

# Effects of Mastery Learning Approach on Secondary School Students' Physics Achievement

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This study aimed at finding out the effects of Mastery Learning Approach (MLA) on students' achievement in Physics. The study was Quasi-experimental and Solomon Four Non-equivalent Control Group Design was used. The target population comprised of secondary school students in Kieni East Division of Nyeri District. The accessible population was Form Two students in district co-educational schools in the division. Purposive sampling was used to obtain a sample of four co-educational secondary schools. Each school provided one Form Two class for the study hence a total of 161 students were involved. The students were taught the same Physics topic of Equilibrium and Centre of Gravity. In the experimental groups MLA teaching method was used while the Regular Teaching Method (RTM) was used in the control groups. The experimental groups were exposed to MLA for a period of three weeks. The researchers trained the teachers in the experimental groups on the technique of MLA before the treatment. Pre-test was administered before treatment and a post-test after three weeks treatment. The instrument used in the study was Physics Achievement Test (PAT) to measure students' achievement. The instrument was pilot tested to ascertain the reliability. The reliability coefficient  $\alpha$  was 0.76. Experts ascertained their validity before being used for data collection. Data was analysed using t-test, ANOVA and ANCOVA. Hypotheses were accepted or rejected at significant level of 0.05. The results of the study show that MLA teaching method resulted in higher achievement but gender had no significant influence on their achievement. The researchers concludes that MLA is an effective teaching method, which physics teachers should be encouraged to use and should be implemented in all teacher education programmes in Kenya.

*Keywords:* Mastery Learning, Kenya, Physics Achievement, Secondary School

## INTRODUCTION

Science is recognized widely as being of great importance internationally both for economic well being of nations and because of the need for scientifically literate citizenry (Fraser & Walberg, 1995). Knowledge of science and technology is therefore a requirement in all countries and all people globally due to the many challenges that are facing them. These challenges

include emergences of new drug resistant diseases, effects of genetic experimentation and engineering, ecological impact of modern technology, dangers of nuclear war and explosions and global warming among others (Alsop & Hicks, 2001; Minishi, Muni, Okumu, Mutai, Mwangasha, Omolo & Muniyeke, 2004). As a result there are rapid changes taking place in industry, communication, agriculture, and medicine. Science as an instrument of development plays a dominant role in bringing about these changes by advancing technological development, promoting national wealth, improving health and industrialization (Republic of Kenya, 1999; Validya, 2003). Weham, Dorlin, Snell and Taylor (1984) emphasized that Physics is and will remain the fundamental science. This suggests that

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other sciences depend upon the knowledge obtained through the study of Physics. Physics is therefore an important base in science and technology since it studies the essence of natural phenomena and helps people understand the increasingly technological changing society (Zhaoyao, 2002). Physics as a branch of Science has many applications for example in medicine; where throughout this century advances in Physics and medicine have gone hand in hand. The most fundamental discoveries in Physics have rapidly been exploited by medical community to devise new techniques for diagnosing and treating a variety of illness. Even in the continuing research necessitated by the challenges posed by diseases as Ebola and HIV/AIDS, the development of high precision equipment employing principles of Physics remain necessary (Minishi et.al, 2004).

In information technology, which has reduced the world into a global village through use of satellites and computers the use of principles of Physics has, been very useful. A wide range of application of Physics is used in industrial development for improvement of materials useful to the well being of human race. Furthermore in the entertainment industry Physics has contributed to the refinement of sound and colour mixing to create special effects in stage presentations. The study of Physics involves the pursuit of truth, hence it inculcates intellectual honesty, diligence, perseverance and observation in the learners (Das, 1985). Physics education therefore enables the learner to acquire problem-solving and decision-making skills that provides ways of thinking and inquiry which help them to respond to widespread and radical changes in industry, health, climatic changes, information technology and economic development. These changes are demanding knowledge of scientific principles in order to tackle them (Kleeves & Ai kenhead, 1995; Mohanty, 2003). The teaching of Physics provides the learners with understanding, skills and scientific knowledge needed for scientific research, fostering technological and economic growth in the society, where they live thus improving the standards of living (Kenya.Institute of Education K.I.E., 2002; Minishi et.al, 2004). Physics education therefore should be a lifelong and recurrent, and not restricted to the stages of secondary school because issues will undoubtedly emerge during the coming decade.

Kenya needs to develop through science and technology education, a human resource capacity for rapid industrialization, which will ensure economic growth and sustainable development (Changeiywo, 2001). Therefore if the Kenya government is to meet her goal of industrialization by the year 2020 (Republic of Kenya, 1996), she should expand science and technology education in order to produce the required human resource. Although science is essential for

industrialization, there has been a decline in academic achievement scores of secondary school students as well as low enrolment in the subjects in Kenya (Kenya National Examination Council KNEC, 2003). Students shun Sciences particularly Physics when given an option and this especially applies to girls (Aduda, 2003). That is, given a choice a student would rather drop Physics in favour of other Science subjects.

For a long time, Physics has been mystified as difficult and hence, some schools have not offered it in the last two years of secondary school education. Recent findings show that students who hold negative stereotype images of scientists, science and technology in society are easily discouraged from pursuing scientific disciplines and usually performed poorly in science subjects (Changeiywo, 2000). This situation does not favour Kenya's move towards developing a scientific and technological nation. The concern is that the performance in Physics is poor and the subject is less popular among students in Kenyan secondary schools as compared to other science subjects. The recurrent complain aired every time the National examinations are released is that performance in science is low. Since 2003 the government has been implementing a new curriculum in both primary and secondary schools, and has a new examination format (KNEC, 2005). This new format makes a deliberate attempt to lure students to take physics (Orende & Chesos, 2005). Although the government has done its part the role of the teacher in the classroom is important. The teaching approach that a teacher adopts is one factor that may affect students achievement (Mills, 1991). Therefore use of appropriate teaching method is critical to the successful teaching and learning of Physics.

In an attempt to achieve the objectives of secondary school education and improve on performance various strategies of teaching have been researched in Kenya though in other subjects. Wachanga and Mwangi (2004) found out that cooperative class experiment teaching method facilitated students' chemistry learning. This method also increased student' motivation to learn. The cooperative concept mapping approach teaching method enhanced the teaching of secondary school biology in Gucha district (Orora, Wachanga & Keraro, 2005). A research done in the teaching of agriculture by Kibett and Kathuri (2005) revealed that students who were taught using project based learning out performed their counterparts in regular teaching approach. This study aimed at finding the effects of mastery learning approach (MLA) on achievement in physics.

Mastery Learning Approach (MLA) is an instructional method, where students are allowed unlimited opportunities to demonstrate mastery of content taught (Kibler, Cegala, Watson, Barker & Miler, 1981). MLA involves breaking down the subject matter

to be learned into units of learning, each with its own objectives.

The strategy allows students to study material unit after unit until they master it (Dembo, 1994). Mastery of each unit is shown when the student acquires the set pass mark of a diagnostic test. MLA helps the student to acquire prerequisite skills to move to the next unit. The teacher also is required to do task analysis and state the objectives before designating the activities. MLA can help the teacher to know students area of weakness and correct it thus breaking the cycle of failure. Results from research studies carried out on MLA suggest that MLA yields better retention and transfer of material, yields greater interest and more positive attitudes in various subjects than non Mastery Learning Approaches (Kibler et al, 1981). Other research studies report similar findings (Hon, 1990; Ngesa, 2002; Wachanga & Gamba, 2004).

This method of teaching had not been tried out in Physics teaching and learning in Kieni East Division where performance in the subject has continued to decline. This study aimed at finding out the effects of Mastery Learning Approach teaching method in the teaching of Physics in the division. The study was meant to contribute in the understanding of effects of MLA on academic achievement in Physics in this division of Nyeri District in Kenya.

Despite the fact that Physics is an important subject in economic, scientific and technological development most schools have made it optional in Forms Three and Four and others do not offer it at all due to students' poor performance in the subject. The mean at KCSE has continued to be low over the years. Often the teacher is blamed for the poor performance among other factors such as availability of teaching facilities and the attitude of the students towards the subject. Teaching methods therefore are a crucial factor that affects the academic achievement of students (Mills, 1991).

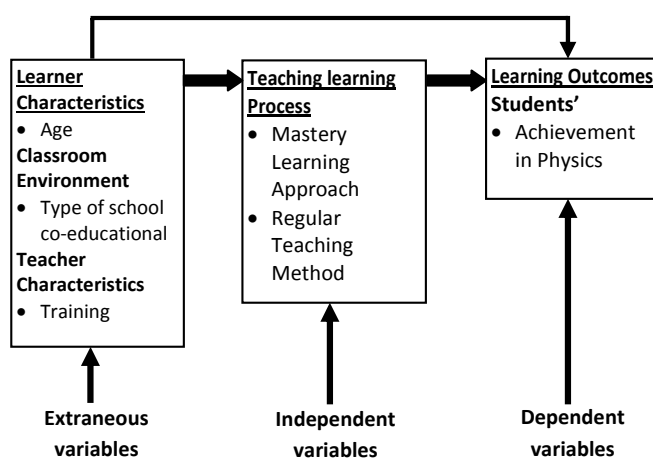


Figure 1. The conceptual framework

MLA 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. MLA also requires the teacher to do task analysis, thereby becoming better prepared to teach the units. The use of MLA in teaching Physics in secondary schools is likely to help improve their academic achievement. The available research does not indicate any research on the effectiveness of Mastery Learning Approach in secondary school Physics in Kieni East Division. This research study was therefore intended to fill this gap in the body of knowledge. The study provides empirical evidence on the effects of MLA on students achievement in secondary school Physics.

### Purpose of the Study

The purpose of the study was designed to investigate the effect of using MLA on students' achievement in secondary school Physics.

### Objective of the Study

The e specific objective of the study was to compare the achievement of students' taught Physics through MLA with that of students taught through regular teaching methods

### Hypothesis of the Study

The following null hypothesis was tested in this study at significance alpha level of 0.05.

H<sub>01</sub> There is no statistically significant difference in achievement in Physics between students who are exposed to MLA and those who are not exposed to it.

### The Conceptual framework

The Conceptual framework to guide the study was based on the Systems Approach (Joyce & Weil, 1980), which holds that the teaching and learning process has inputs and outputs. To achieve good results then the inputs must have suitable materials. The study was also based on the assumption that the blame for a students' failure rests with the quality of instruction and not lack of student's ability to learn. (Bloom, 1981; Levine, 1985). The framework is represented diagrammatically in figure 1. Figure 1 shows the relationship of variables for determining the effects of using MLA on secondary school students' achievement in Physics. Learning outcomes are influenced by various factors. These include: learner characteristics, classroom environment and teacher characteristics as shown in Figure1. These are extraneous variables which needed to be controlled. Teacher training determine the teaching approach a

teacher uses and how effective the teacher will use the approach. The learners' age and hence their class determine what they are taught. The type of school as a teaching environment affects the learning outcomes. The study involved trained Physics teachers to control the teacher variable. The type of school used was co-educational to control the effect of the classroom environment. Form Two students who are approximately of the same age were involved in the study. In this study therefore the teaching method used influenced the learning outcomes.

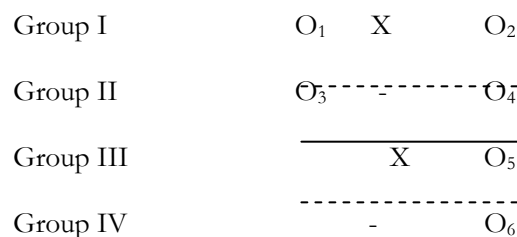
## METHODOLOGY

### Research design

Quasi-experimental research involving the Solomon's four Non-Equivalent Control Group Design was used. This is because there was non-random selection of students to the groups. Secondary school classes exist as intact groups and school authorities do not normally allow the classes to be dismantled and reconstituted for research purposes. (Borg & Gall, 1989; Fraenkel & Wallen, 2000). This design has advantage over others since it controls the major threats to internal validity except those associated with interaction and history, maturity and instrumentation (Cook & Campbell, 1979). In this study no major event observed in the sample schools to introduce the threat of history and interaction. The conditions under which the instruments were administered were kept as similar as possible across the schools in order to control instrumentation and selection. The schools were randomly assigned to the control and treatment groups to control for selection maturation and interaction (Ary, Jacobs & Razavien, 1979).

Where  $O_1$  and  $O_3$  were pre-test;  $O_2, O_4, O_5, O_6$  were the post-test; X was the treatment where students were taught using MLA. The dotted line implies involvement of intact groups. Group I was the experimental group which received the pre-test, the treatment X and the post-test. Group II was the control group, which received a pre-test followed by the control condition and then the post-test. Group III received the treatment X and post-test but did not receive the pre-test. Group IV received the post-test only since it was a control group. Group I and III were taught using MLA while Group II and IV were taught using RTM.

The Research design may be represented as shown in Figure 2.



**Figure 2. Solomon Four Non-Equivalent Control Group Research Design. Source: Fraenkel and Wallen (2000 p.291)**

### Sampling Procedures.

The unit of Sampling was the secondary school rather than individual learners because secondary schools operate as intact groups (Borg & Gall, 1989). This means therefore that each school was considered as one group. The list of the co-educational schools in the division was the sampling frame. The researcher visited the schools to ascertain that they were suitable for research. During the visit the researcher established that there were trained teachers in the schools and also obtained information on class composition and learner characteristics from schools records. Purposive sampling technique was used to select four schools that formed the sample of the study. The four schools sampled provided the four groups. Purposive sampling was used so as to minimize experimental contamination (Fraenkel & Wallen, 2000). The four schools were randomly assigned to the treatment and control groups. For schools that had more than one Form Two streams, all the streams were taught using similar method of teaching because of ethical reasons and then simple random sampling was used to pick one stream for the study.

### Sample Size

The sample of four selected co-educational schools in the division were obtained. The schools in each group are shown below.

- Group 1 (Experimental group) N= 35
- Group 2 (Control group) N=37
- Group 3 (Experimental group) N=45
- Group 4 (Control group) N=44

Therefore, the sample size in the research was 161 Form Two students. Fraenkel and Wallen (2000) recommend at least 30 subjects per group. Hence this number was adequate for the study.

## Instrumentation

A Physics Achievement Test (PAT) adapted from Kenya National examination council past examination papers and modified was used to measure the students' achievement. It contained twenty structured questions with a maximum score of 29. The instrument was given to four experts in science education for validation. The test was pilot tested using a school in a Division that was not included in the study but had similar characteristics as the sample schools. This ascertained the test reliability. The reliability coefficient was calculated using Kuder-Richardson formula 21 (Gronlund, 1981). This method is suitable when test items can be scored correct or incorrect. The reliability coefficient of PAT instrument was 0.7570 which rounds off to  $\alpha=0.76$ . According to Fraenkel and Wallen (2000), an alpha value of 0.7 and above is considered suitable to make group inferences that are accurate enough.

## The Development and use of Instructional Materials

The content used in the class instruction was developed based on the revised KIE 2002 physics syllabus. A guiding manual was constructed for the teachers involved in administering Mastery Learning Approach that was used throughout the treatment period. The teachers of the experimental groups were trained by the researcher on how to use the manual. These teachers taught using MLA on a different topic other than Equilibrium and Centre of Gravity for one week to enable them to master the skills. After this period the pre-test were administered to Group I and Group II. Treatment period was Three weeks as recommended in the syllabus (KIE, 2002). At the end of the treatment period a post-test was administered to all the groups.

## Data Collection

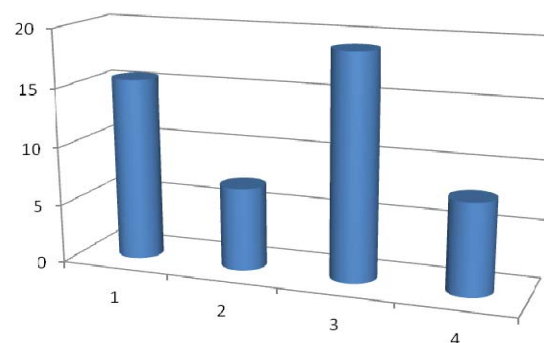
For this study PAT was used to collect data. The pre-test was administered to the two schools in group 1 and group 2. Then treatment took three weeks and was given to the two experimental groups after which post-tests were administered to all the groups. The researchers scored the pre-tests and post-tests and generated quantitative data, which were analysed.

## Data Analysis

The ANOVA was used to analyse differences in the four means of the post-test scores. It was used to determine whether the differences were significant. ANCOVA was used to establish whether there were initial differences in the treatment and control groups. It

**Table 1. PAT Post-test Means**

Group	N	Mean
1	35	15.57
2	37	7.078
3	45	16.04
4	44	7.81
Total	161	11.78



**Figure 2. PAT Mean by Groups**

reduces experimental error by statistical rather than by experimental procedure (Borg & Gall, 1989; Coolican, 1994). A t-test was used when dealing with two means because of its superior power to detect differences between two means. Significance level of 0.05 was used to test the null Hypotheses.

## RESULTS

The Solomon four-group design used in this study enabled the researchers to have two groups sit for pre-tests as recommended by Borg and Gall (1989). This enabled the researchers to assess the effects of the pre-test relative to no pre-test and assess if there was an interaction between the pre-test and the treatment conditions.

The results of the pre-test scores on PAT for groups 1 and 2 showed a statistically significant difference  $t(70)=0.056$ ,  $p > 0.05$ . This means that the p value was large, and therefore the obtained difference between the sample means is regarded as not significant. This indicated that the groups used in the study exhibited comparable characteristics. The groups were therefore suitable for the study when comparing the effects of Mastery Learning Approach with the Regular Teaching Method on achievement in Physics.

## Effects of MLA on Students' Achievement in Physics.

To determine the relative effects of MLA teaching method on student's achievement in Physics, an analysis of Students' Post-test PAT was carried out. Hypothesis

**Table 2. Analysis of Variance (ANOVA) of the Post-test scores on the PAT**

Group	Sums of Squares	df	Means Square	F	P-value
Between groups	2602.94	3	867.65	68.55	0.005 (s)
Within groups	1987.30	157	12.66		
Total	4590.24	160			

\* (P < 0.05, df=3, F=68.55)

**Table 3. Scheffe's Comparisons of the PAT Post- Test means**

	I Group	J Group	Mean Difference (I-J)	P-value
Scheffe's	1	2	7.79*	0.00
		3	-0.47	0.56
		4	7.75*	0.00
	2	1	-7.79*	0.00
		3	-8.26*	0.00
		4	-3.44 E-02	0.00
	3	1	0.47	0.97
		2	8.26*	0.56
		4	8.23*	0.00
	4	1	-7.75*	0.00
		2	-3.44 E-02	0.79
		3	-8.23*	0.00

\*p < 0.05. Note. Values enclosed in the parentheses represent a statistical significant difference

**Table 4. Analysis of Covariance (ANCOVA) of the Post-test score with KCPE as covariate**

	Sum of Squares	Df	Mean Square	F	P-value
KCPE	486.97	1	486.97	50.63	0.00
GROUP	2456.024	3	818.68	85.12	0.00
ERROR	1500.33	156	9.62		

\* (F=85.12, df=3, p<0.05)

**Table 5. ANCOVA of the PAT Pre-test Score**

	Sum of Squares	df	Mean Square	F	P-value
PAT (Pretest)	5671.40	1	5671.40	444.53	0.00
GROUP	1092.06	1	1092.06	85.60	0.00
ERROR	880.32	69	12.76		

\* (F=85.12, df=1, p<0.05)

H<sub>01</sub> of the study sought to find out whether there was any statistically significant difference in achievement scores between students exposed to MLA teaching method and those who were not exposed to it.

Table 1 shows the post-test mean score for PAT on a maximum of 29 obtained by the students in the four groups. An examination of the table 1 shows that the mean scores for Groups 1 and 3, the experimental groups, were higher than those of Groups 2 and 4. This shows that Mastery Learning Approach had an effect of improving performance as compared to the Regular Teaching Method. Although a conclusion of whether to

reject or accept the hypothesis cannot be made based on these results. The results can further be illustrated by a graph as shown in Figure 2.

The graph in Figure 3 shows the PAT mean scores for the four groups. The graph further confirms that the mean of the experimental groups 1 and 3 which were taught using Mastery Learning Approach teaching method were higher than the means of the control groups 2 and 4, which were taught using Regular Teaching Method. A further analysis on an ANOVA was done as shown on Table 4.

Table 2 shows the results of the ANOVA post-test scores on PAT. The table shows that there was a statistically significant difference between the means  $F(3,157)=68.55$ ,  $p < 0.05$ . This means that the F factor is significant at  $p < 0.05$  level and between means square is statistically significantly greater than within means square. This shows that there is a highly significant overall treatment effect. That is, the null hypothesis could be rejected and can also conclude that there is probably at least one significant difference among possible comparisons of two means in the four groups. There was therefore, need to find out where this experimental effect was located. This made it necessary to carry out Scheffe's test of significance for a difference between any two means. The results are shown in table 3.

Table 3 shows the results of Scheffe's test of significance for a difference between any two means. The results in Table 3 show that the pairs of PAT mean of groups 1 and 2, groups 1 and 4, groups 2 and 3 and groups 3 and 4 were statistically significant different at the  $0.05\alpha$ -level. However there was no statistically significant difference in the mean between Groups 1 and 3 and Groups 2 and 4. This study involved non-equivalent control group design there was therefore, need to confirm these results by performing analysis of covariance (ANCOVA) using the students' Kenya Certificate of Primary Education (KCPE) scores as covariate. KCPE scores correlate closely with the scores used in this study.

Table 4 shows the ANCOVA of the post-test PAT scores with KCPE scores as covariate. Table 4 shows that there is a statistically significant difference in the PAT mean scores of the four groups  $F(3,156) = 85.12$ ,  $p < 0.05$ . This confirms that the differences between the means are statistically significant at  $0.05\alpha$ -level. And therefore the differences were as result of the treatment effect. This could be further confirmed by using ANCOVA with pre-test as covariate as shown in table 7.

An examination of Table 5 shows that the difference between groups 1 and 2 is highly statistically significant  $F(1,69) = 85.60$ ,  $P < < 0.05$ . This implies that the treatment condition affected Group 1 only. Since Group 1 was taught using MLA while Group 2 was the control; therefore the MLA teaching method gave higher achievement than the Regular Teaching Method. This confirms the results of the ANOVA and ANCOVA with KCPE as covariate, therefore  $H_0$  was rejected.

## DISCUSSIONS

### The Effect of MLA on Students' Achievement in Physics.

The researcher found out that the students who were taught through the MLA teaching method achieved statistically significantly higher scores in the PAT

compared to those were taught through the RTM. This implies that MLA teaching method is more effective in enhancing students' achievement. A study conducted by Block (1971) showed that students with minimal prior knowledge of material had higher achievement when taught MLA teaching method than those taught through regular teaching method. The findings of the current study at  $0.05 \alpha$ -level, showed a statistically significant difference in scores even when the students had no prior knowledge on the topic to be taught when MLA was used as compared to RTM, therefore concurs with the findings of previous research.

Bloom (1984) in his research on group instruction showed scores of students taught through MLA were around the ninety-eighth percentile, or approximately two standard deviations above the mean. He argued that students taught through Mastery Learning needed more time to master more advanced material. Bloom through his many empirical studies on MLA suggests that Mastery Learning procedures are likely to enhance achievement mainly in mathematics and Sciences since learning in these subjects' areas is ordered and sequential (Guskey & Gates, 1986). Physics as a science subjects fits in this category. The physics syllabus as recommended by the Kenya Institute of Education is ordered and sequential. This makes MLA an effective method of teaching it in Kenyan secondary schools. The findings of the current study shows that MLA covers small units of study which students show mastery as they proceed to the next. In this study there was improved performance for the students who were taught using MLA. Kulik, Kulik and Bangert-Downs (1990) conducting a meta-analysis involving 108 evaluations of Mastery Learning programmes found out that performance on examinations at the end of instruction showed positive effects on students achievement although these effects were higher on locally prepared examinations than on nationally standardized test. Their results concur with the findings of this study where the achievement of students taught through MLA was higher.

Also Kulik et al (1990) found out that the effects of MLA were not uniform on all students in a class low aptitude students were found to have higher gains than high aptitude students. They found out that MLA produces more gains in achievements than other teaching methods. The results of the current study agree with this because they show that students in co-educational district schools who are normally selected after national and provincial have done their selection, did better when they were taught using MLA.

Lazarowitz, Baird, Bowlden and Lazarowitz (1996) studied the effects of using Group Mastery Learning on the achievement of high school biology students. They found that in Group Mastery Learning students did better in some topics as compared to individualize

Mastery Learning, although their method stressed more on students co-operative skills than mastery of the content. MLA used in this study stressed more of mastery of content, through corrective feedback and remediation rather cooperative skills but the results showed that MLA is superior than RTM in terms of achieving higher scores.

Research conducted on comparing effects of Mastery Learning alone, and regular teaching methods on student achievement (Mevarech, 1985) showed that Mastery Learning was the indicator that significantly increased achievement Wentling (1973) when comparing Mastery Learning and non Mastery Learning as to how feedback relates to achievement found that students who received feedback in MLA had higher achievement scores for both immediate achievement and long-term retention. However, time spent toward instruction showed no significant difference. The findings of this study concur with these results.

Apart from feedback the other aspect of MLA that receives attention is time. Mastery Learning theorist especially Bloom (1984) contend that MLA reduces the amount of time needed to achieve Mastery. A research conducted by Arlin and Webster (1983) on achievement, time and learning rate found out that use of MLA significantly raises achievement levels but the time needed for this increase is considerable. Wachanga and Gamba (2004), in their study on effects of using MLA on secondary school students' achievement in Chemistry found that MLA facilitates students learning Chemistry better than the regular teaching method. This agrees with Ngesa (2002) who reported that MLA resulted in higher student achievement in Agriculture than the regular teaching method. He argued that the results were significant with regard to classroom Instruction and Teacher Education in Agriculture.

The current study was carried out with these issues in mind and also that the students' performance in Physics at KCSE examination has been less than fifty percent. In the nutshell the results have shown that the use of MLA in Physics results in better students achievement than the regular teaching method. This agrees with previous studies done by other researchers. One of the factors influencing the quality of education is the quality of the teacher and the instruction carried out in the classroom. In the present study the teachers were carefully trained into the use of MLA teaching method. Learning materials were prepared to ensure that after teaching testing was done followed by remedial and retesting. Continued interaction with the teacher, helped the teacher to discover the area of weakness and therefore assisted the students to reach the expected area of competence. MLA helped the students to have a deeper understanding of the concepts.

MLA allows students to have enough time to master the prerequisites before making progress. However, Arlin and Webster (1983) raised an important issue regarding the use of instructional time in Mastery Learning. He argued that low achievers in grouped Mastery Learning do better because of corrective instruction, but faster students may be slowed down waiting for the other students. This would require the Physics teacher to be willing to use the time outside the normal school timetable for corrective procedures and retesting. The results also show that MLA is beneficial to both boys and girls. If secondary school Physics teachers enhance in the use of this method, they might be able to overcome the disparity between boys and girls achievement in KCSE examination.

In this study, peer tutoring was encouraged in, out of class time where the students checked each other for mastery. They tutored one another and verified that everyone mastered the subtopic and was ready for the test. Since Mastery Learning stresses need for formative assessment and feedback for each unit a variety of remediation materials were prepared. This was done by using a variety of the recommended books by the ministry of education as sources of information. These books included Comprehensive Physics, Secondary School Physics, and Foundation Physics for form 2. All the tests were prepared before the teaching and the remedial ones were prepared according to the numbers, who failed to reach the required pass mark. The teachers were encouraged to avoid objective test, since they could easily lead to memorizing and learning specifics rather than higher levels of learning. Mastery Learning Approach assumes that virtually all students can learn what is taught in school if their instruction is approached systematically and students are helped when and where they have learning difficulties (Bloom, 1984).

The most important feature of Mastery Learning Approach is that it accommodates the natural diversity of ability with any group of students. With careful preparation and greater flexibility all students can be appropriately accommodated according to their respective levels of understanding and they can progress at their own rate (Kibler et. al, 1981).

## CONCLUSIONS

Based on the results of this study it can be concluded that MLA facilitates students learning in Physics better as compared to regular teaching method.

### Implications of the study

This study offers evidence that Mastery Learning Approach can increase achievement. Since achievement is important in the student learning process, physics teachers should be encouraged to use MLA in order to improve performance in physics. Generally the



performance in KCSE Physics examination over the years has been below average. The achievement of students taught through MLA teaching method at form two were able to get higher scores compared to those taught using regular teaching method. This means therefore that there is a likelihood of improvement in performance at KCSE if this method is implemented in the four years of the secondary school cycle.

Many of the professional courses in the Kenyan universities and other tertiary institutions have Physics as a requirement (Siringi, 2005). Therefore if MLA teaching method is introduced in secondary schools more students will opt to do Physics and access these courses. The features of Mastery Learning Approach teaching method suggests that it can be easily implemented in the existing school setting. However it should be realized that time needed to develop the materials is considerable and that the development of learning objectives along with corresponding formative tests and corrective activities is an enormous burden on the teachers. Nonetheless, experience in the United States (Guskey & Pigott, 1988) indicates that teams of teachers working cooperatively can develop materials. The best developing time is during the school holidays and the full days away from school. The practice of teamwork can generate teacher enthusiasm and commitment to Mastery Learning Approach teaching method.

## RECOMMENDATIONS

This study has provided data on the effectiveness of MLA teaching method in enhancing academic achievement. This means that the use of MLA in the teaching of Physics at secondary school level can address the poor performance and the low enrolment in the subject. Therefore supplement the government's efforts to improve Physics education in Kenya's secondary schools.

Curriculum developers will find the study helpful in designing appropriate instructional strategies involving Mastery Learning, which would enhance the learning of Physics.

Physics teachers and education inspectors will identify this as an effective teaching method that would be suitable, to provide favourable learning conditions for all students rather than just for the top fraction of the class. The revised (2002) secondary school syllabus would accommodate this method since the time allocated for each topic is adequate to enable the learner to acquire mastery of concepts in the subject (K.I.E, 2002). And teacher educators will find the study useful in developing programs aimed at producing teachers capable of structuring learning environment that can equalize their interaction with learners enabling greater

learner participation, satisfaction and further academic aspirations.

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