

Effects of Scaffolding Instructional Techniques on the Academic Achievement of Automechanics Technology Students in Lagos State Technical Colleges

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Abstract

The study investigated the effects of scaffolding instructional techniques on the academic achievement of students in Automobile Technology. A quasi-experimental pretest, posttest design with an experimental and non-equivalent control group was adopted. The population of the study consisted of 187 technical college school year two students in four Technical College in Lagos State. Due to the relatively small and manageable size of the population, no sampling was made as the entire population was used. Two instruments were used for data collection, Automobile Technology Achievement Test (ATAT) and conventional teacher made test. The data was analyzed using mean and standard deviation to answer research questions while analysis of covariance (ANCOVA) was used to test the hypothesis at 0.05 level of significance. The study among other things found out that, there is a significant difference in performance of students taught with scaffolding technique than those taught with conventional lecture method.

Keywords: Technology; ATAT; Technical Colleges.

Introduction

The world and societies are changing at an exponential rate as a result of technology. Technology and Science advancement determines nation development (Ball, 2000). The education system holds the responsibility of preparing the youths to assume productive roles in the societies. There is also a subtle shift in the population of learners throughout the developed world that raises new opportunities and problem for post-primary education. Technology literacy ensures that the students should understand the nature of technological knowledge and the application of such knowledge in giving solution to environmental problem, decision making, and sustainable development in the society.

The Federal Government of Nigeria realizing this introduced automobile technology to be taught at technical colleges as vocational subject. Automobiles are self-propelled road vehicle designed to carry passengers, esp. one with four wheels that is powered by an internal-combustion engine. An auto mechanic is a craftsman who specializes in the maintenance and repair of motor vehicles. The role of the auto mechanic has evolved to include high technology, in addition to basic mechanical systems (Fakorede, 2008). However, Auto mechanics, or automotive service technicians, are skilled in diagnosing problems, estimating repairs, completing repairs and maintaining vehicles. They must know how to use diagnostic and power tools, as well as be experienced in customer service and computer technology. This which ought to have being inculcated in the teaching strategies in preparing the students.

Teachers are encouraged to use student-centered teaching strategies that nurture students' literacy and critical thinking skills within a respectful classroom climate. There are a variety of teaching strategies that instructors can use to improve student learning. Collins and Robert (2004) and Adunola (2011), all in separate findings lamented on the long list of traditional methods of teaching as they are incapacitated to produce the desired effects of high academic achievement. These methods include; lecture, discussion, role-play, demonstration methods among others. Using these methods of teaching could be traced to repetitive of processes which enhances rote and parrot fashion of learning with the following limitations: Lack of stimulation of students' interest, instructional process is not logically sequenced starting from unusual, novel or complex situation and working backward toward understanding is elusive (Berryman, 2000).

Accordingly, Finch and Crunkilton (2009) criticized educational institution for lack of quick action to recognize and respond to these crucial changes and while Information Communication Technology (ICT) has had great influence on the lives of people around the globe, Vocational Education has been slow to adapt and consider the need for the new changes in psychology and pedagogy. These lacks according to Grubb (2009), suggest that there is need for academic development of students for optimum achievement during this time of rapid technological changes. One of such academic development of student is the introduction and implementation of Scaffolding Instructional Technique in the teaching of Automobile Technology in technical colleges. Scaffolding Instructional Technique is among the cognitive apprenticeship approach to instruction. Experts in cognitive apprenticeship such as Cole, *et al.*, (2011), noted that this instructional technique could be used in the classroom where students could learn through the help and guidance of a teacher and mostly when the skills to be learnt are cognitive in nature. These guided participations they noted could help students achieve a solution to a task that independently would have been too hard or complicated to accomplish.

Scaffolding technique is a teaching technique that involves providing students with the supports needed to complete a task or facilitate their learning of new concepts. Stephen *et al.*, (2014), also added that scaffolding technique is a variety of instructional techniques used to move students progressively towards stronger understanding and ultimately, greater independence in the learning process scaffolding is often used to bridge learning gap as seen in the construction industry. It helps students to bridge the gap between what they have learnt and what they are expected to know and be able to do at a certain point in their education. He further stressed that like the physical structures supporting construction around the building, instructional scaffolding is temporary and adjustable as students demonstrate greater proficiency on their own, and the scaffolding is gradually removed. It could be observed that there is lack of written guidelines, cue card, modeling and prompt in the conventional method of teaching automechanics Technology in secondary schools.

The FGN (2013) stipulated that Automechanics Technology is one of the pre-vocational courses in the secondary schools taught to provide trained manpower and give training necessary for an acquisition of skills to individual who shall be self-reliance economically. But the way topics in Automechanics Technology are taught lack instructional procedure that creates interactive style. Sean *et al.* (2000), explained that instructions are not arranged based on learners needs which tends to be difficult in terms of assimilation of contents by the learners. This is also in line with Berryman (2000), who noted that the implication is that the instructions are not logically sequence to fit the ability of the learner, as teacher could not provide teacher-led practice to engage in reciprocal teaching. This premise shows that there is absence of instructional materials with demonstration but theorized to the detriment of the students.

It could be observed that the value of instruction depends to a large extent on the quality of the teacher, as teachers are life-wire of a sound educational process. the conventional method of teaching lacks scaffolding approach which could explain what is being done, the rule of the task, and why it is done and what will lead to the achievement of the stated objectives. Scaffolding technique ensures the students are given increase responsibility for a successful application, as the teacher reduces and shift his role to that of a sympathetic audience (Gerbe, 2016) but as could be noticed, instead the teacher will spoon feed or water down the ultimate task so that the learner can appear to be successful. The lofty objectives of the National Policy on Education would not be realized if perpetually teachers of vocational subjects are allowed to dabble in the use of conventional methods of Teaching. Accordingly, Ukoha and Eneogwe (2016) lamented that the students leave schools without school and work place skills needed for increasing complexity of technology. There is need for schools in addition to academic skills, inculcate workplace skills such as creativity, problem solving and higher order of thinking skills in order to increase the students' flexibility and job mobility which will make them adaptable to the present and envisaged changes (Hallak and Poisson, 2000). As noted earlier by Hawkins (2014) it is critical to develop student capacity for self-directed learning and self-growth, as the focus on teaching has become one guiding the learners to build and modify their existing

model. It seems necessary and highly beneficial to begin early strategies and activities necessary to solve problems in automechanics Technology to reflect Scaffolding techniques. According to Van Der Stuyf (2012) scaffolding techniques include all devices that support students understanding during teaching which include 'Sequencing' - this is a deliberate decision regarding the order of learning activities. The learning is increased in complexity and in diversity. 'Demonstration' the teacher applies the procedures to demonstrate the task, 'Model the skill' - the teacher explain the rules of the task in explicit terms on what is to be done, and why it is done and the students are given opportunity to model the task in order to acquire the skills.

Gerber (2012) observed that the students then observed the supports and copied the instructor actions on a similar task using Bruner's spiral approach. Task or problem is designed to be increasingly complex and the instructor provides less and less assistance as the students gain expertise and experience. In addition, caregivers help young children learn how to link old information or familiar with new knowledge through verbal and nonverbal communication and modeling behaviors. Observational research on early childhood learning shows that parents and other caregivers facilitate learning by providing scaffolds. The scaffolds provided are activities and task that;

- i. Motivate or enlist the child's interest related to the task.
- ii. Simplify the task to make it more manageable and achievable for a child.
- iii. Provide some direction in order to help the child focus on achieving the goal.
- iv. Clearly indicate differences between the child's work and the standard or desired solution.
- v. Reduce frustration and risk.
- vi. Model and clearly define the expectation of the activity to be performed. (Bransford *et al.*, 2000)

The activities listed above are also detailed in the Executive Summary of the Research Synthesis on Effective Teaching Principles and the Design of Quality Tools for Educators, which refers to these as "...Rogoff's six characteristics of scaffolded instruction". The ultimate goal of the educator when using the scaffolding teaching strategy is for the students to become an independent and self-regulating learner and problem solver (Hartman, 2002). As the learner's knowledge and learning competency increases, the educator gradually reduces the supports provided (Ellis, Larkin and Worthington, n.d).

The short coming of the present lecture method of teaching automechanics technology has accounted for poor performance in junior secondary examination in recent years (Eliot, 2005). Based on the literature there is need to determine the effects of scaffolding technique on academic achievement of students given the apparent lack of documented research in the field of prevocational subjects.

Research Questions

- i. What are the effects of scaffolding technique on academic achievement of students in automechanics technology?
- ii. What are the effects of scaffolding technique on academic achievement male and female of students in automechanics technology?

Hypotheses

- i. There is no significant difference between the mean scores of students taught automechanics technology with scaffolding technique and those taught with the conventional lecture method in achievement test.
- ii. There is no significant difference between the mean achievement scores of male and female students taught automechanics technology with scaffolding technique.
- iii. There is no significant interaction of treatment given to students and their gender with respect to their mean score in the automechanics technology achievement test.

Method

The study was carried out in Lagos State and the study covered four technical colleges (Government Technical College Ado-soba, Government Technical College Ikorodu, Government Technical College Odomola Epe and Government Technical College Agidingbin). These schools were selected because they offer Automechanics technology and possess all the necessary facilities and well-equipped workshops, spacious classrooms and personnel for carrying out research.

The quasi-experimental design was employed for the study. This design was suitable as it was possible to assign subjects to groups without disrupting other school programme.

Group	Pretest	Treatment	Posttest
Experimental	0_1	X	0_2
Control	0_1	$-X$	0_2

Where 0_1 = Pretest for both control and experimental group
 0_2 = Posttest for both control and experimental group
 X = Treatment given to the experimental group
 $-X$ = No treatment given to the experimental group
 ----- = Non-randomization

Population

Table 1: The population for the study was made up of two hundred (187) automechanics technology students in the four technical colleges.

S/N	Names of Schools	Class Enrolment
1.	Government Technical College Ado-soba	53
2.	Government Technical College Ikorodu	46
3.	Government Technical College Odomola Epe	50
4.	Government Technical College Agidingbin	38
Total		187

Sample

Due to the relatively small and manageable size of the population, no sampling was implored. However, the schools were randomly control and experimental groups (each of the two schools was assigned randomly to either control or experimental group).

Instrument

The instruments used in this study were conventional teacher made test/scaffolding techniques lesson plans as well as Automechanics Technology Achievement Test (ATAT) developed by the researcher. The scaffolding technique lesson plan constituted the treatment and therefore was used for teaching the experimental group. Each scaffolding lesson plan had at least one scaffolding element. These elements are sequencing, demonstration and model the skills. Topics in the lesson plans include: site preparation, setting out of building, types of lever, geometrical solids, energy and types, appliance based on conversation. The achievement test items were 40 in number, 20 items were used for the pretest while the remaining 20 were adopted in, both pretest and posttest.

Method of Data Collection

Two groups (experimental and Control) were subjected to a Pre-test and Posttest. The scores of the experimental groups in the post test were recorded and compared with the scores obtained by the control groups in the same test, three weeks later after treatment; the subject administered the same posttest items on the group to assess the extent of achievement of the materials and the scores were also compared. Experimental conditions such as experimental bias and teachers’ variability were control as regular class teacher taught their own class and the researcher only prepared all teaching instrument. Moreover, the researcher organized seminar for the participating teachers.

Method of Data Analysis

The scores obtained from the pretest and posttests were analyzed using mean and standard deviation to answer the research questions while (ANCOVA) was employed to test the hypothesis at 0.05 level of significance.

Research Question I

Table 2: Distribution of respondents on mean and standard deviation scores of scaffolding techniques on academic achievement of students in automobile technology

Group	N	Pre-Test		Post-Test	
		X	SD	X1	SD
Experimental	91	19.13	11.12	23.11	9.63
Control	96	19.41	10.29	20.40	9.12

The data presented on table 2 indicated that the experimental groups had a mean score of 19.13 and a standard deviation of 11.12 in the pre-test and a mean score of 23.22 and a standard deviation of 9.63 in the post test making a pretest posttest gain of 4.09. The control group had a means score of 19.41 and a standard deviation of 10.29 in the pretest and a means score of 20.40 and a standard deviation of 9.12 in the posttest with a pretest posttest difference of 0.99. This shows that the experimental group performed better than the control group.

Research Question II

Table 3: Distribution of respondents on mean and standard deviation scores of scaffolding techniques on gender of students in automobile technology

Group	N	Pre Test	Post Test
		X	X
Experimental (Male)	53	19.50	23.59
(Female)	38	18.13	23.02
Control (Male)	50	18.47	18.03
(Female)	46	18.89	20.64

The data presented on table 3 indicated that the male experimental group had a mean score of 23.59 in the posttest, while females had and a mean score of 23.02, with a mean difference of 0.57. The control groups have a mean difference of 2.61 in the posttest. This shows a narrow gap in the performance of male and female in the experimental group, and a wide gap in the performance of male and female in the control group.

Findings on the Hypotheses

Table 4: Analysis of Covariance for the effect of scaffolding technique on students' scores in achievement test, gender, and interaction

Source	Type III Sum	df	Mean	F	
Sig. of F(p)	of Squares		Square		
Corrected Model	22720.222 ^a	4	10309.812	859.080	.000
Intercept	13215.954	1	12174.573	935.588	.000
Pretest	3.419	1	3.419	.318	.504
Group	36668.713	1	21238.112	4124.122	.000
Gender	3.535	1	3.535	.371	.306
group * gender	32.623	1	32.623	3.404	.230
Error	2342.306	188	14.064		
Total	514100.000	193			
Corrected Total	36194.934	192			

^aSignificant at Sig. of F(p) < .05

The analysis of data presented in the table shows F-value of 4124.122 for the treatment, while the p-value is .000, which is less than 0.05 alpha value. This implies that there is a significant difference between the mean scores of students taught automechanics technology with scaffolding technique and those taught with the conventional lecture method in achievement test. Data in the table also indicated that there is no significant difference between the mean achievement scores of male and female students taught automechanics technology with scaffolding technique (F=0.317, p=.306). The table also revealed that there is no significant interaction of treatment given to students and their gender with respect to their mean score in the automechanics technology achievement test (F=3.404, p=.230).

Discussion of Findings

The students taught with scaffolding technique had a higher mean score than those taught by the conventional lecture method and in achievement test. The result is in line with the findings of Koedigner and Alevan (2007) and Kapur (2008), who found out that the techniques will encourage students to learn by doing, engage recall from the long-term memory and facilitate knowledge checks and activation. All of which will enhance students' performance in automechanics technology over the long run. The findings present demand on globalization and rapid technological changes that can be adequately addressed by exposing students to scaffolding techniques in the teaching environment. Hotman (2000), asserted that it will enable students acquire skills necessary for industrial complexity.

Accordingly, the results have the supported view of Larkin (2002) and Raymond (2000), that scaffolding technique will also increase the complexity and diversity in lesson sequences and provide a learning environment that promotes intrinsic motivation, reflection, meta-cognition, co-operation and competition. Moreover, the result reveals that learners exposed to contextual, situated learning situations enhances their ability to transfer their newly acquired skills and knowledge through the teacher's use of sequencing, demonstration and model the skills. Lindsay *et al.* (2014), Were also of the opinion that scaffolding technique is a viable alternative to conventional methods of instruction. It ensures that instructional contents are reached with all domains of knowledge necessary for self-actualization and self-reliance. Furthermore, Stephen *et al.* (2104), Rachel (2002) and Lange (2002) also supported that scaffolding technique serve to bridge the gap between school and work, school and community, as it enables the transfer of knowledge and skills through contextualized and situated learning.

Scaffolding technique has proven to be effective in implementing the condition constructivist believes are essential for learning such as creativity, problem solving, retention, understanding, cognitive flexibility, mindful reflection and critical thinking. Scaffolding technique goes beyond traditional apprenticeship in that the activity is modeled within the context of real-world situation and emphasizes cognitive skills rather than physical skills. It also helps the learner to accomplish a goal beyond simply imitating the activity of the skilled teacher.

Recommendations

- i. Scaffolding technique should be provided to students in automobile technology as it incorporates academic, vocational knowledge and skills which prepares student for the future technological complexity.
- ii. Teachers should ensure the use of specific technique as presented in scaffolding to enhance student's ability to transfer skills to real life situation.
- iii. It is important for the schools to provide opportunities for the students to develop and generalize a concept in automobile technology with the use of scaffolding techniques.
- iv. Curriculum developers should build in the strategies of scaffolding technique into the curriculum of vocational subjects.
- v. More time should be allotted to teaching periods since scaffolding technique require: more time, resources, efforts and money. Lagos State Government in conjunction with state Ministry of Education should organize seminar/workshops for teachers and school's administrator on the proper use of scaffolding technique. This method of teaching is recommended in teaching vocational subjects as it puts the control over learning in the hands of the students' and out of the teacher.

References

- Adunola, O. (2011). The impact of teacher teaching methods on the academic performance of primary school pupils in ijobu-ode local government area of ogun state. Ego Booster Books, Ogun State.
- Ball, D. (2000). With an eye on the mathematical horizon Dilemmas of teaching. Paper presented at the Annual Meeting of the American Educational Research Association.
- Berryman, S.E. (2000). Cognitive science, challenging schools to design effective learning environment. <http://www.lit.columbia.edu/k12/hvetex/docs/herrv/htm>.
- Bransford, J, Brown, A, & Cocking, R (2000). How people learn: brain, mind and experience and school. Washington, DC: National Academy Press.
- Collins. A. and Robert, J. (2004). Enhancing students learning through innovation teaching and technology. Kogan Page.
- Eliot (2005). Lecture retrieved on 18/09/2014 from www.en.m.wikipedia.Org/wiki/lecture.
- Ellis, E., Larkin, M. and Worthington, L. Executive summary of the research synthesis on effective teaching principle and the design of quality tools for educators. University of Alabama, A.L. retrieved on 8/9/2018, from <http://idea.Voregon.edu/ncite/documents/techrep/tech0.6html>.
- Fakorede, S.O.A and Ogbuanya, T.C. (2008). Effects of learning mode on the psychomotor achievement of automobile technology students in technical colleges: education in the information age. Global Challenges and Enhancement Strategies Proceeding of 1st International Conference of the Faculty of Education University of Nigeria, Nsukka.
- Federal Republic of Nigeria (2004). National Policy on Education (4th ed.). Lagos: NERDC Press.
- Finch, C.R. and Crunkilton, J.R. (1999). Curriculum development in vocational and technical education planning: content and implementation (Ahl Ed). Boston: Allyn and Becon.
- Gerbe, S.R. (2006). Teaching for learning cognitive apprenticeship. <http://vwwgse.buffalo.edulfas/shvell/TFL cog Ap/cog.htm>
- Grubb, W.N. (1999). Prospect and problem for education through occupation. *Journal of Vocational Education Research*, 22(2), 77-94.
- Hallak, J. and Poisson, M. (2000). Education and globalization: UNESCO globalization and learning together: the challenges for educational content in Asia. France. UNESCO, 10-16.
- Hawkins, S.G. (1994). Applied statistics for the animal science. Boston. MA. Houghton Miff/In Company.
- Hartman, H. (2002). Scaffolding and cooperative learning. *Hartman Learning and Instruction*, 23-69, New York: City of City University of New York.
- Kaur, M. (2008). Production failure; *Cognition and Instruction*, 26, 379-424. Retrieved from <http://www.tandfonline.com/doi/abs/10.1080/0737000802212669>.

Koedinger, K. and Alevan, V. (2007). Exploring the assistance psychology review, 19, 239-264, Retrived from <http://www.spingerlink.com/content/u8k26g2j24p37168/>

Lange, V.L (2002). Instructional scaffolding. Retrieved on 8/9/2014 from [http://condor.admin.cny.cuny.edu/group\\$/cano/cano/cano%20.paper.doc](http://condor.admin.cny.cuny.edu/group$/cano/cano/cano%20.paper.doc).

Larkin, M. (2002). Using scaffolded instruction to optimize learning. Arlington, YA: ERIC Clearing house on Disabilities and Gifted Education Retrieved 18/9/2014 from ERIC at EBSCO host, ERIC no, ED.474 301).

Lindsay, L., Janet. S. & Anne, W. (2014). Scaffolding-Emerging perspective on learning and tecaching retrieved on 18/09/2014 from <http://www.goole.scaffolding/emerging/perspective/>.

Rachel, R. Van Der Stuyf (2002). Scaffolding as a teaching strategy; adolescent learning and development, Section 0500A-Fall 2002.

Raymond, E. (2000). Cognitive characteristics learner with mild disabilities, 169-201. Needham Height, M.A: Allyn and Bacon, a Pearson Education Company.

Sean, Derek and Richard (2000). Journal of Effective Teaching, 5(2). Retreived on 18/9/2014 from uncw.edu/cte/et/articles/bugler.

Stephen, E., Abbott, Lisa. G., Jack, L., & Meg, S. (2014). Scaffolding definition retrieved on 17/09/2014 from www.edglossary.org/scaffolding/.

Ukoha, U.A. and Eneogwe, U.N. (2016). Instructional Process in BA. Ogow Curriculum Development and EduL atwn Technology, 89-154. Murkudi: Onaivi Pnnti and Publishing Co.

Wikipedia (2014). Blooms's taxonomy retrived on 8/9/2014 from <http://en.m.wikipedia.org/wiki/Bloom's-taxonomy>.