Technical Certificate (NTC) II Machine-shop students in the two technical colleges in Rivers State selected for the study. The entire population was used since the entire population is of manageable size. The instrument used for this study is titled machine-shop Performance Test (MPT) which has two parts according to the topics was used for data collection. Three experts validated the instrument. The reliability co-efficient of Machine-shop Performance Test was determined using Kuder Richardson formula 20 (KR-20) which yielded a reliability index of 0.85. The findings of the study revealed that the treatment group performed better when compared with the untreated group on the general fitting skills and milling skills needs for industrial and technological manpower development amongst technical colleges in Rivers State. It was recommended that machine-shop teachers should explore the use of problem based teaching method in the teaching of general fitting and millingskills in Technical Colleges

Keyword: *Problem based study, Machine related skill, Industrial Manpower Development*

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Background to the Study

Technical Vocational Education (TVE) could be termed as that aspect of education which provides the recipients with the basic knowledge and practical skills necessary for entry into the world of work as employees or as self-employed. According to Nsiah-Gyabaah, (2009) TVE is concerned with the acquisition of skills and knowledge for employment and sustainable livelihood. Musa, & Okorieocha, (2012) stated that TVE involves training in the process of relating both science and technical education to practical problems right from primary to higher level of education; this is because it aims at developing practical skills as well as the creative and innovative abilities and enables decision making skills and problem solving abilities.

However, technical colleges in Nigeria are regarded as the principal vocational institutions. They give full vocational training intended to prepare students for entry into various trade areas. The technical colleges are established to produce craftsmen at the craft (secondary) level and master craftsmen at the advance craft (postsecondary) level. According to International Qualifications Assessment Service (IGAS, 2011) the programs of technical colleges are classified into related trades, which includes electrical/electronic trades, construction trades, miscellaneous trades, business trades and mechanical engineering trades.

Mechanical Engineering craft practice is a trade that provides a post primary technical education and practical proficiency in fitting, turning and machining to the level of good craftsman. The subject matter of mechanical engineering craft practice is specifically designed to provide the skills and knowledge to fill the needs of the modern industry (Eze, 2010). The scheme has been devised in two main stages, part I and part II. Provision was also made for supplementary courses of more specialized character for those who may wish to pursue their studies a stage further after obtaining their part II certificate. Throughout the course emphasis is on practical training and theoretical knowledge, with such general studies as are essential for a sound understanding of the craft practice. The mechanical craft practice workshop is made up of hand and machine tools of various types. Due to the low rate of industrialization in Nigeria, the aspiration of mechanical engineering craft practice students in South-South States is very high. They have very high hope of being employed by the industries or advanced in their academic pursuit. For the purpose of enhancing efficiency and effectiveness of Technical College education where craftsmen and master craftsmen are prepared, it is necessary to include training on real jobs within the school setting in production units (NTBE, 2006).

According to Adamu, (2015) posited that the goals of fitting includes to develop: the basic principles and methods of shaping metal to given specifications, the various clamping devices used in metal work and apply them as appropriate, Grind metals of various shapes and sizes to given specifications and the working principles of common drilling machines and accessories and apply them to drill holes on various engineering material. Oyebolu (2011) also explained that the aims of fitting in metal work are to train graduates with good knowledge in Understanding the purposes of reaming and ream a hole, Lap engineering

component to good surface finish and accuracy, changing the mechanical properties of metal using heat, Understanding the principles of measuring tools and apply the same to measure and align components and Understanding the alignment of components/machines.

Milling skills are designed to provide the trainee with the knowledge and skills to enable them produce engineering components. NBTE (2002) explained that on completion of the module, the trainee should be able to: Understand the working principle of a milling machine and operate the same machine to produce engineering components, Determine the correct work holding devices and use them for mounting work piece for milling operations, Understanding the working principles of a plane milling machine and operate the same machine to produce engineering components. Furthermore, NBTE (2002) explained that on completion of this module the trainees will demonstrate the following competences to a standard expected in trade Identify common milling cutters; slab, side and face, slotting, angular, etc. Select and mount appropriate cutters onto milling, Machine arbors, adaptors and collar chucks for the horizontal and vertical milling machines, Select and mount work holding devices on milling machine. Work holding devices: milling Vice, plate clamps, dividing head, rotary table, Select and set milling speeds and feeds to carry out a range of milling operations using appropriate cutting fluids.

Therefore, the ultimate goal of training Mechanical Engineering Trades (METs) students at technical college level is for the acquisition of knowledge, attitude and marketable skills for sustainable development. The training of the students is based on the production of skilful individuals who are proficient in production of goods and services that are not only relevant to themselves but to the society (Udofia., Ekpo., Nsa,. and Akpan, 2012). All technical courses, irrespective of their levels and objectives must be structured and made to stress practical activities. Johannsen (2012) stated that practical skills consists of the knowledge of methods, processes, procedures, and techniques for conducting a specialized task and the ability to operate tools and equipment related to that task. The process of learning will be more effective when the students are being exposed to the actual working condition by practically applying their knowledge and also the skills that they had learned. One of the theories that support students' involvement is the theory of constructivism which has resulted into emergence of a more productive and student-centered (Problem based teaching technique). This technique focuses on student's constructed learning as opposed to teacher transmit information. In learning through Problem based teaching technique, learners are place in a problem situation and are surrounded by lots of appropriate and suitable materials with which to explore the environment and solve problems (Ezeani, 2014).

Problem based teaching technique is one of the methods that involve active learner participation in learning process. According to Agboola and Oloyede (2007), it creates situations in which students take the role of a scientist. This is because ; students take the initiative to observe and question phenomena, pose explanation of what they see, device

and conduct test to support or contradict their theories, analyze data, draw conclusion from experimental data, design and build models or any combination of these. The America National Scientific Foundation (2000) viewed Problem based teaching technique as an approach to learning that involve the process of exploring the natural or material world, and that lead to asking questions, making discoveries, rigorously testing those discoveries in the search of new understanding. Problem -Based teaching technique is the activities associated with discovery learning in which students “discover” ideas instead of learning ideas from the explanations of a teacher or textbook. In extension, Problem -Based teaching technique are more generally, as any activity in which students explore situations and try to solve problems. Erick and Reed (2002) asserted that Problem based teaching technique is a project-oriented pedagogy strategy based on constructivist and social constructivist theories of learning. It is a method that elicits critical thinking skills. It is also a mental process that engages in cognitive process to understand conflicting factors in a situation (Moon, 2001; Davis, 2003).

Problem-based learning (PBL) is an instructional method where relevant problems are introduced at the beginning of the instructional cycle and used to provide the context and motivation for the learning that follows. Udofia, (2009) defined problem-based learning as a curriculum development and instructional system that simultaneously develops both problem solving strategies, disciplinary knowledge bases and skills by placing students in the active role of problem-solver confronted with an ill-structured problem that mirrors real-world problems.

Problem-based instructional method is part of the shift from the teaching paradigm to the learning paradigm (Okafor, 2011). It shifts the focus away from what the teacher is teaching to what the students are learning. Teachers using a PBL approach are not concerned with what and how they are teaching, rather they are observing, looking, listening, stimulating and provoking student learning. The learning by the students is their focus not the teaching by the teacher. The role of the teacher becomes that of facilitating learning rather than primary sources of information, instruction becomes interaction in the classroom and the students assume more active role in the teaching and learning process. The students become increasingly responsible for their learning, giving them more motivation and setting the pace for them to become successful life-long learners. The teacher in turn becomes a resource, tutor and evaluator, guiding the students in their problem solving efforts. Though the teacher instructs the students, the teacher gradually removes the support offered to the learners as instruction and interaction continues and as the learners gradually internalizes and understands the content and are able to do more on their own.

Problem-based learning can be used for developing both hard and soft skills needed for participation in the industrial world today. However, technical skills can also be acquired through Problem -Based teaching technique of which places greater demands on students' for their skills development than the age-old popular demonstration approach. The Problem -Based teaching technique has been found to be commonly used in Technical

Colleges. It is a method in which students', individually or in groups, accept an assignment together and integrate data relative to some problem and are then free to fulfill the requirements independently of the teacher who gives help only when necessary (Kakiri, Joshua, Gangkwi & Caleb 2016). Udofia (2009) opined that students' who are taught with Problem -Based teaching technique have opportunities of developing their cognitive, affective and psychomotor domains. Some faculties are advocating the increased use of alternative instructional methods like the project method and PBL for instruction in Technical Education, where demonstration method has failed to develop soft skills.

Skill acquisition as one of the expected result of an organization is the bedrock of any developing nation particularly now that unemployment is becoming a serious problem facing the nation (Dike, 2009). In technical institutions, the situation is made worst when graduates pass out of school with little or no employable skills. Skill acquisition involves the development of skills gained through practice, training or experience (Gumbari, 2009). The importance of skill acquisition cannot be over emphasized because its roles to national development are multi-dimensional but of particular mention are the following: elimination of hunger and poverty; reduction or elimination of joblessness and reduction of crime through effective engagement of youths (Apagu, & Andural, 2007). In Nigeria, skill acquisition is hoped to be achieved through technical education for human development.

In recent times, the development of human capital has been the focus of concern towards the development of a nation. This is a fact that the growth of tangible capital stock of a nation depends to a considerable degree on human capital development. Without adequate investment in developing the human capital which is the process of increasing knowledge, skills and the capacities of people in the country, the possibility of the growth of that nation might be minimal.

It is apparent that employment and occupational skills can be provided by technical and vocational education. As employers look for new talents every year from new graduates, it is important to look for not only those who have solid education, but graduates that have features that stand out from the rest of the graduating students. Manpower development has to do with organized learning activities arranged in a well organized setting for the purpose of improving performance and/or personal growth so as to improve the job, the individual, and/or the organization.

Manpower on the hand according to Okorie (2000) could be seen as the total supply of person available and fitted for service. Thus vocational education prepares manpower since according to Klegeris & Hurren (2011), vocational education is a process of getting people ready and keeping them ready for the types of service we need. Vocational education is thus a sine-qua-non for manpower development. Medina (2010) highlights the significant roles which TVE can play in curbing unemployment and in providing the needed skilled labour for industrialization. According to Hoidn & Karkkainen (2014), "technical education stresses the engineering aspect of vocational education such as

electronics, electrical, mechanical and automobile works". Thus, both vocational education and technical education aim at developing, among others, useful skills for productive purposes. The world has become aware in recent times of the magnitude of the changes resulting from advances in and the intensive application of technology. Science and technological knowledge have become so important that today; they have replaced capital as society's most important resources. The efficiency of the system of TVE of a nation is a major factor that determines its economic well-being, its standard of living, its potential growth and security.

Statement of the Problem

There is a general concern over the low performance of technical college graduates, most especially those of mechanical craft practice who cannot cope with the world of work. The goal of mechanical craft practice in technical colleges in Nigeria according to NBTE (2002) is to produce skilled craftsmen with good knowledge of the working principles of machines and the techniques and safety practices involved in its maintenance. Technical college graduates have prospects of either being employed in the industries or set-up their own mechanical workshop and become self-employed. Better still, technical college graduates should have the opportunity of furthering their education in higher institutions.

Contrary to achieving the above goal, majority of students have been completing the programme with very poor academic performance and inadequate skills which is not capable of earning them a living. This decline in students performance has been associated to a number of factors, among which is the strategy employed in impacting knowledge to the learners (Akinyele, 2000). Lack of fitting skill and milling skill needs for industrial and technological manpower development according to Olaoye and Adu (2015) who observed that it is as a result of many teaching methods that do not use students to their full capacity, and for this reason, teachers should use appropriate teaching method that is student-centered as against teacher-centered in order to increase the rate of understanding. The National Business and Technical Examination Board (NABTEB) (2008) observed that the poor performance of the students in National Technical Certificate (NTC) examinations in recent years is partly due to the teaching methods employed by the teachers. The above underscore the needs to investigate the Effect of problem based technique on the Machine related skills needs for industrial and technological manpower amongst technical colleges in Rivers State.

Objective of the Study

The general objective of the study is to assess the effect of problem based technique on the Machine related skills needs for industrial and technological manpower amongst technical colleges in Rivers State. Specifically, the study tends to explore the following:

1. Effect of problem based technique on the general fitting skills needs for industrial and technological manpower amongst technical colleges in Rivers State.
2. Effect of problem based technique on the milling skills needs for industrial and technological manpower amongst technical colleges in Rivers State.

Research Questions

Two research questions were formulated to guide the study

1. What are the effect of problem based technique on the general fitting skills needs for industrial and technological manpower amongst technical colleges in Rivers State?
2. What are the effect of problem based technique on the milling skills needs for industrial and technological manpower amongst technical colleges in Rivers State?

Hypotheses

Two hypotheses were formulated to guide the study and were tested at 0.05% level of significance.

Ho₁ There is no significant difference in the effect of problem based technique on the general fitting skills needs for industrial and technological manpower amongst technical colleges in Rivers State.

Ho₂ There is no significant difference in the effect of problem based technique on the milling skills needs for industrial and technological manpower amongst technical colleges in Rivers State.

Materials and Methods

This study adopted quasi-experimental design. Specifically, the pre-test, post test, non-equivalent control group design was adopted for the study. According to Gall, Gall and Borg (2007) quasi-experimental design can be used when it is not possible for the researcher to randomly sample the subject and assign them to treatment groups without disrupting the academic programmes of the schools involved in the study. Gall et al (2007) stated further that in a non-equivalent control group design, it is possible to have all groups receive treatments. This design was considered suitable for the study because intact classes (non-randomized groups) was assigned to the two different techniques of teaching. This is in order to determine the effect of the Effect of problem based technique on the Machine related skills needs for industrial and technological manpower. The experimental design of the study is symbolically represented as follows: E =Experimental group, C= Control group, O₁=Pre-test, O₂=Post-test, – Treatment and ≠ No Treatment. The study was carried out in Rivers State. Rivers State is one of the States in South-South Geopolitical Zone. It has boundaries with Abia, Akwa-Ibom, Delta and Imo States. The State has 23 local government areas with eight ethnic groups. The state has more technical and oil servicing industries that can use of these technical graduates. The technical colleges in the state have more Machine-shop students and teachers who can form the population to be used in the research. The population for the study comprised 78 National Technical Certificate (NTC) II Machine-shop students in the two technical colleges in Rivers State selected for the study (Records Unit, Rivers State Post Primary School Board, 2017). The choice of National Technical Certificate (NTC) II students is based on the selected topics for the study which falls within National Technical Certificate (NTC) II machine-shop curriculum.

The entire population was used since the entire population is of manageable size. Hence there was no sample and sampling technique used in the study. One instrument was developed for this study. The Machine-shop Performance Test (MPT) which has two parts according to the topics was used for data collection. Each part of the instrument has two sections, section A elicits personal information from the students and session B carries the 40 items questions from the topic. The development entails constructed test items on the following specific Machine-shop topics which were covered in the study: general fitting skills needs for industrial and technological manpower and milling skills needs for industrial and technological manpower. The relative weights of emphasis on the test items are general fitting skills 25% and milling skills 25%. The table of specification was developed based on the topics outlined.

An initial pool of 40 items was drawn up based on the table of specifications or test blue print and sent to three experts for face-validation. The experts comprised two machine-shop lecturers of industrial technical education department. Ignatius Ajuru University of Education, Rivers State and a lecturer of industrial technical section of vocational teacher education department, University of Nigeria, Nsukka. The items was corrected based on the validates' criticisms and suggestion before testing. The reliability co-efficient of Machine-shop Performance Test was determined using Kuder Richardson formula 20 (KR-20). The students' scores were computed which yielded a reliability index of 0.85. Data was collected through the use of pre-test post-test for each topic in each week. The test was administered to the students by the machine-shop teachers in both groups. The data for the two research questions of this study was analyzed using mean and standard deviation. The hypotheses were tested at 0.05 level of significance using analysis of covariance (ANCOVA). The statistical package for social sciences (SPSS) was used for all data analysis in this study. With the calculated f-ratio being greater than the table or critical f-ratio, the null hypotheses were rejected. The value of calculated f-ratio being less than the table f-ratio value, the null hypotheses was accepted. The value of f-ratio at 0.05% level of significance and above was accepted while the value of f-ratio less than 0.05% level of significance was rejected.

Results

Research Questions 1: What are the Effect of problem based technique on the general fitting skills needs for industrial and technological manpower development amongst technical colleges in Rivers State?

Table 1: Mean and Standard Deviation Scores of Students Taught with problem based Teaching Technique and Students Taught Using the Conventional Teaching Technique on general fitting skills needs for industrial and technological manpower development.

Group	School	N	Pre-test		Post-test		Mean-Gain
			\bar{x}	SD	\bar{x}	SD	
Experimental	GTC Ahoada	38	18.14	2.93	39.20	2.52	21.06
Control	GTC PH	40	14.19	2.53	23.21	2.12	9.02

Table 1 shows the pre-test and post-test mean score of students' performance in general fitting skills needs for industrial and technological manpower for both treatment and control groups. Result shows that the students in the treatment group had a pre-test mean score of 18.14 with a standard deviation of 2.93 and a post-test mean score of 39.20 with a SD of 2.52. The difference between the pre-test and post-test mean for the experiment group was 21.06, while the control group had a pre-test mean score 14.19 with a standard deviation of 2.58 and a post-test mean score of 23.21 and SD of 2.12. This shows that the mean score for the treatment group is higher than the control group, indicating that those taught with the problem-based teaching technique performed better.

Research Question 2: What are the Effect of problem based technique on the milling skills needs for industrial and technological manpower development amongst technical colleges in Rivers State?

Table 2: Mean and Standard Deviation Scores of Students Taught with Inquiry-based Teaching Technique and Students Taught Using the Conventional Technique on the milling skills needs for industrial and technological manpower development.

Group	School	N	Pre-test		Post-test		Mean-Gain
			\bar{x}	SD	\bar{x}	SD	
Experimental	GTC Ahoada	38	17.14	2.89	38.76	2.99	21.62
Control	GTC PH	40	15.16	2.76	24.52	2.53	9.36

Table 2 shows the pre-test and post-test mean score of students' in milling skills needs for industrial and technological manpower for both treatment and control groups. Result shows that the students in the treatment group had a pre-test mean score of 17.14 with a standard deviation of 2.89 and a post-test mean score of 38.76 with a SD of 2.99. The difference between the pre-test and post-test mean for the experiment group was 21.62, while the control group had a pre-test mean score 15.16 with a standard deviation of 2.76 and a post-test mean score of 24.52 and SD of 2.53. This shows that the mean score for the treatment group is higher than the control group, indicating that those taught with the problem based teaching technique performed better.

Hypotheses

Hypothesis 1: There is no significant difference in the Effect of problem based technique on the general fitting skills needs for industrial and technological manpower development amongst technical colleges in Rivers State.

Table 3: The analysis of covariance (ANCOVA) of Difference Between Students Taught with Inquiry-based Teaching Technique and those Taught with Conventional Teaching Technique in general fitting skills needs for industrial and technological manpower development.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	1183.871 ^a	2	591.936	115.924	.000
Intercept	637.069	1	637.069	124.763	.000
PRE-TEST_C	62.431	1	62.431	12.226	.001
GROUP	1078.067	1	1078.067	211.127	.000
Error	250.206	49	5.106		
Total	50788.000	60			
Corrected Total	1434.077	51			

The analysis of covariance of students performance scores presented in Table 3 showed that f-calculated for teaching methods in the two groups is 211.127 at 0.000 significant level. It therefore implies that the null hypothesis is rejected. Thus, there is a significant difference in the mean scores of students taught with problem-based teaching technique and conventional teaching technique respectively.

Hypothesis 2: There is no significant difference in the Effect of problem based technique on the milling skills needs for industrial and technological manpower development amongst technical colleges in Rivers State.

Table 4: The ANCOVA of Difference Between Students Taught with Inquiry-based Teaching Technique and those Taught with Conventional Teaching Technique in milling skills needs for industrial and technological manpower development.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	1322.769 ^a	2	661.385	120.072	.000
Intercept	765.257	1	765.257	138.929	.000
PRE-TEST_D	95.769	1	95.769	17.386	.000
GROUP	1322.710	1	1322.710	240.133	.000
Error	269.904	49	5.508		
Total	50885.000	60			
Corrected Total	1592.673	51			

Significance at $\alpha \leq 0.05$

The analysis of covariance of students performance scores presented in Table 4 showed that f -calculated for teaching methods in the two groups is 240.133 at 0.000 significant level. It therefore implies that the null hypothesis is rejected. Thus, there is a significant difference in the mean scores of students taught with problem-based teaching technique and conventional teaching technique respectively.

Discussion of the Findings

The findings of the study revealed that the treatment group performed better when compared with the untreated group on the general fitting skills needs for industrial and technological manpower amongst technical colleges in Rivers State. Also there is a significant difference in the Effect of problem based technique on the general fitting skills needs for industrial and technological manpower amongst technical colleges in Rivers State. This findings is in line with Udofia, (2009) who explained that problem-based learning as a curriculum development and instructional system that simultaneously develops both problem solving strategies, disciplinary knowledge bases and skills by placing students in the active role of problem-solver confronted with an ill-structured problem that mirrors real-world problems.

Finally, the study revealed that the treatment group out-performed the untreated group on the milling skills needs for industrial and technological manpower amongst technical colleges in Rivers State. Furthermore, there is a significant difference in the Effect of problem based technique on the milling skills needs for industrial and technological manpower amongst technical colleges in Rivers State. The findings are in agreement with Ekpo, & Emmanuel, (2014) asserted that Problem based teaching technique is a project-oriented pedagogy strategy based on constructivist and social constructivist theories of learning. It is a method that elicits critical thinking skills. It is also a mental process that engages in cognitive process to understand conflicting factors in a situation (Moon, 2001; Davis, 2003).

Conclusion

Based on the findings of the study, the following conclusions are drawn. Problem based teaching Machine related skills needs for industrial and technological manpower amongst technical colleges in Rivers State. Problem-based instructional method was found to enhance general fitting skills needs for industrial and technological manpower amongst technical colleges in Rivers State. More-also, problem based teaching technique was found to enhance milling skills needs for industrial and technological manpower amongst technical colleges in Rivers State. However, while conventional based teaching method is teacher centred, PBL is student centred and students who are exposed to PBL learning environments, were able to discover knowledge for themselves, were also found to be better at collaboration, were more confident and grew in proficiency than students taught with project-based teaching methods.

Recommendations

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

1. Machine-shop teachers should explore the use of problem based teaching method in the teaching of general fitting skills in Technical Colleges
2. Machine-shop teachers should explore the use of problem -based instructional method in the teaching of milling skills in Technical Colleges

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