Effects of Mastery Learning Approach (MLA) on Secondary School Students' Achievement in Physics in Ekiti State, Nigeria

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Abstract
The study investigated the effects of mastery learning approach on secondary school students' academic achievement in Physics in Ekiti West Local Government Area, Ekiti State, Nigeria. The research design adopted in the study was Pretest-Posttest Quasi- experimental. Purposive and stratified random sampling techniques was used to select a total sample of 100 Senior Secondary One (SSI) Physics students (50 each experimental and control group respectively) from four senior secondary schools in Ekiti West local Government Area, Ekiti State. The instrument used to collect relevant data from the subjects was Physics Achievement Test (PAT). The reliability of the instrument was determined through the split-half method with the reliability coefficient of 0.88. Three null hypotheses were formulated and tested at 0.05 level of significance. The data collected were analysed using t-test and Analysis of Covariance (ANCOVA) statistical analysis. The results of the analyses showed that no significant difference existed between the performances of students in experimental and control groups involved in the study at pretest. However, academic achievement in the experimental group at post-test was found to be significantly better than that of the control group. Based on the findings of the study, it was concluded that Mastery Learning Approach teaching strategy is more potent in boosting students' achievement in Physics in secondary schools than the conventional method in vogue in the nation and It was recommended that the conventional method presently in use by Physics teachers should either be improved upon, modified or replaced with a modern teaching approach (as appropriate).
Key words: Mastery, learning, approach, learning approach, academic achievement

Introduction

The process of teaching and learning aims at transmission of knowledge, imparting skills, formation of attitudes, values, and behavior. Teaching involves setting appropriate learning experiences for students. Teaching is intended to learning, without learning teaching is incomplete. Learning is a natural and common attribute in any human being, and is the acquisition of knowledge or skills through study, experience, or being taught.

Mastery learning is a method of instruction where the focus is on the role of feedback in learning. Mastery learning is a category of instructional methods which establishes a level of performance that all students must master before moving on to the next unit. Mastery learning is a set of group-based, individualized teaching and learning strategy based on the premise that students will achieve a high level of understanding in a given domain if they are given enough time. Mastery is the idea that you learn best incrementally, with one skill building on the next. In a mastery programme, a student develops a thorough comprehension of one topic before moving on.

Adeyemi (2007) described mastery learning as a teaching strategy that involves a pre-specified criterion level of performance which students must master in order to complete the instruction and move on. Slavin (1987) asserted that mastery learning refers to a category of instructional methods which establishes a level of performance that all students must master before moving on to the next unit. Also, according to Adeyemo & Babajide (2014), Mastery Learning Approach (MLA) is an instructional method, where students are allowed unlimited opportunities to demonstrate mastery of content taught. Mastery learning approach involves breaking down the subject master to be learned into units of learning, each with its own objectives. Furthermore, Zimmerman & Dibenedetto (2008) cited in Adeyemo & Babajide (2014) affirmed that mastery learning uses differentiated and individualized instruction, progress monitoring , formative assessment, feedback, correlative procedures, and instructional alignment to minimize achievement gaps.

Moreover, according to Tukur (2018), mastery learning approach is an instructional strategy proposed by Benjamin in 1968 which upholds that students must attain a level of mastery in requirement knowledge before stirring 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. In addition, Candler (2010) cited in Tukur (2018), mastery learning approach is an instructional process that provides students with multiple opportunities to demonstrate content mastery.

The broad aim of Physics is to understand and explain various physical phenomena occurring in nature/laboratory through observation, experimentation and theoretical formulation. Well known examples of physical processes are the motion of planets around the sun, evaporation of water, sound emission from a tuning fork, refraction of light, attraction of iron by magnets, discharge of an electrical capacitor, and decay of the pi meson (Agrawal & Menon, 2015). Thus, meaningful learning of Physics is acquired through proper planning of Physics syllabuses and their relationship to environmental issues. It is important that at secondary school, the aim of Physics should be acquisition of process skills. These skills help the students apply Physics knowledge to solve every-day problems. In addition, these skills aid in the acquisition of the Physics concepts and apply them in their daily life (Zdenek & Hana, 2018).

Physics strives towards an understanding of the material universe. To gain this understanding, physicists systematically question nature through experiments. These experiments are designed to challenge existing hypotheses and provide clues to more powerful theories. However, experiments are not only essential in expanding our knowledge of our universe, but play a key role in the teaching of Physics (Chris & Vollmer, 2016).

According to Olarinmoye (2000) cited in Awodun, Oni & Oyeniyi (2015), "Physics is the most utilized basic science subject in most technology and technology- related profession". This merely indicates that the enormous role that Physics plays in the technological growth of any nation must not be undermined. It is germane to say that the technological growth of a nation leads to its social and economic development. The importance of Physics for the development of a nation is, therefore, glaring. Physics is the most basic of the sciences and its concepts and techniques underpin the understanding of other disciplines: A thorough understanding of mechanics is necessary to the chemists and the material scientists since the structure of every atom in the universe is determined by mechanics.

The challenges faced by Physics as a subject include teachers' training and conceptualization of the subject, students' understanding of the subject, physical resources such as laboratories, teaching aids and text books. Research findings suggest that traditional lecture instruction is ineffective in dealing with students' misconceptions. Tarekegn (2017) opined that traditional lecture instruction does not consider the view of students. This technique is limited in helping a learner develop skills. The practical approach on the other hand engages the student productively and leads to relational understanding. The proposed study contends that if practical work instructional approach is used perhaps improved

students' achievements in the subject may occur. In addition, the enrolment is likely to increase.

Physics education enables the learner to acquire problem-solving and decision-making skills that provides ways of thinking and inquiry which help them to respond to wide spread and radical changes in industry, health, climatic changes, information technology and economic development (Wambugu & Changeiywo, 2008).

Adeyemo & Babajide (2014) affirmed that poor academic achievement in physics could be attributed to many factors among which teachers strategy itself considered as an important factor. This implies that the mastery of physics concepts might not be fully achieved without the use of instructional materials. Mastery learning is a method of instruction where the focus is on the role of feedback in learning. Master learning is an instructional strategy and educational philosophy, first formally proposed by Benjamin Bloom in 1968. The mastery approach presents a given set of topics that repeat from level to level. Mastery learning maintains that students must achieve a level of mastery in prerequisite knowledge before moving forward to learn subsequent information (Wikipedia, 2019). It is a model where students are expected to master a learning objective or goal, before they can move on to the next level goal.

Adeyemi (2007) who studied the effectiveness of learning social studies through mastery learning approach on students' performance in social studies using two groups of 200 level students from a university in Nigeria and a study centre of the same university. He found that students taught with mastery learning in the two groups performed better than students taught with the conventional approach to teaching.

Furthermore, Mayanchi, Anya & Kainuwa (2017) reported Babalola (1991) that investigated the mastery learning model in teaching mathematics to form four students by a non-expert mathematics teacher. He found that a group taught by mastery learning approach performed significantly better than those taught by non-mastery approach. Mayanchi, Anya & Kainuwa (2017) reported Ogun (2001) on the effect of mastery learning on senior secondary school achievement in Geography and he found that the mastery learning group performed better than the control group (conventional teaching method).

In addition, according to Wambugu and Changeiywo (2008), mastery learning Approach has the unique quality of enabling mastery of content by the student through supplementary instruction and corrective activities of small units of the subject matter. Tim (2014) opined that mastery learning approach (MLA) can help the teacher to know students area of weakness and correct it thus breaking the cycle of failure. Also, Wambugu &

Changeigwo (2007) cited in Tim (2014) that the results from research studies carried out on mastery learning approach (MLA) suggest that mastery learning approach (MLA) yields better retention and transfer of material, yield greater interest and more positive attitude in various subjects than non-mastery learning approach.

In the study of Wambugu & Changeiywo (2008) on the effects of mastery learning Approach on secondary school students' Physics achievement reported that Mastery learning approach had an effect of improving performance as compared to the regular teaching method. According to Keter, Wachanga & Anditi (2017), conventional teaching methods of instruction focus on the acquisition of content, with little development of the skills and attitudes necessary for scientific inquiry. The teacher transmits information to students, who receive and memorize it. Assessment of knowledge typically involves one right answer. The curriculum is loaded with many facts and a large number of vocabulary words, which encourages a lecture format of teaching. This kind of teaching approach encourages rote learning. The selection of appropriate instructional strategy enhances smooth delivery and effective achievement of instructional objectives (Keter, Wachanga & Anditi, 2007).

Research conducted by Pepple (2014) on the effect of mastery learning approach on secondary school students achievement in chemistry in river state, Nigeria shows that there is a significant difference between achievement of students taught with the mastery learning approach (MLA) and those taught using conventional teaching method (CTM) in Chemistry. According to Pepple (2014), in a mastery learning environment, the teacher directs a variety of group-based instructional techniques, with frequent and specific feedback by using diagnostic, formative test, as well as regularly correcting mistakes students make along their learning path. The use of MLA in teaching Physics in Secondary schools is likely to help improve their academic achievement.

Gender differences have become critical issues of concern around the world most especially to educators and researchers. Awodun (2015) cited the work of Omotayo & Yusuf (2002) in their study on the acquisition for qualitative skills among girls at the junior secondary school level reported that male students perform better tasks at some specified scientific processes than their female counterparts. They also submitted that girls posses lower confidence in their ability to learn science than did boys. Conversely, Kolawole & Popoola (2011) in their study maintained that academic achievement is free of gender influence. Also, the findings of Ogunkola & Fayombo (2009) in their study of "investigating the combined and relative effects of some student-related variables on science achievement among secondary school students in Barbados" confirmed that there was no significant

statistical difference in Barbadian secondary students' science achievement based on their gender.

According to Macmillan (2012) cited in Awodun, Oni & Oyeniyi (2015), some of the factors inhibiting the learning of Physics and leading to students' poor academic performances in Physics have been identified. These factors include: poor teaching methodology, students' negative attitude towards Physics, students' lack of interest in Physics, school location, gender inequality and poor quality of Physics teacher.

In recent times, there has been a growing public anxiety about teaching and learning in Nigerian schools based on deteriorating performance of students' in internal and external examinations especially in science subjects and Physics in particular. Due to the observed deterioration in students' academic performance, questions are continually being asked by individuals and organizations and various efforts are being made to remedy the situation but unfortunately, it appears as if these efforts have not yielded the much needed result (Awodun, 2019).

The need to improve the quality of science teaching and learning for citizens so that they develop scientific literacy to cope with the demands of science and technology growth has been the yearning of every nation in the 21st century. Adediwura & Bada (2007) and Ehindero & Ajibade (2000) cited in Awodun (2019) supported good methods of teaching that would make the learners develop and have sound education. The methods that are meant to train the child to become a whole being, helping his mind and personality to grow.

This study therefore investigated the effects of mastery learning approach on secondary school students' academic achievement in Physics in Ekiti West Local Government Area, Ekiti State, Nigeria.

Research hypotheses

The following null hypotheses were formulated to guide the study:

1. There is no significant difference in the achievement mean scores of students in experimental and control groups before treatment.
2. There is no significant difference in the achievement mean scores of students in experimental and control groups after treatment.
3. There is no significant difference in the achievement mean scores of male and female students in each of the experimental and control groups.

Methodology

The design for this study was Pretest-Posttest Quasi-Experimental. The design afforded the researcher the opportunity to collect relevant data which helped to facilitate better understanding and evaluation of the problem under study. The pre-test was used to establish the knowledge baseline of the students as well as the academic homogeneity of the two groups before the commencement of the experiment. The post-test was used to determine the levels of academic performance of students within the two groups after the application of treatment.

The population of the study was made up of all senior secondary student class One (SS1) in Ekiti West Local Government Area of Ekiti State. Purposive and stratified random sampling techniques was used to select a total sample of 100 public senior secondary class one (SS I) Physics students (this sample was divided into the experimental and control groups in ratio 1:1 meaning that, 50 students from each group) from four senior secondary schools in Ekiti West Local Government Area, Ekiti State. The instrument used for the study was thirty (30) standardized objective questions tagged: 'Physics Achievement Test (PAT)' drawn from the topic: work, energy and power with four options (A-D) considered for the study. The reliability of the instrument was determined through the split-half method with the reliability coefficient of 0.88.

The teaching covered three weeks with the control group taught using conventional method while the experimental group was taught using mastery learning approach teaching strategy. The tests (Pretest and Posttest) questions were administered to students; each of the tests was marked and scored accordingly.

The three formulated null hypotheses were tested at 0.05 level of significance. The data collected were analysed using t-test and Analysis of Covariance (ANCOVA) statistical analysis.

Results and Discussion

Hypothesis 1

There is no significant difference in the achievement mean scores of students in experimental and control groups before treatment.

Table 1: t-test analysis of achievement mean scores of students in experimental and control groups before treatment

GROUP	N	Mean	SD	df	t_{cal}	t_{tab}	Result
Experimental	50	11.62	6.82	98	1.020	1.671	**
Control	50	13.15	8.12				

P > 0.05 (Result Not significant at 0.05 level), ** = Not Significant.

Source: Author's computation.

As shown in table 1, when the mean score of students in the experimental and control groups before the treatments (pre-test) were statistically compared, a *t-value* (t_{cal} = 1.020) with p> 0.05 alpha level was obtained, which was not significant at 0.05 level. This implies that there is no significant difference between experimental and control groups in pretest achievement mean score. Consequently, the null hypothesis which states that there is no significant difference in the achievement mean scores of students in experimental and control groups before treatment was accepted.

Hypothesis 2

There is no significant difference in the achievement mean scores of students in experimental and control groups after treatment.

Table 2 : t-test analysis of achievement mean scores of students in experimental and control groups after treatment

GROUP	N	Mean	SD	df	t_{cal}	t_{tab}	Result
Experimental	50	21.91	7.78	98	3.03	1.65	*
Control	50	17.66	6.14				

P < 0.05 (Result Significant at 0.05 level). * = Significant.

Source: Author's computation.

As shown in table 2, when the mean score of students in the control and experimental groups after the treatments (posttest) were statistically compared, a *t-value* (t_{cal} = 3.03) with P < 0.05 alpha level was obtained, which was significant at 0.05 level. This implies that there exists significant difference between the control and experimental groups achievement mean scores after the treatment in favour of experimental group. Consequently, the null hypothesis which states that there is no significant difference in the achievement mean scores of students in

experimental and control groups after treatment was rejected. As such, the conventional method of instruction (control group) can be said to be less effective compared with mastery learning approach teaching strategy (experimental group).

Hypothesis 3

There is no significant difference in the achievement mean scores of male and female students in each of the experimental and control groups.

Table 3: Summary of ANCOVA analysis on the achievement mean scores of male and female students in each of the experimental and control groups

Source of variation	SS	df	Ms	F_{cal}	F_{tab}	P	Result
Corrected model	1731.216[a]	4	513.672	54.21	2.42	0.000	
Covariate (pretest)	19.731	1	19.731	3.01	3.89	0.384	
Gender	.684	1	.684	0.82	3.89	0.860	**
Group	1631.228	1	1631.228	207.45	3.89	0.000	*
Gender *Group	10.278	1	13.278	2.31	3.75	0.341	**
Error	1469.710	95	10.652				
Total	12738.297	100					
Corrected Total	4875.450	99					

P > 0.05 (Result Not significant at 0.05 level), ** = Not Significant, and * = Significant

Source: Author's computation.

Table 3 reveals that the computed *F-value* ($\mathbf{F_{cal} = 0.82 < F_{tab} = 3.89}$) with a *P-value* (P > 0.05 alpha level) obtained from the analysis of the students' gender was not significant. Hence, the mean achievement scores of male and female students were not significantly different. The table also revealed that the compared *F-value* ($\mathbf{F_{cal} = 2.31 < F_{tab} = 3.75}$) with a *P-value* (P > 0.05 alpha level) obtained for the interaction of gender and group was not significant as well. The null hypothesis was thus not rejected. It, therefore, implies that there is no significant interaction between gender of students and mastery learning approach teaching strategy applied. In other words, gender of students has no significant influence on either the effectiveness (or otherwise) of the approach of instruction applied.

Discussion

The result of this study revealed that the pre-test mean scores of the students in the mastery learning approach of teaching was not significantly different from that of those exposed to conventional method. The implication of this is that the two groups involved in the study exhibited comparable characteristics. Thus, they both entered the instructional experiment on equal strength and ability which showed that the two groups were suitable for the study when comparing mastery learning approach of teaching with conventional method on achievement in Physics.

Furthermore, the result of the study also revealed a relative increase in the post-test mean score of the students in the mastery learning approach of teaching group over those taught with the conventional method. Thus confirmed that mastery learning approach of teaching are learner-centered and capable of making remarkable impart on instructional practices. This result agrees with the findings of Pepple (2014) and Wambugu & Changeiywo (2008) on the effects of mastery learning Approach on secondary school students' Physics achievement reported that Mastery learning approach had an effect of improving performance as compared to the regular teaching method and Mayanchi, Anya & Kainuwa (2017) reported Ogun (2001) on the effect of mastery learning on senior secondary school achievement in Geography and he found that the mastery learning group performed better than the control group (conventional teaching method).

Moreover, the findings of this study also revealed that: there was no significant difference in the achievement mean scores of male and female students in each of the experimental and control groups before and after the treatment. In other words, the achievement of male and female students exposed to mastery learning approach teaching method did not differ significantly as female students were found to have similar achievement in Physics as their male counterparts in the two groups involved in the study. The implication of this result is that gender was not a significant predictor of students' achievement in Physics. The finding agrees with the findings of Ogunkola & Fayombo (2009) and Kolawole & Popoola (2011) in their studies maintained that academic achievement is free of gender influence.

Conclusion

Based on the findings of this study, it can be concluded that mastery learning approach teaching strategy is more potent in improving students' academic performance in

Physics in secondary schools than conventional method in vogue in the nation in term of performance and retention.

The study however found no significant difference between academic performance of male and female students in Physics when mastery learning approach teaching was used as strategy of instruction. This simply implies that performance of students taught using different teaching strategies is not in any manner affected by either their gender.

Recommendations

Based on the findings of this study, the following recommendations were made:

1. Mastery learning approach teaching method should be practically applied to classroom situations. Teachers should use Mastery learning approach strategy to arouse the interest of their students in Physics teaching. They should be trained and encourage to use Mastery learning approach teaching method.
2. Principals of secondary schools should encourage their Physics teachers through sponsorship to attend refresher courses and other forms of in-service training to enable them acquire the needed skill that can help them use or apply different strategies in the classroom teaching and learning. Thus help eradicate mediocrity among Physics teachers and expose them to a wide range of methods which can enhance their teaching in classroom situation.
3. Authors of Physics textbooks should present the content and concepts alongside the worked examples using mastery learning approach teaching strategy.

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