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## Effects of Greeno Problem Solving Method of Teaching on Students' Academic Achievement and Interest in Basic Technology in Secondary Schools in Nsukka Education Zone of Enugu State

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**EFFECTS OF GREENO PROBLEM SOLVING METHOD OF TEACHING ON STUDENTS' ACADEMIC ACHIEVEMENT AND INTEREST IN BASIC TECHNOLOGY IN SECONDARY SCHOOLS IN NSUKKA EDUCATION ZONE OF ENUGU STATE**

By

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**ABSTRACT**

The study was carried out to determine the effect of greeno problem solving method on the academic achievement and interest of students in basic technology in Nsukka Educational zone of Enugu state, Nigeria. A quasi non-randomized control group, pre-test post-test design was used. The population for the study comprised all 6123 junior secondary school two (JSS II) students in 58 secondary schools in Nsukka Education zone in 2018/19 academic session. The instrument used for data collection were basic technology achievement test and interest inventory. Two research questions were posed and two hypotheses were formulated to guide the study. Mean and standard deviation were used to analyze the data for answering research questions while analysis of covariance (ANCOVA) was used to test the hypotheses of no significant difference at 0.05 level of significance. It was found out that the students taught with greeno problem solving method had higher mean post-test scores in the basic technology achievement test than those taught with conventional method. The study also revealed that both methods arose students' interest. Based on these finding, it was recommended that basic technology teachers should always incorporate in their teachings, the use of greeno problem solving method.

**Key words:** Greeno Problem Solving, Academic Achievement, Students Interest, Basic Technology and Secondary School.

**Introduction**

Basic technology is one of the compulsory prevocational subjects which students are supposed to take at the junior secondary school (JSS) level. It was formally called introductory technology. Basic Technology is an integrated subject which comprises metal work, wood work, technical drawing, electrical / electronics, auto-mechanics and building construction. Basic Technology seeks to widen the learners' knowledge and inculcate in him/her the process of technology (Okafor in Edinoh, 2010). Nwaodo&Asogwa (2019) noted that Basic Technology exposes students to career awareness by exploring useable options in the world of work and enable youths to have an intelligent understanding of the increasing complexity of technology. In addition, it aims at making the learning of vocations more relevant to the child's environment. This is because the emphasis of Basic Technology is on the learner having direct experience in doing, thinking and in discovery. Hence, it is child centered and activity oriented. One of the objectives of the National policy on education (2013) at the JSS level is to ensure the acquisition of the appropriate level of literacy, numeracy, manipulative, communicative and life skills.

Basic technology is expected to equip the learners with the needed skills for laying of solid foundation for long learning. It was structured to assist learners to develop interest in technology.

However, the extent to which basic technology succeeds in actualizing the objectives depend on the mode of instruction and motivation of students in the study of basic technology by the teachers. Even though the government made the study of basic technology in junior secondary school compulsory, many teachers find it difficult to teach some basic technology concepts thus, leading to students poor achievement in junior school certificate examination (Udofia, 2008). Evidence from junior school certificate results, between 2014-2019 in Enugu state in basic technology, has shown that the number of students, that passed with distinction and credit grade levels were on the decline while those with ordinary passes and failure were on the increase ( Enugu State Examination development Centre, Enugu, 2019). This decline is worse in Nsukka Educational zone. The students' achievements from the above were unsatisfactory and have continued to be a major source of concern to schools, parents and public examination bodies.

Junior secondary school students low achievement in some core subjects and indeed basic technology has been largely attributed to inefficient and ineffective way the subject is being taught (Ibitoye, 1998). There are also indication that the conventional lecture method of instruction is predominantly used in teaching students in basic technology (Udofia 2008). These findings are not different in Nsukka Educational Zone. Students are mostly known to memorize and regurgitate facts and concepts without carrying out activities on which these goals and concepts are based. Nwosu (1991) has also indicated that there is poor quality teaching in science subjects (including basic technology) and stated that the class sessions are more teacher centered than student-centered. Musa (2007) equally observed that most students in secondary school adopt rote memorization. He further added that the approach has not been effective in learning especially when difficult tasks are involved.

The urge to improve basic technology achievement and interest through more effective instructional method has increased the awareness of the importance of learners centeredness in teaching. Learners therefore must be assisted to learn and understand concepts very well. Thus, there is a shift in the perception of the roles of the learners in the learning process. Instead of viewing learners as passive recipients of information supplied by the teachers, they are looked upon as active participants in the knowledge acquisition process (Nwokorie and Akpata, 2004). Teaching of basic technology at the junior secondary school require a solid foundation in theory and practical aspects by the teacher of basic technology.

The teacher is recognized as the key factor in determining the quality and success of curriculum contents in basic technology through proper instructional methods. According to Mbagwu, Osilike, Mbara&Onwuadi (2019), a teacher is referred to as someone who must have undergone a period of

educational training and has acquired the principles and practice in teaching methods, instructional techniques and approaches to adopt; coupled with professional ethics which will guide him in the instructional delivery of his subject matter. The teacher as an agent of change employs different learning methods which go a long way to modify students behavior, academic achievement and interest in the students when teaching basic technology. It is imperative for the teacher to give proper and adequate attention especially in the choice of methods appropriate for the inculcation of knowledge, ideas and skills in students to facilitate a better understanding of the subject matter (Adah and Ameh, 2002). There are many methods a teacher can use in the course of his work such as lecture, demonstration, discussion, role play, project among others. It is however worthy to note that none of the methods should be regarded as the best to be used by the teacher always.

Problem solving method is selected and used for this study. Problem solving method is selected based on the fact that it is activity-based and student-centered oriented. The students under the employment of the method is not ordinarily mere spectators but were actively involved in the learning process. The domineering characteristics of teachers and passive posture of the students were reduced to the barest minimum.

Problem solving method involves the identification and selection of problems arising from individual experiences of the students (Omalle, 1996). Nwaodo&Ogbonna (2019) stated that problem solving is a pathway of getting to a solution of problem which involves identification of the type of problem to be solved, the necessary pre-requisites, the strategies, the heuristics or hints and the element used in applying the strategies. These problems are placed before the learners and they are guided to the solutions. As a teaching method, it involves steps of scientific method and also steps of reflective thinking. The teachers also play an important part in clarifying the problems and providing necessary materials which will help the students solve the problems. The success in the use of a problem-solving method depends on sufficient interest and creative minds on the part of the students in activity undertaken which should be within the researchable reach of the students. Students must be willing to succeed on the problem given or selected.

Over fifteen problem solving models have been developed by researchers to enhance the problem solving capabilities of students and promote their problem solving strategies (Pekene, 2002). In this study, Greeno 1973 problem solving model was used. Greeno 1973 model was a developed model with four phase for problem solving (Pekene in Daluba, 2011). Greeno problem solving model is highly innovative, activity based and student centered. The choice of the model was based on the fact that in Nigeria, emphasis was placed on it as a valuable instructional method (FME, 1985). The model would help the students to acquire appropriate problem solving skills and offer student the opportunities to work at different levels of basic technology abstractions. The four steps known as RRCC are reading and

interpreting concept; retrieving relevant information; constructing solution and carrying out a solution and other operations.

This model has provision for understanding and bringing out clearly relevant information before constructing a solution. Understanding here, is characterized by correct interpretation of problem statement, descriptions of the basic problems, the conditions unopposed in the problem and its desired goal. In other word, the extent student understands the problem and the nature of its solution depends largely on how clear and accurate his interpretation is. Having read the text, interpreted concepts and retrieved relevant information from the problem, the next step is to construct a solution. This involves defining problem and drawing sketches by students, paraphrasing the problem statement and looking at different ways to interpret the problem. Students at this stage can use tables, charts and any other relevant material that can help them solve the problem. Finally, the ability of students to handle the unknowns in order to arrive at the final answer is the last phase in the model. In this phase, they should be encouraged to monitor their progress. The students should be required to check their results and evaluate them according to the needed requirements once a problem has been identified.

The problem solving phases seem to have direct bearing on some psychological theories. For example, the Gestalt theories hold the view that when a learner is placed in a problem situation, he perceives the problem, begin to establish relationships between the various parts of the problem and formulate rules and hypothesis that will enable him solve the problem. He then tests the applicability of the most relevant rule until he solves the problem.

Although examination of the theory revealed that a basic problem solving model is dependent on the content and structure of the knowledge in a particular domain. Hence, a conceptual understanding of the structure of knowledge, how it is communicated and learnt would be important in one's capacity to apply the knowledge of solving problems. The use of greeno problem solving may have not been tried in teaching secondary school student basic technology especially in Enugu State, Nigeria. The researcher deemed it necessary to find out the effects of the method on students' achievement and interest in basic technology.

Students' achievement connotes performance in school subject as symbolized by a score or mark on an achievement test. According to Anene (2005) achievement is quantified by a measure of the student academic standing in relation to those of other students of his age. Nwaodo, Asogwa, Chiamoogu, Ogbonna& Ede (2018) described achievement as when somebody has succeeded in doing something, especially after a lot of effort. Udofia (2008) contended that students achievement is dependent upon several factors among which are instructional methods, learning environment and the learner. Teachers with good teaching method challenge students to work at higher intellectual level. Presently, discussion on chalk board is predominantly used to teach basic technology in Nigerian junior secondary schools.

Besides the use of good teaching method in the classroom, another important role of the teacher is to order and structure the learning environment and use of motivational method to secure and sustain the attention and interest of the learner (Moore, 1998).

Interest is a persisting tendency to any attention and ability to enjoy some activities. Interest has been viewed as emotionally oriented behavioural trait which determines students' vim and vigour in tackling educational programmes or other activities (Chukwu, 2002). Worker (1999) defined interest as a social construction developing within the dynamic relationship between the individual and the situation. Interest is the positive state of mind or the standard that respond to the learning processes. Students' interest and achievement in any learning activity is sustained by the active involvement of the learner in all aspect of the learning process. Ogwo&Oranu (2006) and Ngwoke (2004) emphasized that unless the teacher stimulates students' interest in learning, students academic achievement will be minimal. Hence, it is essential that basic technology teachers use teaching methods which ensure students' active involvement in learning environment to improve academic achievement and stimulate interest in basic technology students in the secondary schools.

### **Purpose of the study**

The general purpose of this study was to determine the effects of greeno problem solving method of teaching on students' academic achievement and interest in basic technology in Nsukka education zone of Enugu State, Nigeria. Specifically, the study determined:

1. the mean achievement scores of students taught basic technology with conventional method and greeno problem solving method.
2. the difference mean interest score between the students taught basic technology with conventional method and greeno problem solving method.

### **Research Questions**

The following research questions guided the study

1. What are the differences in the mean achievement scores of students taught basic technology with Conventional method and those taught with Greeno problem solving method?
2. What are the differences in the mean interest scores of students taught basic technology with Conventional method and those taught with Greeno problem solving method ?

### **Hypothesis**

The study tested two null hypotheses at 0.05 level of significance.

- Ho<sub>1</sub>: There is no significant difference between the mean achievement scores of students taught basic technology with Conventional method and those taught with greeno problem solving method.
- Ho<sub>2</sub>: There is no significant difference between the mean interest scores of students taught basic technology with Conventional method and those taught with Greeno problem solving method.

## **Methods**

This study adopted a quasi experimental research design specifically, non-randomized control group pre-test post-test design was used for the study. This design was used for this study because the researchers do not intend to disrupt the academic activities of the secondary schools involved in the study area during the time of study. A true experimental research design involve subjects' randomization and will disrupt academic activities of the secondary schools involved in the study area during the time of study. Such random selection in true experimental design according to Ezeudu and Ezeh (2008) is hardly permitted by the authorities of the school used for the research. A non randomized group (intact classes) was used for the study.

The study was carried out in the secondary schools in Nsukka Educational zone of Enugu state, Nigeria. It is made up of fifty eight secondary schools. The population for the study was all the 6123 junior secondary school two (JSSII) students in 58 secondary schools in Nsukka Education zone in 2018/2019 academic session. The sample was six secondary schools obtained from 58 secondary schools through purposive sampling techniques. The six secondary schools had 720 students made-up of 12 intact classes of basic technology students.

Basic Technology Achievement Test (BTAT), Interest Inventory, Greeno Problem Solving Lesson plans and Conventional lesson plans were the instrument for the study. Greeno problem solving lesson plan was used to teach experimental groups while the conventional lesson plan was employed to teach control groups. BTAT has forty multiple choice items while interest inventory has 30 statements based on junior secondary school curriculum content for year two students. Three lecturers from Industrial Technical Education Department, University of Nigeria, Nsukka helped to validate the instrument for the study. The test-retest reliability technique and KuderRickardson 20 (K-R20) were used to test the reliability of the instruments and the coefficient of 0.82 was obtained.

## **Experimental Conditions**

1. Experimental Bias: The following conditions were laid down to minimize experimental bias (a) the same lesson topics was given to both experimental and control groups (b) the same achievement test was given to both groups at the same time in order to avoid experimental bias; (c) the students had no pre knowledge of their involvement in the experiment; (d) the researcher was not directly involved in the test administration.
2. Teacher variability: Greeno Problem Solving lesson plan was prepared by the researcher and the conventional lesson plan was prepared by the teacher concerned in order to control invalidity that could be caused by teacher variability.

3. Training of Teachers: A two week intensive training was organized for the participating teachers by the researcher on how to use greeno problem solving lesson plans for effective teaching of basic technology to students.

### Experimental Procedure

The intact groups were used for the experiment. The trained teachers were supplied with materials and the scheme of work. Topics to be taught were selected from the scheme of work for basic technology. Five topics were selected altogether. The topics were selected based on the class used for the experiment. The experimental group was taught with five greeno problem solving lesson plans, while the control group was taught with five conventional lesson plans. Each lesson plan lasted for five weeks. At the end of the treatment, BTAT was administered to both experimental and control groups to collect data.

The data collected from the students were analyzed using mean scores and standard deviation for answering research questions and analysis of covariance (ANCOVA) to test the hypotheses of no significant difference.

### Results

The following research questions were answered and the hypotheses tested.

#### Research Question 1

What is the mean achievement scores of students taught basic technology with greeno problem solving and those taught with conventional method in basic technology.

**Table 1:** Mean and Standard Deviation achievement scores of the students in experimental and control groups taught with greeno problem solving and conventional methods in “Basic Technology”.

Groups	N	Teaching	Pre-test		Post-test		Mean score
		Methods	$\bar{X}$	S.D	$\bar{X}$	S.D	Gain
<b>Experimental</b>	345	Greenoproblem solving	27.70	7.8	40.01	5.70	12.31
<b>Control</b>	375	Conventional	26.88	8.69	28.50	7.91	1.62

Table 1 shows that the pre-test achievement mean and standard deviation scores for students taught basic technology using greeno problem solving method are 27.70 and 7.8, while those taught basic technology using conventional method are 26.88 and 8.69. This shows that both groups were almost in the same achievement standing prior to experimental treatment. However, post test achievement mean and standard deviation scores for greeno problem solving method are 40.01 and 5.70, whereas the post test mean and standard deviation scores for conventional method are 28.50 and 7.91. This shows that group taught using greeno problem solving method out performed group taught using conventional method, with mean gain score of 10.51.

#### Hypothesis 1

There is no significant difference between the mean achievement scores of students taught basic technology with greeno problem solving and conventional method.

**Table 2:** Analysis of Covariance (ANCOVA) of mean achievement score of the students in experimental and control groups taught basic technology with greeno problem solving and conventional methods.

### Tests of Between-subjects Effects

Dependent Variable: Posttest

Source	Type III sum of squares	Df	Mean square	F	Sig
<b>Corrected</b>					
<b>Model</b>	23209.818 <sup>a</sup>	2	11604.909	36.605	.000
<b>Intercept</b>	13582.97	1	13582.970	42.844	.000
<b>Pretest</b>	66.430	1	66.430	.210	.649
<b>Method</b>	22686.902	1	22686.902	71.560	.000
<b>Error</b>	20607.167	705	317.033		
<b>Total</b>	207183.000	720			
<b>Corrected</b>					
<b>Total</b>	43816.985	719			

**a.R square = .530 (Adjusted R squared = .515)**

Table2 indicates that F-ratio (71.56) with associate probability (sig (2-tailed) (P=0.000) under method is less than significant level (0.05) postulated by the researcher. Hence, the researcher failed to uphold the null hypothesis, which means that the alternative hypothesis was upheld.

Therefore, there is a significant difference between the mean achievement scores of students taught basic technology with greeno problem solving method and those taught with conventional method in favour of greeno problem solving method.

### Research Question 2

What is the mean interest scores of students taught basic technology with greeno problem solving method and those taught with conventional method.

**Table 3:** Mean and Standard Deviation interest scores of the students taught basic technology with greeno problem solving and conventional methods

Groups	N	Teaching Methods	Pre-test		Post- test		Mean score Gain
			$\bar{X}$	SD	$\bar{X}$	SD	
<b>Experimental</b>	345	Greeno problem solving	2.84	0.33	3.01	0.47	0.17
<b>Control</b>	375	Conventional	2.85	0.32	3.01	0.42	0.16

Table 3 reveals that pre-interest mean and standard deviation scores for students taught basic technology with greeno problem solving method are 2.84 and 0.32, while those taught basic technology using conventional methods are 2.85 and 0.32. Again posttest interest mean and standard deviation scores for students taught basic technology with greeno problem solving method are 3.01 and 0.47, while that of conventional method are 3.01 and 0.42. The statistics shows that both methods are almost equal in their

interest scores, an indication that both greeno problem solving and conventional methods are friendly or unbiased methods in terms of students interest to learn

## Hypothesis 2

There is no significant difference between the mean interest scores of students taught basic technology with greeno problem solving method and those taught with conventional method .

**Table 4:** Analysis of covariance (ANCOVA) of interest scores of the students in experimental and control groups taught basic technology with greeno problem solving and conventional methods.

### Tests of Between-subjects Effects

Dependent Variable: Posttest

Source	Type III sum of squares	Df	Mean square	F	Sig
<b>Corrected</b>					
<b>Model</b>	.346 <sup>a</sup>	2	.173	1.070	.349
<b>Intercept</b>	8.738	1	8.738	54.056	.000
<b>Pretest</b>	.226	1	.226	1.396	.242
<b>Method</b>	.036	1	.036	.223	.638
<b>Error</b>	10.507	705	.162		
<b>Total</b>	612.547	720			
<b>Corrected</b>					
<b>Total</b>	10.853	719			

**a.R square = 0.32 (Adjusted R squared = .002)**

Table 4 indicates that F-ratio (0.223) with associate probability (sig (2-tailed) (P=0.638) under method being greater than significant level (0.05) postulated by the researcher. Hence, the null hypothesis was rejected. Therefore, there is no significant difference between the mean interest scores of students taught basic technology with greeno problem solving and those taught with conventional methods.

## Discussion

The findings on research question 1 revealed that greeno problem solving method is more effective in improving students' cognitive achievement in basic technology than conventional method. The implication of this findings is that greeno problem solving method is more effective than conventional method in enhancing students academic achievement in basic technology. The finding is in line with Daluba (2011) who in his study revealed that students taught with greeno problem solving method performed significantly better than those taught with conventional method in Agricultural science. A possible explanation for the effectiveness of greeno problem solving method is the students' active involvement in learning process using cooperative and intensive way, probing and questioning as the class is going on. The analysis of covariance indicates that there is a significant difference between the mean achievement scores of students taught basic technology with greeno problem solving method and those taught with conventional method in favour of greeno problem solving method with mean gain score

of 10.51. The significant difference is attributed to the treatment. This is an indication that greeno problem solving method has positive effects on students' academic achievements.

The finding on research question 2 showed that the group taught using greeno problem solving method have a mean gain interest score of 0.17 while those taught with conventional method have a mean gain interest score of 0.16. This implies that both methods improve students' interest in basic technology. The analysis of covariance showed that there is no significant difference between the mean interest scores of students taught basic technology with greeno problem solving method and those taught with conventional method.

### **Conclusion**

Based on the result of this study, greeno problem solving method was found to be effective than conventional method in the teaching of basic technology in Nsukka Education Zones of Enugu State. It is therefore recommended that greeno problem solving method should be used for teaching basic technology in all the secondary schools in Nsukka.

### **References**

- Ada, O.C and Ameh, O.S (2002). Determination of Agricultural teaching methods on students achievement in secondary schools. A case study of Olamabor Local government area of Kogi state. *Teacher Education journal (TEJ)* 12 (2), 41-41
- Anene, M. (2005). *Measurement and Assessment in Education*. Lagos; Bolabay publication.
- Chukwu, A. (2002). Promoting students interest in mathematics using local games. *International journal of Arts and Technical Education* 2(1), 54-56.
- Daluba, N.E. (2011). Effect of demonstration and Greeno problem solving methods of teaching on students achievement in Agricultural science. *An unpublished Ph.D thesis, Vocational Teacher Education, University of Nigeria, Nsukka.*
- Edinoh, C.K. (2010). Evaluation of teaching resources for teaching and learning of introductory technology. *An unpublished MEd thesis, Vocational Teacher Education, University of Nigeria, Nsukka.*
- Enugu State Examination Development Centre (ESEDCE) (2019). *Chief Examiners report on Junior school certificate conduct and results Enugu*: WAEC Press.
- Ezeudu, S.A; and Ezech, O. (2008). *Effect of the use of scale models on Academic Achievement of students in map work*. In B.G Nworgu (Eds). Educational Reforms and the attainment of the millennium development Goals (MDGs): The Nigeria Experience. 179-183. Nsukka: University Trust Publishers.
- Federal Ministry of Education (1985). *National Curriculum for Senior secondary schools*. Lagos: NERDC Press.
- Federal Republic of Nigeria (FRN) (2013). *National Policy on education 4<sup>th</sup>ed*. Lagos : NERDC press.

- Greeno, J.G. (1973). *The structure of memory and the process of solving problem: In Solso R. | contemporary Issues in Cognitive Psychology*. New York: Willey Publishers.
- Ibittoye, S.J. (1998). *Performance Rates of students in Agricultural science in selected secondary schools in Yagba-East Local Government Area of Kogi State*. *AJASS2* (1) 35-40.
- Mbagwa F.O., Osilike C., Mbara,K.U.&Onwuadi,C.C. (2019). New responsibilities and ethical practices required by teachers for transforming the education system in Nigeria:Implication for Adult Educators *Institute of Education Journal* , University of Nigeria , Nsukka 31(2) 35-48.
- Nwaodo, S.I.,Asogwa, J.O.,Chiamago, C.C., Ogbonna, G.N. &Ede, E.O. (2018). Effect of Computer Assisted Instruction on Technical College Students Academic Achievement and Interest in metal work Technology in Enugu State. *Journal of centre for Technical Vocational Education, training and research* 3(1) 180-187.
- Nwaodo, S.I. &Asogwa, J.O.(2019).Management and Prevention of accident in Basic Technology Workshops in Public Secondary Schools in Nsukka Education Zone of Enugu State. *Institute of Education Journal University of Nigeria,Nsukka*31(2) 92-102.
- Nwaodo,S.I. &Ogbonna, G .N. (2019).Relative Effectiveness of Reda and Rusbults Problem Solving Models on metal work Students Academic Achievement, Interest and Retention in Technical Colleges in Enugu State,Nigeria. *Industrial Technical Education Journal* 1(1)71-79.
- Moore, D.K. (1998). *Classroom Teaching skill*, New York: McGraw. HIKK Companies.
- Musa, S.A. A. (2007). The Effects of lecture method on students' achievement in physics in secondary schools in Kogi state. *Journal of vocational and Teacher Educators (JOVOTED)* 1(1) 12-17.
- Ngwoke, D.U. (2004).*Developmental Psychology and Education*. Enugu: magnet business.
- Nwokoria, L.S and Akpata, S. I. (2004). *Principles and methods of teaching in primary and secondary schools*. Ankpa; Kogi State.
- Nwosu, A. A. (1991). The effect of teacher sensitization on secondary school students level of acquisition of science process skills. *Unpublished Ph.d Thesis. Nsukka: University of Nigeria*.
- Ogwo, B.A and Oranu, R.N. (2006). *Methodology in formal and non-formal technical / vocational education*. Nsukka: University of Nigeria press.
- Omalle, A. I. (1996). *Project approach to science teaching: A recipe for scientific and technological development in Nigeria*. Ankpa STAN workshop proceedings of Kogi State 9<sup>th</sup>-12<sup>th</sup> December, 16-24.
- Pekene, D.J. (2002). Effect of Greeno and mettes et al problem solving models on students achievement in physics. *Journal of science teachers Association of Nigeria (STAN)* 37 (1&2) 39-43.
- Udofia, A.G. (2008). Effect of edutainment on academic achievement and interest on students' in interest of students' in introductory technology. *An unpublished Ph.D thesis, University of Nigeria, Nsukka*.

Worker, M. (1999). *Principles of modern management*. W.M.C. Dubugme: Brown Company publishers.