

EFFECT OF SELF-DIRECTED LEARNING BASED ON STUDENTS' ACHIEVEMENT AND INTEREST IN BASIC TECHNOLOGY FOR SUSTAINABLE DEVELOPMENT

¹HASSAN, A. M ²SHUAIBU SAMINU., ³KARFE, ROSELINE YUSUF., ⁴ZAKARI MOHAMMED, ⁵ABDULLAHI UMAR BALA & ⁶UMAR JIYA

^{1,4&6}Department of Industrial and Technology Education, Federal University of Technology, Minna,

²Department of Technology Education, Yusuf Maitama Sule University, Kano State Nigeria;

³Directorate of Remedial and General Studies, Department of General Studies, Federal University of Health Sciences, Azare, Bauchi State.

⁵Department of Science Education, Federal University of Technology, Minna

Corresponding Email: shuaibu772@gmail.com. TEL: 08036933849

Abstract

The study adopted quasi-experimental design. The study was carried out in technical colleges in Niger State. The population of the study consists of seven technical colleges in Niger State. The sample of study was two hundred and forty seven (247) NTC II, Basic Technology students in technical colleges in Niger State. Basic Technology Achievement Test (BTAT) and Basic Technology Interest Scale (BTIS) were used as the instrument. The two instruments were validated by three experts from the Department of Industrial and Technology Education, Federal University of Technology, Minna. Pearson Product Moment Correlation Coefficient was used to compute results of the trial testing after test re-test instrument administration and the results indicated positive correlation coefficients of 0.85 and 0.88 for BTAT and BTIS respectively. The researcher administered the instrument with the help of two research assistants. Data for the study were collected through pre-test and posttest using the Basic Technology Achievement Test (BTAT) and the Basic Technology Interest Scale (BTIS). Data collected were analyzed using Mean and Standard Deviation to answer the two research questions while Analysis of Co-variance (ANCOVA) was used to test the two null hypotheses at 0.05 level of significance. From the findings, the study revealed that self-directed learning enhances students' achievement in Basic Technology in technical schools more than the lecture method. The finding also revealed that self-directed learning promotes students' interest in Basic Technology in technical schools more than the lecture method among others. The study therefore concluded that students' poor achievement and interest in Basic Technology informed the need for the study on the effect of self-directed learning on students' achievement and interest in Basic Technology in Technical Colleges in Niger state.

Keywords: self-directed learning, students, Basic Technology, achievement, interest

Introduction

Technical colleges are specialized institutions of learning where learners acquire knowledge, skills and attitudes necessary for the world of work. Technical college's according to Umar *et al.* (2020) are integral part of the total educational system in Nigeria that contributes towards the development of good citizenship by developing the physical, social, civic, cultural and economic competencies of the individual. The goals of technical colleges, as stated by Federal Republic of Nigeria, FRN, (2013) are to provide trained manpower in the applied sciences, technology and business, particularly at craft, advanced craft and technician levels; provide the technical knowledge and vocational skills necessary for agricultural, commercial and economic development; and give training and impart the requisite skills to individuals who shall be self-reliant economically.

Basic technology is aimed at exposing students to career awareness by exploring usable options in the world of work and enabling youth to have an intelligent understanding of the increasing complexity of technology. (Adodo, 2013) it is meant to provide the technical knowledge and vocational skills necessary for self-reliance. Basic technology is a three year programmes of preparatory instruction in manipulative skills, mathematics, sciences, communicative abilities and leadership skills which prepares individual for self-employment. Some of the instructional programmes of basic technology are; wood work, metal work, electrical/electronic, building architecture/technical drawing. (Federal Republic of Nigeria, 2013).

Basic technology, stresses the preparatory aspect of pre-vocational training offered to student at Junior Secondary School level to introduce them into the world of technology and have an appreciation of technology towards interest arousal and choice of a vocation at the end of Junior Secondary School and professionalism later in life.

As a result of this focus, Adodo (2013) states that, these are components of the general education curriculum which introduces pupils to the elements of technology in order to acquaint them with the role of technology in a contemporary life and permits them to develop basic practical skills in the manipulation of simple tools and materials. This element is also designed for information and guidance purposes for eventual educational and occupational choice. Federal Republic of Nigeria, (2013) refers to those aspects of the educational processes involving the study of technologies and related sciences, and the acquisition of practical skills, attitude, and knowledge relating to occupation in various sectors of economic and social life. Okorie, (2009) perceives vocational education as any form of education whose primary purpose is to prepare persons for employment in a recognize occupation.

Rocser, (2011) is of the view that, education consists of two components input and output. Input consists of human and material resources while outputs are the goal and philosophy of the educational process. Both the input and output form a dynamic organic whole and if one wants to investigate and assess the educational system in order to improve its performance, effects of one component on the other. Instructional materials are those materials that teachers need to incorporate in the teaching learning processes, to help the pupils benefit maximally from the learning experiences (Keshav, 2020).

Self-Directed Learning is a learning process for which students take their role and initiatives to learn independently without the help of other persons. The activities that are performed by students in this SDL include diagnosis of the necessity needed in the learning activity, formulating learning objectives, identifying learning source, choosing and performing learning strategy and evaluating learning achievement. Harsono (2008) states that SDL is one of the educational learning strategies of equality which is done either individually or group outside of lecturing or tutorial. It needs to be well managed by the manager of instruction through well planning.

SDL is considered to be one of the learning methods that is performed by a person for self-interest. SDL can be conducted in classrooms and in classroom environments that are individual or group who need limited assistance to orderly conduct in activities (Nur, 2017). Knowles' theory of SDL as cited by Malison & Thammakoranonta (2018) state that SDL is as a study process in which students need help or without the help of others, assessing their learning, formulating goals with appropriate strategies and evaluate learning outcome. SDL can be viewed as learners' effort of performing learning activity independently or with the help of others concerning their motivation to master learning material or to achieve a particular competency. Students in SDL are usually more actively participating in learning assignments as they read online learning material, completing class assignments, planning and evaluating learning outcomes (Geng *et al.*, 2019). With the implementation of self-directed learning might improve student academic achievement.

Student Academic achievement has to do with the successful accomplishment of goals, measured by the extent to which instructional objectives are achieved. According to Eze and Osuyi, (2018), academic achievement is a measure of the degree of success in performing specific tasks in a subject area or area of study by students after a learning experience. Whereas Ahmad and Ombuguhim, (2020) defined achievement as the scholastic standing of a student at a given moment in learning both theoretical and practical skills in Basic technology therefore, is essential to students' progress in the changing world of technology. In this regard, effective instructional approach must be developed to improve skills achievement and to maintain acquired skills at a functional level over a period of time. With adoption of design-thinking learning strategies, students' interest might increase. When students' interests are piqued, their performance improves.

Student interest according to Duru *et al.* (2021) is defined as a content-specific, person-object relationship that emerges from an individual's interaction with the environment. According to the authors, interest is an important variable in the school context, as it can influence students' level of

participation in learning, Self-efficacy of their learning experience as well as their level of performance. The study therefore poised to find out the effect of self-directed learning on students' achievement and interest in basic technology for sustainable development.

Statement of the Problem

Basic technology is one of the trade programme offered at the Technical Colleges which is meant to prepare students with the requisite skills that can make them to be self-reliant after graduation. Such skills include but not limited to demonstration of basic knowledge in theory and practical skill content (NBTE, 2017). The National Examinations Council (NECO) reports show the persistent records of the students' low performance in Basic technology and this has been attributed to teachers' inappropriate pedagogical approaches. Study Mbonyirivuze, *et al.* (2019) had shown that students' poor academic achievement is as a result of teaching methods employed by teachers. Similarly, Researchers such as Duhu and Ibanga, (2020) and Lawal *et al.*, (2020) also identified several factors responsible for students' poor performance in subjects such as Basic technology to be specific, and they classified these factors as students-related factors, teacher related factors, society-related factors and government-related factors. Among other things that form the teacher-related factors is the teaching methods adopted by teacher like conventional teaching method. These learning methods adopted by teacher's in the technical colleges according Ayonmike, (2020) results to students' absenteeism during lesson thereby paving way for students poor learning outcome.

Various methods of improving the poor performance of students have been neglected, hence there is the need to look for more proactive methods that will incorporate individual differences of learners and make them learn in a more profitable way. To search for more efficient methods that will improve students' academic performance call for the trial of another individualized approach such as design-thinking teaching methods. Therefore, the study, seeks to investigate effect of self-directed learning on students' achievement and interest in basic technology for sustainable development in Niger State.

Research Questions

The following research questions guided the study:

1. What are the mean achievement scores of students taught Basic technology using self-directed learning and those taught using lecture method for sustainable development?
2. What are the mean interest scores of students taught Basic technology using self-directed learning and those taught using lecture method for sustainable development?

Hypotheses

The following null hypotheses were formulated and tested a 0.05 level of significance.

- H₀₁:** There is no significant difference in the mean achievement scores of students taught Basic technology using self-directed learning and those taught using lecture method for sustainable development.
- H₀₂:** There is no significant difference in the mean interest scores of students taught Basic technology using self-directed learning and those taught using lecture method for sustainable development.

Methodology

The study adopted quasi-experimental design. The study was carried out in technical colleges in Niger State. The population of the study consists of seven technical colleges in Niger State. The sample of study was two hundred and forty-seven (247) NTC II, Basic technology students in technical colleges in Niger State. Basic technology Achievement Test (BTAT) and Basic Technology Interest Scale (BTIS) were used as the instrument. The two instruments were validated by three experts from the Department of Industrial and Technology Education, Federal University of Technology, Minna. Pearson Product Moment Correlation Coefficient was used to compute results of the trial testing after test re-test instrument administration and the results indicated positive correlation coefficients of 0.85 and 0.88 for BTAT and BTIS respectively. The researcher administered the instrument with the help of two research assistants. Data for the study were collected through pre-test and posttest using the Basic Technology Achievement Test (BTAT) and the Basic Technology Interest Scale (BTIS). After the pre-test, items of the BTAT were reshuffled before re-administration for posttest. The essence of reshuffling the items was to ensure that students do not memorise all the contents of the BTAT. Data collected from the two tests (pre-test and post-test) were used for data analysis. Data collected were analyzed using

Mean and Standard Deviation to answer the two research questions while Analysis of Co-variance (ANCOVA) was used to test the two null hypotheses at 0.05 level of significance. The ANCOVA was preferred because of its power to take care of the initial lack of equivalence (differences) in the experimental and control groups since intact classes were used for the study. The pretest served as covariate to the post-test and this justifies more the use of ANCOVA for testing the null hypotheses.

Results

Research Question 1: What are the mean achievement scores of students taught Basic technology using self-directed learning and those taught using lecture method?

Table 1: Mean Achievement Scores of Students taught Basic technology using Self-directed learning and those taught using Lecture Method

Teaching Methods	N	Pre-test		Post-test		Mean Gain Score
		Mean	SD	Mean	SD	
Self-directed learning	126	33.28	10.32	79.08	8.80	42.80
Lecture Method	121	33.62	6.20	37.77	7.25	4.15
Total	247	33.45	8.26	58.43	8.03	23.48

Table 1 showed that students taught Basic technology in technical schools using Self-directed learning had a mean and standard deviation achievement score of 33.28 (10.32) in pre-test while students taught with lecture method had pretest mean and standard deviation achievement score of 33.62 (6.20) respectively. This suggests that at pretest level students in both design thinking based and lecture methods almost had the same achievement. The post-test mean and standard deviation achievement of students taught Basic technology in technical schools using the design thinking based and lecture methods are 79.08 (8.80) and 37.77 (7.25) respectively. This implies that students taught Basic technology in technical schools with design thinking based had better achievement than their counterparts taught using the lecture method. Thus, the Self-directed learning enhances students' achievement in Basic technology in technical schools more than the lecture method.

Research Question 2: What are the mean interest scores of students taught Basic technology using self-directed learning and those taught using lecture method?

Table 2: Mean Interest Scores of students taught Basic technology using Self-directed learning and those taught using lecture method

Teaching Methods	N	Pre-test		Post-test		Mean Gain Score
		Mean	SD	Mean	SD	
Self-directed learning	126	1.69	0.80	3.39	0.68	1.70
Lecture Method	121	1.55	0.62	1.76	0.75	0.21
Total	247	1.62	0.71	2.58	0.72	0.95

Table 2 revealed that students taught Basic technology in technical schools using Self-directed learning had a mean and standard deviation interest score of 1.69 (0.80) in pre-test while students taught with lecture method had pretest mean and standard deviation interest score of 1.55 (0.62) respectively. This suggests that at pretest level students in both Self-directed learning and lecture method almost had the same interest level. The post-test mean and standard deviation interest of students taught Basic technology in technical schools using the design thinking based and lecture methods are 3.39 (0.68) and 1.76 (0.75) respectively. This implies that students taught Basic technology in technical schools with design thinking based had higher interest in Basic technology than their counterparts taught using the lecture method. Thus, the Self-directed learning promotes students' interest in Basic technology in technical schools more than the lecture method.

Ho₁: There is no significant difference in the mean achievement scores of students taught Basic technology using self-directed learning and those taught using lecture method.

Table 3: ANCOVA Summary Table of the difference in the mean (x) achievement scores of students taught Basic technology using Self-directed learning and those taught using lecture method

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	109046.255 ^a	2	54523.128	1081.545	.000
Intercept	28358.581	1	28358.581	562.534	.000
Pretest	3708.140	1	3708.140	73.556	.000
Method	106104.674	1	106104.674	2104.740	.000
Error	12300.587	244	50.412		
Total	976558.000	247			
Corrected Total	121346.842	246			

Table 3 shows the F value as 2104.74 and the probability value as .000. The probability value of .000 of this finding is less than the alpha value of 0.05. Therefore, the null hypothesis is rejected and thus, there is significant difference in the mean achievement scores of students taught Basic technology using Self-directed learning and those taught using lecture method in favour of the Self-directed learning. This implies that students taught Basic technology with Self-directed learning had better achievement compared with their counterparts taught with the lecture strategy.

Ho₂: There is no significant difference in the mean interest scores of students taught Basic technology using self-directed learning and those taught using lecture method.

Table 4: ANCOVA Summary Table of the difference in the mean (x) interest scores of students taught Basic technology using Self-directed learning and those taught using lecture method

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	165.925 ^a	2	82.963	163.546	.000
Intercept	313.734	1	313.734	618.469	.000
Pre-Interest	2.219	1	2.219	4.374	.038
Method	165.854	1	165.854	326.950	.000
Error	123.775	244	.507		
Total	1948.000	247			
Corrected Total	289.700	246			

Table 4 showed the F value as 326.95 and the probability value as .000. Since the probability value of .000 of this finding is less than the alpha value of 0.05. Therefore, the null hypothesis is rejected and thus, there is a significant difference in the mean interest scores of students taught Basic technology using Self-directed learning and those taught using lecture method in favour of the Self-directed learning. This suggests that students taught Basic technology with the Self-directed learning had higher interest in the subject compared to their counterparts taught with the lecture method.

Discussion of Results

The data presented in Table 1 and Table 3 revealed that students taught Basic technology in technical schools with design thinking based learning had better achievement than their counterparts taught using the lecture method. There is significant difference in the mean achievement scores of students taught Basic technology using Self-directed learning and those taught using lecture method. This implies that students taught Basic technology with Self-directed learning had better achievement compared with their counterparts taught with the lecture method. This finding is expected as students' direct involvement in the teaching and learning processes enhances students' achievement more than teacher-dominated instruction. The finding of this study is coherent with that of Fabiano *et al.* (2021) who

found that Self-directed learning was very effective in promoting students' academic performance and retention in children.

The data presented in Table 2 answered research question 2 while the data presented in Table 4 answered hypothesis 2. The result of the analysis revealed that students taught Basic technology in technical schools with Self-directed learning had higher interest in Basic technology than their counterparts taught using the lecture method. There is a significant difference in the mean interest scores of students taught Basic technology using Self-directed learning and those taught using lecture method in favour of the Self-directed learning. This suggests that students taught Basic technology with the Self-directed learning had higher interest in the subject compared to their counterparts taught with the lecture method. This finding is expected as students' active participation in teaching and learning process rekindles their interests and deactivates boredom and day dreaming. In line with the findings of this study Cereja *et al.* (2018) found out that students taught using design thinking exhibited higher interest in the subject Technical Drawing, than those taught by their teachers using the lecture method.

Conclusions

Students' poor achievement and interest in Basic technology informed the need for the study on the effect of self-directed learning on students' achievement and interest in Basic technology in Technical Colleges in Niger state. The study indicated that self-directed learning enhances students' achievement and interest in Basic technology more than the lecture method. Basically, there was significant difference in the mean achievement and interest scores of students taught Basic technology using Self-directed learning and those taught using lecture method in favour of the Self-directed learning. It was concluded that appropriate use of self-directed learning in teaching Basic technology would facilitate students' achievement and interest in Basic technology.

Recommendations

Based on the findings of the study, the following recommendations were made.

1. Basic technology teachers should be encouraged by the government through its relevant ministries to adopt self-directed learning in teaching and learning Basic technology for better academic achievement of the students in the subject.
2. The Government through its relevant ministries of education should organize seminars, workshops and symposia for the in-service teachers on the use of self-directed learning for effective teaching and learning of Basic technology in technical schools.

References

- Adodo, S. O. (2013). Effect of mind-mapping as a self-regulated learning strategy on students' achievement in basic science and technology. *Mediterranean Journal of Social Sciences*, 4(6), 163.
- Ahmad, T. A., & Ombuguhim, S. U. (2020). Effect of Self-Regulatory Learning Strategy on Students' Achievement in Basic Science and Technology in Minna, Niger State. *Journal of Information, Education, Science and Technology*, 6(2), 122-131.
- Akinpade, O. A., Alawode, O. D. & Usman, G. A. (2020). Assessment of Workshop Facilities for Effective Teaching - Learning Delivery in Industrial and Technology Education Department. Federal University of Technology, Minna. *Journal of Information Education, Science and Technology*, 6 (1), 62-67.
- Amabile, T. M. (2018). Creativity in Context: Update to the Social Psychology of Creativity. New York: Routledge.
- Amaechi, O.J., & Thomas, C.G. (2016). Strategies of effective teaching and learning Practical skills in technical and vocational training programmes in Nigeria. *International Journal of Scientific Research Engineering & Technology (IJSRET)*, 5(12), 598-603.

- Ayonmike, C. S. (2020). Strategic work-based learning framework for achieving sustainable development goals(SDG) through global partnership in TVET. *Journal of Information Education, Science and Technology*, 6 (1), 89-97.
- Barroca, A., & Soares, J. (2017). Design Thinking Mindset Applied to Education and Training. *INTED2017 Proceedings*. doi:10.21125/inted.2017.
- Bashir, M. (2018). Adequacy and utilization of instructional materials for teaching electrical installation and maintenance work trade in Adamawa State technical colleges. *ATBU Journal of Science, Technology & Education (JOSTE)*, 6(2), 226-233. Retrieved April 24, 2019, from: www.atbuftejoste.com
- Cereja, J. R., Santoro, F. M., Gorbacheva, E., & Matzner, M. (2018). Application of the Design Thinking Approach to Process Redesign at an Insurance Company in Brazil. In *Business Process Management Cases* (pp. 205-233): Springer.
- DeGone, B. (2021). The Impact of Project-Based Learning on Students in High School Chemistry in Rural Maine. Electronic Theses and Dissertations. 3504. <https://digitalcommons.library.umaine.edu/etd/3504>.
- Duhu, P.C. & Ibanga, I. J. (2020). Effects of Guided Discovery Method of Teaching on Students' Academic Achievement and Retention in Electrical Installation and Maintenance Work in Government Technical Colleges of Adamawa State. *Journal of Information, Education, Science and Technology*, 6 (2), 43-50.
- Duru, P. T., Nwankwo, F., Motanya, C., Aliyu, M. & Rabi, M. B. (2021). Effects of Science Process Skills on Achievement and Interest of Pre-service Biology Teacher's in College of Education, Minna Niger State, Nigeria. *International Journal of Industrial Technology, Engineering, Science and Education*, 2(1), 98-104.
- Eze, T. L. & Osuyi, S.O. (2018), "Effect of Problem-based Teaching Method on Students' Academic Performance in Electrical Installation and Maintenance Works in Technical Colleges in Edo State", *International Journal of Development and Sustainability*, 7(2), 666-678.
- Fabiano, P. N., Marcos M., Francisco Antonio Pereira, F. & Carolina, (2021). Design Thinking as A Tool to The Teaching of Children, And Teachers In The 21st Century: An Integrative Review. *International Journal for Innovation Education and Research*, 9(11)131-146
- Federal Republic of Nigeria (FRN) (2013). *National Policy on Education* (6th edition). Lagos: National Educational Research and Development Council (NERDC) Press.
- Idris, N. B. (2019). Malaysia. *Issues in Upper Secondary Science Education*. doi:10.1057/9781137275967.0010
- Kudu, B. U. & Beji, D. B. (2018). Development and Validation of Training Manual for Block, Bricklaining and Concreting Students in Technical Clooeges in Nigeria. *International journal of industrial technology, engineering, science and education*, 1(1), 81-86.
- Lawal, G., Aniah A., & Alabi, T. O. (2020). The Perception, Attitudes and Readiness Towards Online Learning among College of Education Pre-service Teachers in Katsina State, Nigeria. *Journal of Information, Education, Science and Technology*, 6(2), 132-138.
- Mbonyiriyivuze, A., Yadav, L.L., & Amadalo, M.M. (2019). Students' conceptual Understanding of electricity and magnetismand its implications: A review. *African Journal of Educational Studies in Mathematics and Sciences*.15(2), 55-67. doi: <https://dx.doi.org/10.4314/ajesms.v15i2.5>.

- Mohammed, R. E., & Iredje, N. (2020). Effects of Target Task Model and Experiential Learning Approach on Senior Secondary School Students' Performance in Physics. *Journal of Science, Technology, Mathematics and Education*, 16(2), 186-197.
- Oviawe, J.I., Uwameiye, R., & Uddin, P.S.O. (2017). Bridging skill gap to meet technical, vocational education and training school-workplace collaboration in the 21st Century. *International Journal of Vocational Education and Training Research*, 3(1), 7-14. doi: 10.11648/j.ijvetr.20170301.12.
- Pande, M., & Bharathi, S. V. (2020). Theoretical foundations of design thinking—A constructivism learning approach to design thinking. *Thinking Skills and Creativity*, 36(3), 10-26.
- Pusca, D. & Northwood, D. O. (2018). Design Thinking and its Application to Problem Solving. *Global Journal of Engineering Education*, 20, (1) 48-53.
- Shé, C. N., Farrell, O., Brunton, J., & Costello, E. (2021). Integrating Design Thinking into Instructional Design: The Open Teach case study. *Australasian Journal of Educational Technology*, 33-52. Doi: <https://doi.org/10.14742/ajet.6667>.
- Tema, J. T. & Dauda, G. (2018). Assessment of the cognitive skills performance of students in building construction trade in technical colleges in Nigeria for national development. *Benue State University Journal of Education*, 19(1), 17-23
- Umar, B. K., Alhassan, N. U. & Nathaniel, J. U. (2020). Entrepreneurship Skills Needed by Blocks, Bricklaying & Concreting in Technical College Graduates in Niger State. *Journal of Information, Education, Science and Technology*, 6(2), 89-93.
- William, X. T. (2019). 21st Century Learning Skills in Education and Employability. A Dissertation Submitted in Partial Fulfillment of the Requirements for the Degree of Doctor of Education to the Faculty of the Department of Administrative and Instructional Leadership of the School of Education St. John's University, New York