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The Effect Of Model Lead Test On Students' Achievement In Technical Education (Automobile Technology), Rivers State University, Port Harcourt

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ABSTRACT
This study investigated the effect of Model Lead Test (MLT) teaching strategy on students' academic achievement in Automobile Technology at Rivers State University, Port Harcourt. The research adopted a quasi-experimental design with 82 students randomly assigned to experimental and control groups. The experimental group was taught using the MLT strategy while the control group was taught using conventional teaching methods. Data were collected using an Automobile Technology Achievement Test (ATAT) administered as pre-test and post-test. The data were analyzed using mean, standard deviation, and Analysis of Covariance (ANCOVA). Findings revealed that students in the experimental group had a higher achievement than their counterparts in the control group. This was seen from the mean score of both categories of students from the Automobile Technology Achievement Test (ATAT). Students in the experimental group recorded a mean gain of 32.22 after exposure to the Model-Lead-Test. The study therefore concluded that the Model Lead Test teaching strategy significantly improves students' achievement in automobile technology and recommended amongst others that lecturers of automobile technology at Rivers State University and other tertiary institutions should adopt the Model Lead Test strategy in their teaching to enhance students' achievement and also the department of Vocational and Technology Education should periodically, organize workshops and training sessions to familiarize lecturers with the implementation of the MLT strategy in technical courses. Consequently, this research contributes to the body of knowledge on effective teaching strategies in technical education, particularly in the context of Automobile Technology instruction in Nigerian universities.
Keywords: Model Lead Test, Technical Education, Automobile Technology, Academic Achievement, Teaching Strategy

INTRODUCTION

Technical education plays a vital role in Nigeria's development by producing skilled manpower required for industrial growth and technological advancement. Automobile technology, as a specialized field within technical education, is particularly critical given the increasing complexities of modern vehicles and the growing automotive industry in Nigeria. Despite its importance, students' achievement in automobile technology courses at tertiary institutions has been observed to be below expectations.

Several factors have been identified as responsible for poor academic performance in technical courses, including inadequate teaching methods, insufficient practical exposure, and limited instructional resources. The conventional teaching approaches predominantly used in Nigerian technical institutions often emphasize theoretical knowledge over practical skills and fail to actively engage students in the learning process.

The Model Lead Test (MLT) strategy, represents a structured teaching approach that guides students through a systematic process of skill acquisition. The strategy involves three phases: the "model" phase, where the instructor demonstrates the target skill; the "lead" phase, where the instructor guides students through the skill; and the "test" phase, where students perform the skill independently. This approach aligns with social learning theory (Bandura, 1977) and principles of explicit instruction.

Despite the potential benefits of the MLT strategy, its effectiveness in teaching automobile technology at the tertiary level in Nigeria has not been extensively investigated. This study therefore aimed to determine the effect of MLT on students' achievement in automobile technology at Rivers State University, Port Harcourt.

Statement of the Problem

The persistent low achievement of students in automobile technology courses at Rivers State University has raised concerns among educators and stakeholders. Traditional teaching methods appear inadequate in fostering deep understanding and practical skills in the technical fields (Okwelle & Owo, 2018). Thus, there is a need to explore alternative teaching strategies that might enhance student learning outcomes. This study investigated whether the Model Lead Test strategy could improve students' achievement in automobile technology compared to conventional teaching methods.

Purpose of the Study

The purpose of this study was to determine the effect of Model Lead Test teaching strategy on students' achievement in automobile technology at Rivers State University, Port Harcourt.

Research Questions

The following research question guided the study:

1. What is the effect of Model Lead Test teaching strategy on students' achievement in automobile technology at Rivers State University, Port Harcourt?

Hypothesis

The following null hypothesis was tested at 0.05 level of significance: H_0: There is no significant difference in the achievement of students taught automobile technology using Model Lead Test strategy and those taught using conventional methods.

LITERATURE REVIEW

Theoretical Framework

This study is anchored on two theoretical frameworks: Social Learning Theory (Bandura, 1977) and the Theory of Explicit Instruction

Bandura's Social Learning Theory posits that individuals learn through observation, imitation, and modeling. The theory emphasizes the importance of observing and modeling behaviors, attitudes, and emotional reactions of others in the learning process. This aligns with the MLT strategy's modeling phase, where the instructor demonstrates the target skill for students to observe before attempting it themselves.

The Theory of Explicit Instruction emphasizes the importance of clear, direct teaching that leaves nothing to chance. It advocates for a structured, systematic approach to instruction where skills are broken down into manageable components and taught sequentially. This theory supports the systematic nature of the MLT strategy, which progresses from teacher demonstration to guided practice and finally independent performance. Explicit instruction according to Archer and Hughes (2011) is systematic, direct, engaging, and success oriented and has been shown to promote achievement for all students.

Conceptual Framework

Model Lead Test Strategy

The Model Lead Test (MLT) strategy is an instructional approach that follows a three-step sequence: model, lead, and test. In the model phase, the teacher demonstrates the skill or concept while students observe. In the lead phase, the teacher guides students through the process, providing scaffolded support. In the test phase, students perform the skill independently to demonstrate mastery.

The positive nature of Model-Lead-Test strategy stems from the views of Chijioke, Okwelle and Omeodu (2016) that the model-lead-test instructional strategy is a student-centered instructional method in that it is ultimately intended to give students a solid conceptual foundation and also to aid them to reason effectively and succeed at problem-solving tasks in putting for greater emphasis on engaging students in a variety of specific classroom activities. The very purpose of the M-L-T strategy is to maximize the cognitive and learning abilities of students by increasing their rate of success and their achievements. Also, Jirgba, Eriba and Achor (2018) investigated the effect of peer collaboration learning strategy on students' achievement in Basic Science in Makurdi Local Government Area of Benue State and found that there is a significant difference between the mean achievement scores of students taught basic science using peer collaborative learning strategy and those taught using demonstration method. However, there was no significant difference between the mean achievement scores of male and female students taught basic science using peer-collaborative learning strategy

The MLT strategy has been recognized as effective for teaching a variety of subjects, particularly those involving procedural knowledge and skills. Its structured approach ensures that students have clear expectations, sufficient guidance, and opportunities for independent practice and assessment. According to Itikpo et al (2021), Model, Lead Test instructional strategy enhanced the academic achievement of senior secondary students in hydrocarbon aspect of organic chemistry in Benue State.

Technical Education and Automobile Technology

Technical education refers to aspects of the educational process involving general education, the study of technologies and related sciences, and the acquisition of practical skills, attitudes, and knowledge relating to occupations in various sectors of economic and social life (UNESCO, 2001). Automobile technology, as a branch of technical education, focuses on the principles, operations, maintenance, and repair of automotive systems.

At Rivers State University, the automobile technology curriculum encompasses engine systems, transmission systems, brake systems, electrical systems, and automotive electronics, among other topics. Students are expected to develop both theoretical knowledge and practical skills in these areas.

Academic Achievement in Technical Education

Academic achievement in technical education encompasses both theoretical understanding and practical competence in the subject matter. In automobile technology, this involves comprehension of vehicle systems and principles as well as the ability to diagnose, repair, and maintain vehicles.

Previous studies have identified various factors affecting academic achievement in technical education, including instructional strategies, learning environment, student motivation, and resource availability. Effective teaching strategies are particularly important in technical fields, where the integration of theory and practice is essential.

METHODOLOGY

Research Design

This study employed a quasi-experimental design, specifically the non-equivalent control group design. This design was appropriate because it allowed for the comparison of two intact groups without random assignment of individual students to groups, which would have disrupted the existing class arrangements at the university.

Population and Sample

The population for this study comprised all 84 undergraduate students enrolled in automobile technology courses at the Department of Vocational and Technology Education, Rivers State University, Port Harcourt, during the 2022/2023 academic session.

A sample of 82 students was selected using random sampling. The sample was divided into experimental (n=42) and control groups (n=[40]).

Instrumentation

The instrument used for data collection was the Automobile Technology Achievement Test (ATAT), developed by the researcher. The ATAT consisted of 20 items designed to measure students' knowledge and understanding of automobile technology concepts in line with the course curriculum.

The instrument was validated by 2 experts in technical education and 2 experts in measurement and evaluation. The reliability of the instrument was established using Kuder Richardson 20, yielding a reliability coefficient of 0.89, which was considered adequate for the study.

Experimental Procedure

The study was conducted over a period of 8 weeks. Before the commencement of the experiment, both groups were administered the ATAT as a pre-test to establish their baseline knowledge.

The experimental group was taught using the Model Lead Test strategy, which involved:

1. **Model phase**: The instructor demonstrated each automotive procedure while verbally explaining the steps and rationale.
2. **Lead phase**: The instructor guided students through the procedure, providing prompts and feedback as needed.
3. **Test phase**: Students performed the procedure independently while the instructor assessed their performance.

The control group was taught the same content using conventional teaching methods, which primarily involved lectures, occasional demonstrations, and assignments.

Both groups received instruction for 8 weeks 2 periods per week, with each period lasting 60 minutes. The same instructor taught both groups to control for teacher variables, and efforts were made to ensure equivalent learning environments and resources.

After the intervention period, the ATAT was administered to both groups as a post-test to measure their achievement.

Method of Data Analysis

The data collected were analyzed using descriptive and inferential statistics. Mean and standard deviation were used to answer the research question, while Analysis of Covariance (ANCOVA) was used to test the hypothesis at 0.05 level of significance. The pre-test scores were used as covariates to control for initial differences between the groups.

RESULTS

Research Question: ***What is the effect of Model Lead Test teaching strategy on students' achievement in automobile technology?***

Table 1: Mean Achievement Scores of Experimental and Control Groups

Group	N	Pre-test		Post-test		Mean Gain
		Mean	SD	Mean	SD	
Experimental	42	45.32	8.76	76.54	9.21	31.22
Control	40	46.18	8.92	61.27	10.45	15.09
Mean Diff		0.86		15.27		

Table 1 shows that the experimental group had a mean pre-test score of 45.32 with a standard deviation of 8.76 while the control group had a mean pre-test score of 46.18 with a standard deviation of 8.92. This indicates that both categories of students have approximately equal level of academic achievement before the administration of treatment to the experimental group.

After the intervention, the experimental group achieved a mean post-test score of 76.54 with a standard deviation of 9.21 while the control group achieved a mean post-test score of 61.27 with a standard deviation of 10.45. The mean gain scores were 32.22 and 15.09 for the experimental and

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control groups, respectively.

These results suggest that the academic performance (achievement) of students increased when taught with model lead test than with the normal conventional (lecture) teaching method.

Hypothesis Testing

H_0: There is no significant difference in the achievement of students taught automobile technology using Model Lead Test strategy and those taught using conventional methods.

Table 2: ANCOVA Results for Achievement Scores

Source of Variation	Sum of Squares	df	Mean Square	F	Sig.	Decision
Corrected Model	5842.74	2	2921.37	32.45	0.000	
Intercept	7645.38	1	7645.38	84.93	0.000	
Pretest (Covariate)	1234.21	1	1234.21	13.71	0.000	
Treatment	4582.63	1	4582.63	50.89	0.000	Reject H_0
Error	7112.45	79	90.03			
Total	421563.00	82				
Corrected Total	12955.19	81				

*Significant at $p < 0.05$

Table 2 shows the ANCOVA results for the achievement scores. The F-value for the treatment effect was 50.89 with a p-value of 0.000, which is less than the alpha level of 0.05. Therefore, the null hypothesis is rejected. This implies that there is a significant difference in the achievement of students taught automobile technology using Model Lead Test strategy and those taught using conventional methods.

REFERENCES

Adams, G. L., & Engelmann, S. (1996). *Research on Direct Instruction: 25 years beyond DISTAR*. Educational Achievement Systems.

Agwi, V. I. A., & Puyate, S. T. (2018). Effect of problem-based learning approach on students' achievement in technical drawing in technical colleges in Rivers State. *International Journal of Innovative Education Research, 6*(1), 94-100.

Akaninwor, G. I. K. (2015). *Principles and methods of teaching technical education subjects*. University of Port Harcourt Press.

Akpan, G. A., Usoro, H. S., & Akpan, B. P. (2020). Effects of demonstration and guided discovery instructional strategies on students' performance in automobile technology in technical colleges in Akwa Ibom State. *Journal of Educational Research and Development, 15*(2), 67-78.

Amaechi, O. J., & Adighije, C. L. (2019). Competency improvement needs of automobile technology teachers in technical colleges in Rivers State. *International Journal of Innovative Social & Science Education Research, 7*(2), 37-44.

Anaele, E. O., Adelakun, O. A., Dem, I. I., & Barfa, G. I. (2014). Strategies for enhancing the skills acquisition of technical education students of tertiary institutions in Nigeria. *Journal of Education and Practice, 5*(16), 128-132.

Archer, A. L., & Hughes, C. A. (2011). *Explicit instruction: Effective and efficient teaching*. Guilford Press.

Asiyai, R. I. (2020). Best teaching practices for technical education delivery in Nigerian tertiary institutions. *International Journal of Mechanical Engineering and Technology, 11*(3), 15-23.

Bandura, A. (1977). *Social learning theory*. Prentice Hall.

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Prentice Hall.

Bronfenbrenner, U. (2005). *Making human beings human: Bioecological perspectives on human development*. Sage Publications.

Chijioke, N., Okwelle, P., & Omeodu, D. (2016). The effect of model lead test technique on secondary schools' performance in in Imo State.

Copper, J. M. (2013). *Classroom teaching skills* (9th ed.). Houghton Mifflin.

Dawodu, P. B. (2016). Enhancing the acquisition of psychomotor skills in automobile technology education in technical colleges in Lagos State, Nigeria. *Journal of Educational Research and Development, 10*(2), 102-112.

Ebuara, V. O., & Uduak, I. E. (2018). Teacher instructional methods and students' academic performance in technical education in secondary schools in Calabar Education Zone, Cross River State. *International Journal of Scientific Research in Education, 11*(3), 501-511.

Egbe, B. O. (2019). Effects of instructional materials on students' achievement in automobile technology in technical colleges in Rivers State. *Journal of Technical Education and Training, 11*(1), 63-72.

Ekereobong, S. U., Ekpenyong, L. E., & Edokpolor, J. E. (2021). Effects of explicit teaching strategy on students' performance in technological courses in Nigerian universities. *Contemporary Educational Technology, 13*(1), 1-10.

Engelmann, S., & Carnine, D. (1991). *Theory of instruction: Principles and applications*. ADI Press.

Federal Republic of Nigeria. (2013). *National policy on education* (6th ed.). Nigerian Educational Research and Development Council (NERDC).

Hollingsworth, J., & Ybarra, S. (2017). *Explicit direct instruction (EDI): The power of the well-crafted, well-taught lesson* (2nd ed.). Corwin Press.

Ibeneme, O. T. (2018). Technical and vocational education for self-reliance and economic development in Nigeria. *International Journal of Vocational and Technical Education Research, 4*(3), 28-36.

Ibrahim, D. H., & Kazeem, S. O. (2019). Work-based learning as a pathway to competence-based education in automobile technology instruction. *Journal of STEM Teacher Education, 54*(1), 1-15.

Igwe, R. O., & Ogunedo, M. S. (2019). Effects of collaborative learning on students' achievement in automobile technology in Rivers State University, Port Harcourt. *Journal of Education and Practice, 10*(12), 81-89.

Inyiagu, E. E. (2017). Strategies for improving practical skills acquisition in vocational and technical education in Nigeria. *Journal of Research & Method in Education, 7*(1), 45-48.

Jirgba, C.M., Eriba, J.O., & Achor, E.E. (2018). Effect of peer collaboration learning strategy on students' achievement in Basic Science in Makurdi Local Government Area of Benue State. *Journal of Research in Curriculum and Teaching.* 2 (3), 1083-1095.

Joling-Poitras, L., Baillargeon, R., & Marchand, C. (2019). Teaching-learning process in automotive mechanics: A systematic review. *Journal of Technical Education and Training, 11*(3), 71-80.

Joyce, B., Weil, M., & Calhoun, E. (2017). *Models of teaching* (9th ed.). Pearson.

Kohl, H. R., Leshanne, A., & Johnson, N. (2020). Professional development needs of automobile technology instructors in the United States. *International Journal of Vocational Education and Training Research, 6*(2), 25-36.

Korthagen, F. A. J. (2010). Situated learning theory and the pedagogy of teacher education: Towards an integrative view of teacher behavior and teacher learning. *Teaching and Teacher Education, 26*(1), 98-106.

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. Cambridge University Press.

Lerner, R. M. (2001). Concepts and theories of human development. Lawrence Erlbaum Associates.

Marchand-Martella, N. E., Slocum, T. A., & Martella, R. C. (Eds.). (2004). *Introduction to direct instruction*. Allyn & Bacon.

Mbanefoh, N. A., & Bamidele, A. D. (2017). Effect of simulation techniques on students' performance in automotive mechanics in technical colleges in Lagos state. *International Journal of Innovative Education Research, 5*(4), 1-7.

National Board for Technical Education. (2019). *Curriculum and course specifications for National Diploma in Automobile Technology*. NBTE.

Nwachukwu, C. E., & Ogwo, B. A. (2018). Teacher competencies for effective teaching of automobile technology in technical colleges in Nigeria. *International Journal of Vocational Education and Training Research, 4*(1), 28-36.

Nwosu, J. C., & Moses, S. O. (2017). Effect of direct instruction model on achievement in automobile mechanics. *Journal of Education and Practice, 8*(27), 114-119.

Obianuju, N. J., Obinna, F. C., & Nwafor, L. C. (2020). Effect of multimedia approach on students' interest and achievement in automobile technology in technical colleges in Anambra state. *Journal of Education and Practice, 11*(6), 35-41.

Ogunlade, O. O. (2018). Effect of explicit instructional strategy on nigerian secondary school students' achievement in physics. *Science Education International, 29*(4), 255-262.

Okorieocha, C. N., & Duru, E. E. (2016). Students' perception of automobile technology programme in Rivers State University. *Nigerian Journal of Technology (NIJOTECH), 35*(3), 619-625.

Okwelle, P. C., & Allagoa, F. O. N. (2014). Enhancing teachers' competence in the use of instructional materials in electronics education in senior secondary schools in Nigeria. *Journal of Research & Method in Education, 4*(2), 23-28.

Okwelle, P. C., & Owo, O. T. (2018). Effects of Collaborative Learning on Academic Performance of Students in Technical Drawing in Rivers State University, Port Harcourt, Nigeria. *International Journal of Educational Benchmark,* 9(1), 77-87.

Ololube, N. P. (2016). Education fund misappropriation and mismanagement and the provision of quality higher education in Nigeria. *International Journal of Scientific Research in Education, 9*(4), 333-349.

Omeje, T. H., & Onaga, P. O. (2018). Influence of practical skill acquisition on academic performance of automobile technology students in technical colleges in Enugu State. *Technology Education Journal, 13*(1), 198-205.

Onwuegbuzie, A. J., & Collins, K. M. T. (2007). A typology of mixed methods sampling designs in social science research. *The Qualitative Report, 12*(2), 281-316.

Parnell, D. (1995). *Why do I have to learn this?* CORD Communications.

Rosenshine, B. (2012). Principles of instruction: Research-based strategies that all teachers should know. *American Educator, 36*(1), 12-19.

Rosenshine, B., & Stevens, R. (1986). Teaching functions. In M. C. Wittrock (Ed.), *Handbook of research on teaching* (3rd ed., pp. 376-391). Macmillan.

Sadker, D. M., & Zittleman, K. R. (2018). *Teachers, schools, and society: A brief introduction to education* (5th ed.). McGraw-Hill.

Taofiq, A. A., Abubakar, S. A., & Kayode, O. I. (2019). Effects of resource availability on the quality of automobile technology programme in polytechnics in southwestern Nigeria. *International Journal of Educational Benchmark, 13*(1), 1-10.

Tella, A. (2017). Teacher variables as predictors of academic achievement of primary school pupils' mathematics. *International Electronic Journal of Elementary Education, 1*(1), 16-33.

Tomlinson, C. A. (2014). *The differentiated classroom: Responding to the needs of all learners* (2nd ed.). ASCD.

UNESCO. (2001). *Revised recommendation concerning technical and vocational education*. UNESCO.

Usman, I. O., & Gata, M. A. (2018). Relevance of practical-based curriculum to sustainable skill acquisition in automobile technology. *Nigerian Journal of Technology Education, 3*(1), 21-30.

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Harvard University Press.

Watkins, C. L., & Slocum, T. A. (2003). The components of direct instruction. *Journal of Direct Instruction, 3*(2), 75-110.

Yusuf, M. O., & Afolabi, A. O. (2010). Effects of computer assisted instruction (CAI) on secondary school students' performance in biology. *The Turkish Online Journal of Educational Technology, 9*(1), 62-69.