

Interactive Effect of Mastery Learning Strategy on Academic Achievement of Secondary School Physics Students in Odeda local Government, Abeokuta, Ogun State, Nigeria

*¹MOKUOLU, Adewunmi Olanrewaju (Ph.D), ²OJO, Kolawole Richard (Ph.D)

^{*1,2}Department of Physics, Federal College of Education, Abeokuta, Ogun State

DOI: <https://doi.org/10.5281/zenodo.8265241>

Published Date: 19-August-2023

Abstract: This study examined the effect of Mastery Learning Strategy (MLS) on students' academic achievement in secondary school physics in Odeda Local Government area of Abeokuta, Ogun State. The study adopted quasi-experimental research design in intact classes. The study sample consists of 140 Senior Secondary School II physics students selected randomly from the urban and rural areas of the local government and then randomly divided into experimental and control groups. The experimental and control groups were taught using MLS and Traditional Lecture Method (TLM), respectively. Data were collected through a validated Mastery Learning Physics Achievement Test with a reliability coefficient of 0.82 obtained using Cronbach Alpha. Collected data were analyzed using mean, standard deviation and t-test statistics at $\alpha = 0.05$ level. The result showed (i) a significant positive effect of MLS on students' academic achievement in physics compared to TLM, both in urban ($t_{cal} = 5.56 > t_{table} = 1.99$) and rural areas ($t_{cal} = 3.47 > t_{table} = 2.01$) (ii) no significant difference in the academic achievement of male and female physics students taught using MLS in urban ($t_{cal} = 1.02 < t_{table} = 2.02$) and rural ($t_{cal} = 0.54 < t_{table} = 2.05$) areas. It is therefore recommended that school authorities should organize training workshops and seminars for science teachers on the use of MLS.

Keywords: Mastery Learning Strategy, Physics, Academic Achievement, Secondary School.

I. INTRODUCTION

Physics is a science that seeks to explain the behavior of the universe and applies the knowledge gathered for human use and comfortability. Physics seems to be boundaryless, intersecting with many research disciplines (like biophysics, medical physics, quantum chemistry etc.) and has, without any doubt been the bedrock of innovations and technology in our modern world. As such it is a huge and diverse area of study which requires some specific skills and teaching method from teachers in order to successfully pass the knowledge and concepts to students who themselves have varying mental and cognitive abilities. According to Lacambra (2016), physics course is supposed to develop in students' conceptual understanding and development of several important cognitive, psychomotor, attitudinal and affective abilities. However, studies over the years has shown decline in students' academic achievement with teachers' quality and inefficient teaching method been indicated as the biggest contributor (Pepple, 2010; Usman and Memeh, 2007; Filgona, 2016; Akinniyi, Olalaye and Adewumi, 2008; Filgona, Filgona and Linus, 2017). One may therefore say that the quality of education provided to students is intricately linked to the strategies teachers adopt in passing on knowledge to students in the classrooms (Filgona, Filgona and Linus 2017). In other words, students' academic achievements can be traced to teachers' methods of teaching which could either be students' centered or teachers' centered.

There are several teaching methods and strategies that can be used by teachers to improve students' academic achievement and attitude towards learning. Among those teaching methods are the Traditional Lecture Method (TLM) and Mastery Learning Strategy (MLS). In Nigeria, the popular teaching method in schools is the Traditional Lecture Method (TLM) which is also known as the conventional method. The TLM is a teaching method in which the teacher does all the talking, explaining the topic concepts, ideas, and principles to students while they only listen and accept all the knowledge presented to them without questioning. Usually in TLM the students maintain a passive presence. Mastery Learning Strategy (MLS) is a teaching-learning method in which the teacher breaks down a topic concept into learning units with specific behavioral objectives which students need to master to at least 80% before being allowed to move to another level of learning unit. In MLS which could be individualized or group-based, progression to another level of learning unit is determined with series of tests or assessments (in forms of formative or summative assessment, etc) conducted by the teacher. With MLS the time required for different students to learn a topic content and achieve same mastery level with other students is different, so requiring teachers teach again and again, test and retest as many times as possible based on students' individual abilities and needs, until the students demonstrate acceptable level of mastery. This therefore implies that for teachers to appropriately use MLS, they need to be able to apply corrective, feedback and enrichment procedures incorporated with patience, focus and objectivity with the students. In essence, MLS offers the students opportunities to several teaching-learning experiences which could help them to further develop their cognitive domain and deepen their content knowledge.

According to Adeyemo and Babajide (2014), Mastery Learning Strategy (MLS) is an instructional strategy where students are allowed unlimited opportunities to demonstrate mastery of content taught. It is an instructional strategy in which learners are provided with the opportunity to master a particular unit of lesson before proceeding to the next. Mastery learning instructional strategy divides subject matter into units that have predetermined objectives or unit expectations. The assumption here is that, if students are given opportunity to learn and time allowed for learning coupled with quality of instruction that will match their need and situation, at least 80% or higher, could achieve mastery in learning (Filgona, Filgona and Linus, 2017). Tukur (2018) defined mastery learning approach as an instructional strategy which upholds that students must attain a level of mastery in requirement knowledge before striving to learn the succeeding information. If students do not succeed mastery in the test, they would be given extra support by reviewing the lesson and undergo retest. The exercise continues until the learner has mastered before moving to the next unit of instruction. According to Bergmann (2016), mastery approach is a practical way to personalize learning for each learner in such a way that students are projected to grasp certain objectives and competencies, and then progress when they learn the competency. Awotua-Efebo (2015) stated that students acquire personal competencies that generate lifelong effective teaching with mastery learning, while Jade (2019) stated that MLS provides a model of instruction that is learners-centered and viewed its use as a way of prompting high performance in a course unit.

In MLS, Students who are deemed to have mastered the learning unit can then proceed to a new learning unit while those who have not mastered the learning unit will be required to undergo remedial instruction (Lamidi, Oyelekan and Olorundare, 2015; Hussain and Suleiman, 2016; Filgona, Filgona and Linus 2017; Barr and Wessel 2018; Tukur, 2018). Renard (2017) explained mastery learning as an approach to learning which entails mastering a topic before moving on to a more advanced one and posited that mastery learning aims at changing, by letting go, of the concept that everyone is of the same time schedule. This implies that mastery learning is technical, mediating, and remediating. The indication is that mastery learning helps the slow learner to match up with fast learners. In addition, mastery learning is used to advance an individual's potentials for learning, compared to traditional learning models. Sufficient time, attention, and help are accorded to each student. Further, mastery learning relates to feedback mechanism in learning. In this sense mastery learning is a technique of teaching where the hub is on the position of feedback in learning. Since it involves feedback, it entails category of instructional technique which create a level of feat that all learners must grasp before advancing to the next unit in a given lesson (Reuben and Ogbeneakoke, 2021). Dasimeokuma (2017) in his study discovered that mastery learning can be a good instructional strategy that can provide learners the possibilities to become aware of their evolving environment, therefore he support the relevance of mastery learning for promoting academic performance.

Proponent of MLS, Bloom (1976) theorized that the goal in mastery learning approaches is to have all students to learn instructional materials at roughly equivalent high levels. The implication of the theory is that teachers are under instruction not to give learners learning materials or experience that is beyond their capacity within a given time frame. This is because the observation implies that most teachers who are in haste to cover scheme of work often undermine the length and breadth

of where to cover. Such approach is consequential because materials would be learnt half hazardly (Reuben and Ogbeneakoke, 2021). Awotua-Efebo (2016) opined that the level of mastery reached by a student on an instructional task (instructional objective) is a function of the time spent learning the material and the amount of time the student needs to master the material.

Statement of the problem

The TLM has been the popular instructional method used in Nigerian schools till date, either in rural areas, urban areas, private or public schools, yet it has proved to be less effective in terms improving students' academic achievements in sciences especially in Physics. This method, without any doubt hampers students' deep learning and understanding of some Physics concepts especially in mathematically related Physics topics (Mokuolu, 2021), thus leading to academic failures of which school system and teachers' teaching methods have been blamed for this occurrence (Mokuolu and Olowookere, 2023). It is in view of this, that this study is conducted to examine the possibility of positively influencing students' academic achievement in Physics with Mastery Learning Strategy (MLS).

Purpose of the Study

The purpose of this study is to examine the academic effect of MLS on students' academic achievement in secondary school Physics. It also intends to investigate the (i) effects of MLS on academic achievement of male and female Physics students (ii) difference in academic achievement of Physics students taught with MLS in Urban and Rural areas.

Research hypotheses

HO₁: There is no significant difference in the academic achievement of Physics students taught using Mastery Learning Strategy (MLS) and those taught using Traditional Lecture Method (TLM) in Urban and Rural areas of Odeda Local Govt.

HO₂: There is no significant difference in the academic achievement of Physics students taught using Mastery Learning Strategy (MLS) in Urban and Rural areas of Odeda Local Govt.

HO₃: There is no significant difference in the academic achievement of Physics students by gender when taught using Mastery Learning Strategy (MLS) in Urban and Rural areas of Odeda Local Govt.

II. METHODOLOGY

This study adopted a quasi-experimental design with control and experimental groups in intact classes with similar academic and social characteristics. The population for this study includes all Physics students in Senior Secondary School II (SSS II) in Odeda Local Government area of Abeokuta, Ogun State. A total of four public secondary schools were randomly selected from the urban and rural areas of the Local Government (two from the urban areas and another two from the rural areas). The selected schools within the urban and rural areas were also randomly divided into control and experimental groups. Forty (40) SSS II Physics students were then drawn from each of the selected urban schools while Thirty (30) SSS II Physics students were drawn from each of the selected rural schools because of less students' population in the area. In all, this makes a total of 140 students in four different intact classes as samples for this study. The selection of students into these groups was based on Physics examination score of 40% - 100% scored in their first term school examination. Students who scored less than 40% in Physics in the first term school examination were exempted from the study (Mokuolu, 2022).

Data collection instrument used in this study is called Physics Learning Achievement Test (PLAT). The PLAT is an assessment test with forty (40) objective questions having options A-D drawn from the topics: scalar and vector, equilibrium of forces and Newton's law of motion. The PLAT was validated by expert colleagues in test and measurement, while its reliability was determined through the test-retest method to yield a reliability coefficient of 0.82. The teaching-learning activities covered six weeks with the experimental groups taught using the MLS while the control groups were taught using the TLM. At the completion of the teaching-learning activities, the PLAT was administered to all students (in the experimental and control groups) under strict examination conditions. The PLAT were marked and scored adequately. Collected data were analyzed using arithmetic mean, standard deviation and t-test statistic at 0.05 level of significance using SPSS statistical software.

III. RESULT AND DISCUSSION

Research hypothesis 1:

HO₁: There is no significant difference in the academic achievement of Physics students taught using Mastery Learning Strategy (MLS) and those taught using Traditional Lecture Method (TLM) in Urban and Rural areas of Odeda Local Govt.

Table I: t-test results of Physics students taught using MLS and TLM in Urban and Rural areas

LG Area	Group	Teaching method	N	MS	SD	MSD	df	t _{cal}	t _{table}	Rmk.
Urban	Experimental	MLS	45	29.85	7.18	9.37	82	5.56	1.99	*Sig.
	Control	TLM	45	20.48	8.73					
Rural	Experimental	MLS	30	26.68	8.66	7.96	58	3.47	2.01	*Sig.
	Control	TLM	30	18.72	9.11					

MS = Mean Score, MSD = Mean Difference, *Sig. = Significant

Table I showed that Physics students taught using MLS had higher scores (MS = 29.85, 26.68) than those taught using TLM (MS = 20.48, 18.72) both in urban and rural areas. A closer look at the results also showed that Physics students taught using MLS and TLM in urban areas had a mean score difference, MSD = 9.37 while those taught using MLS and TLM in rural areas had a mean score difference, MSD = 7.96.

Table I results also indicates that Physics students taught using MLS and TLM in urban and rural areas had calculated t-test values (t_{cal} = 5.56, 3.47) which are greater than the table t-test values (t_{table} = 1.99, 2.01) at 0.05 level of significance. With these results, the null hypothesis is therefore rejected. This implies that there is a significant difference in the academic achievement scores of Physics students taught using MLS and those taught using TLM in urban and rural areas. In essence, MLS enhanced students' academic performance (MS = 29.85, 26.68) better than the TLM (MS = 20.48, 18.72), both in urban and rural areas.

Research hypothesis 2:

HO₂: There is no significant difference in the academic achievement of physics students taught using Mastery Learning Strategy (MLS) in urban and rural areas of Odeda Local Govt.

Table II: t-test results of physics students taught using MLS in urban and rural areas

LG Area	Group	Teaching method	N	MS	SD	MD	df	t _{cal}	t _{table}	Rmk
Urban	Experimental	MLS	45	29.85	7.18	3.17	73	1.66	1.99	*NS
Rural	Experimental	MLS	30	26.68	8.66					

MS = Mean Score, MD = Mean Difference, *NS = Not Significant

Table II results revealed that physics students taught using MLS in urban area had a higher mean score (MS = 29.85) than those in the rural area (MS = 26.68) taught using the same MLS method, with a mean score difference, MSD = 3.17. The t-test analysis further showed a calculated t-test value (t_{cal} = 1.66) which is lesser than the table t-test value (t_{table} = 1.99) at 0.05 level of significance. Hence, the null hypothesis is accepted. This implies that there is no statistically significant difference in the academic achievement scores of physics students taught using MLS in urban and rural areas, even though, physics students in urban area performed slightly better (MS = 29.85) than those in the rural areas (MS = 26.68).

Research hypothesis 3:

HO₃: There is no significant difference in the academic achievement of Physics students by gender when taught using Mastery Learning Strategy (MLS) in Urban and Rural areas of Odeda Local Govt.

Table III: t-test results of Physics students by gender when taught using MLS

LG Area	Teaching Method	Gender	N	MS	SD	MD	df	t _{cal}	t _{table}	Rmk
Urban	MLS	Male	30	30.97	8.02	2.24	43	1.02	2.02	*NS
		Female	15	28.73	6.36					
Rural	MLS	Male	20	27.61	8.21	1.86	28	0.54	2.05	*NS
		Female	10	25.75	9.13					

MS = Mean Score, MD = Mean Difference, *NS = Not Significant

The results in Table III indicated that male physics students exposed to MLS in urban and rural areas scored slightly higher (**MS = 30.97, 27.61**) than their female colleagues (**MS = 28.73, 25.75**) in the urban and rural areas that were also exposed to MLS; with very minimal mean score differences, **MSD = 2.24, 1.86** between them in urban and rural areas.

The result also indicated that the calculated t-test values (**t_{cal} = 1.02, 0.54**) for male and female students taught by MLS is lesser than the table t-test values (**t_{table} = 2.02, 2.05**) at 0.05 level of significance. Thus, the null hypothesis is accepted. This implies that there is no statistically significant difference in the academic achievement scores of male and female physics students taught using MLS in urban and rural areas, even though, the male physics students performed slightly better than their female colleagues in both Urban and rural areas.

IV. DISCUSSION

Results obtained from this study revealed that mastery learning strategy (MLS) had a positive effect on the students' academic achievement scores in physics. Physics students taught using MLS performed academically and significantly better than their colleagues taught using the traditional lecture method (TLM), both in urban and rural areas. T-test analysis conducted further indicated a significant difference in the academic achievement scores of Physics students taught using MLS and those taught using TLM both in urban and rural areas. The result also showed that there is no statistically significant difference in the academic achievement scores of physics students taught using MLS in urban and rural areas. This implies that MLS is not location or student-type based, thus it is capable of improving students' academic achievements irrespective of whether it is used in urban or rural areas. These results are in line with findings of Hussain and Suleman (2016), Filgona, Filgona & Linus (2017), Ajoma (2017), Ejodamen and Raymond (2018), Tukur (2018), Lubna and Arshad (2019), Reuben and Ogbeneakoke, (2021), Joshua and Olabisi (2022), who all observed that mastery learning strategy has positive effects on students' academic achievement and is effective for improving students' academic achievement. Ajoma (2017) found that mastery learning teaching methods help students to think critically, leading to better academic performance. Joshua and Olabisi (2022) based on their findings concluded that mastery learning method has positive effects on students' academic performance in Financial Accounting. Reuben and Ogbeneakoke (2021) observed significant difference in the mean scores of social studies students taught with mastery learning and those taught by lecture method. Lubna and Arshad (2019) and Tukur (2018) observed that mastery learning enhanced academic achievement of students in Mathematics. Ejodamen and Raymond (2018) also reported better academic performance in basic technology by the learners taught through mastery learning Strategy. Filgona, Filgona and Linus (2017) in their study observed enhanced learning retention and improved learning outcomes of students in Physical Geography when exposed to mastery learning strategy. Hussain and Suleman (2016) found its positive impact of mastery learning on the learning outcomes of the learners in English.

This study results again showed that male physics students exposed to MLS performed slightly better than their female colleagues that were also exposed to MLS in both Urban and rural areas with very minimal mean differences. This agrees with the findings of Joshua and Olabisi (2022) who also found that male financial accounting students did better in mastery learning teaching method than their female counterparts with a mean difference of 2.63. T-test analysis conducted showed

that there was no statistically significant difference in the academic achievement scores of male and female physics students taught using MLS in urban and rural areas. This indicates that MLS is not gender sensitive and its effectiveness in improving students' academic achievement is not based on gender. This result agrees with the findings of Reuben and Ogbeneakoke (2021), and Bashirat, Oloyede and Adekunle (2015). Bashirat, Oloyede and Adekunle (2015) in their study reported that gender had no significant effect on the achievement of the students taught using the MLS and opined that the mean difference in academic achievement between male and female students is very minimal. Reuben and Ogbeneakoke (2021) in their also observed no significant disparity in the mean scores of male and female students taught with mastery learning instructional strategy.

V. CONCLUSION

Interactive effect of MLS was examined in this study. Findings from the study revealed that:

1. MLS significantly enhanced students' academic achievement in physics compared to the traditional lecture method both in urban and rural areas.
2. There is no statistically significant difference in the academic achievement of physics students by gender when taught using MLS in both urban and rural areas, although the male students performed slightly better than their female counterparts.

This clearly indicates a very strong hope that with MLS fully and correctly implement in teaching-learning of physics and other sciences in schools, then the ever increasing failures in physics can be drastically reduced, thus raising the believe that students' academic achievement in science subjects can be improve, irrespective of whether the students reside in rural or urban areas, or whether they are males or females.

VI. RECOMMENDATION

Based on the findings obtained from this study, it is recommended that school authorities and other stakeholders in education systems should (i) organize training workshops and seminars for science teachers on the use of MLS in teaching-learning of sciences (ii) encourage and ensure science teachers use MLS in their teaching-learning activities.

REFERENCES

- [1] Adeyemo, S. A. & Babajide, V. F .T. (2014). Effects of mastery learning approach on students' achievement in physics. *International Journal of Scientific & Engineering Research*, 5(2), 910-920.
- [2] Ajoma, U.T. (2017). Teaching and Using Methods of Teaching. *Journal of Teacher Education*, 17(1), 104-112.
- [3] Akinniyi, F. E., Olalaye, B. O. & Adewumi, A. A. (2008). The state of quality teaching/learning in pre-service chemistry teacher education programme. *Nigerian Journal of Curriculum Studies*, 15(4), 55-61.
- [4] Awotua-Efebo, E. B. (2015). Effective teaching: principles and practice. *Jeson Services*.
- [5] Barr, D. and Wessel, L. (2018). Rethinking course structure: increased participation and persistence in introductory post-secondary mathematics courses. *Fields Mathematics Education Journal*, 3(1), 3.
- [6] Bashirat, T. L., Oloyede, S. O. & Adekunle, S. O. (2015). Effects of mastery learning instructional strategy on senior school students' achievement in the Mole Concept. *Electronic Journal of Science Education*, 19(5), 1-20.
- [7] Bergmann, J. (2016). The five stages of mastery learning. www.jonbergmann.com September 6, 2018.
- [8] Bloom, B. S. (1976). Human characteristics and school learning. *New York: McGraw- Hill*
- [9] Dasimeokuma, P. (2017). The role of Social Studies education in promoting religious tolerance in Nigeria. www.medium.com. July 18, 2018.
- [10] Ejodamen, I. F. & Raymond, U. (2018). Effect of mastery learning strategy on rural and urban students' academic achievement in basic technology in Edo State, Nigeria. *World Journal of Research and Review*, 6(6): 22-28.
- [11] Filgona, J. (2016). Effects of hands-on learning strategies on students' achievement. Germany: Lambert Academic Publishers (LAP), 1-165.

International Journal of Novel Research in Education and Learning

 Vol. 10, Issue 4, pp: (85-91), Month: July - August 2023, Available at: www.noveltyjournals.com

- [12] Filgona, J., Filgona, J. & Linus, K. S. (2017). Mastery Learning Strategy and Learning Retention: Effects on Senior Secondary School Students' Achievement in Physical Geography in Ganye Educational Zone, Nigeria. *Asian Research Journal of Arts & Social Sciences*, 2(3), 1-14.
- [13] Hussain, I., & Suleman, Q. (2016). Effect of Bloom's mastery learning approach on students' academic achievement in English at secondary level. *Journal of Literature, Languages and Linguistics*, 23, 35-43.
- [14] Jade, M. (2019). Mastery learning model: Definition, theory and approach. Available at <http://www.study.com>. Retrieved January 6, 2019.
- [15] Joshua, S. M. & Olabisi, S. D. (2022). Effect of Mastery learning teaching method on students' academic performance in Financial Accounting. *KWASU International Journal of Education (KIJE)*, 5(1), 166-176.
- [16] Lacambra W. T. (2016). Students' Academic Performance in Physics 1: Basis for Teaching and Learning Enhancement. *International Institute for Science, Technology and Education (IISTE): E-Journal, research on humanities and social sciences*, 6(4), 78-84.
- [17] Lamidi, B. T., Oyelekan, O. S., & Olorundare, A. S. (2015). Effects of mastery learning instructional strategy on senior school students' achievement in the mole concept. *Electronic Journal of Science Education*, 19(5), 1-20.
- [18] Lubna, T. & Arshad, A. (2019). Effects of Mastery Learning Model on Academic Achievement of Secondary School Students in Mathematics. *Global Social Sciences Review (GSSR)*, 4(4), 232-238.
- [19] Mokuolu, A. O. (2021). Academic Influence of Brain-Based Learning Strategy on Students' Academic Achievement in Physics in Odeda Local Government Area, Abeokuta. *Ikere Journal of Science (Published by Bamidele Olumilua University of Education, Science and Technology, Ikere-Ekiti)*, 2(1), 42-51.
- [20] Mokuolu, A. O. & Olowookere, I. O. (2023). Influence of Students' Indiscipline And Social Media on Academic Achievement of Secondary School Physics in Odeda Local Government Area, Abeokuta, Ogun State, Nigeria. *African Journal of Pure and Applied Science Education, AJOPASE (Published by the School of Science Education, Federal College of Education (Technical), Akoka, Lagos state, Nigeria)*, 21(1).
- [21] Pepple, T. F. (2010). Effects of cooperative learning and programmed instructional strategies on students' learning outcomes in chemistry. An unpublished Ph.D. Thesis, Delta State University, Nigeria.
- [22] Renard, L. (2017). What is mastery learning? A different approach to learning. www.bookwidgets.com September 6, 2018.
- [23] Reuben, D. & Ogheneakoke, E. C. (2021). Effects of Mastery learning on academic performance of upper basic Social studies students in Delta State. *Nigerian Journal of social studies*, 24(1), 405-423.
- [24] Tukur, M. Y. (2018). Mastery learning Approach (MLA). Its effects on the students Mathematics academic achievement. *European Journal Alternative Education Studies*, 3(1), 77-88.
- [25] Usman, K. O. & Memeh, E. (2007). Improving students' achievement in further Chemistry using team teaching approach. *Review of Education*, 18(1), 15-21.