A Meta-Analysis on Effects of Mastery Learning Strategy (MLS) on Academic Achievements of Learners

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Abstract: **The study sought to analyze previous studies on effects of MLS on academic achievements between 2008 and 2020 in connection to purposes, methodologies and findings/recommendations. At the initial stage, we access 13articles electronically for reading purpose yet selected seven for the purpose of meta-analysis. All the studies deployed quantitative method design specifically experimental design. The study revealed and concluded that, MLS has positive effects on learners' academic achievements and that the empirical evidence from this study warrants a generalization without hesitation. It was also revealed and concluded that, large amount of studies on effects of MLS on academic achievements deployed experimental design. Finally, it was revealed and concluded that, majority of the researchers who have conducted studies into effects of MLS on academic achievements used self-developed tests which have their items validated by experts and also their reliability been estimated with cronbach alpha or test re-test methods. Based on the conclusions, we recommended that teachers and educationalists should embrace the use of MLS. Again, it was suggested to future researchers who deem to replicate a study on effects of MLS on academic achievements should deployed mixed method design in order to assess the qualitative aspect of the purpose of the studies under this meta-analysis. Finally, it was suggested to future researchers to validate their test items or either adopt or adapt test items used by scholars.**

Key words: **meta-analysis, mastery learning strategy (MLS), academic achievement, experimental study.**

I. INTRODUCTION

Hollebrands (2004) as cited in Yemi, HjAzid, & Md Ali (2018) avow s that, it is necessary for a teacher to adopt and adapt several methods to teaching and learning in order to stimulus the students' understanding and it is paramount in the teaching of mathematics of which he recommended Mastery Learning Strategy (MLS). The strategy can be functional to all levels/ages and should be well-matched with collective teaching methods (Candler, 2010). Similarly, Candler posits that MLS as an instruction strategy gives to students, more than showing mastery of instructional content.

Bloom (1968) asserted that, MLS has been defined in many ways. Candler (2010) defines it as an instructional process that offers students with several probabilities to exhibit content mastery. It is distinctive related to the conservative teaching method in that the unit of learning is taught and students' understanding is assessed using a formative assessment before they are allowed to change on to the subsequent unit. Students who show mastery on the formative assessment are assigned more inspiring assignments so as to cover and deepen their content knowledge while those who do not pass the assessment task at a designated level (80%) are given remediation which is followed by another formative assessment. A comprehensive mastery for students on largely would then call for progress to the next unit. This assertion is supported by Block & Anderson (1975) who argue that, students who fail the assessment test may go back and repeat the learning until all students achieve the mastery level or the teacher decides to change to the next unit or until the majority of the class masters the unit.

Kalia (2005) investigated the effectiveness of Mastery Learning Strategy and Inquiry Training Model on pupils' achievement in science. The results showed that treatment group attains significantly higher achievement scores than Control Group. Similarly, Elaldi (2016) conducted a research on the mastery learning model with medical students. In the study, a mixed method (Quantitative and Qualitative) research was used, quantitative used pre-test and post-test control group design while qualitative data were collected through semi-structured interviews with six students from the treatment group. The results of the study indicate significant difference between post-tests scores of the treatment and control groups favoring the treatment group [t (62) = -2, 815; P = .007]. The qualitative findings on the other hand showed positive attitudes towards learning in terms of increasing achievement.

These agree with Adeyemi (2007) who studied the effectiveness of learning social studies through mastery learning strategy 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 strategy in the two groups performed better than students taught with the conventional methods of teaching. Furthermore, MLS can be used in almost every subject, but it is more suitable in mathematics instruction since it helps students to develop a solid foundation of mathematical understanding in order to solve mathematical problems which involve a higher-level

thinking and reasoning (Yemi, *et al.,* 2018). Henceforth, its application in cooperative situations will promote a strategy that enhances academic achievement and attitude towards learning mathematics. Mastery Learning Strategy is so crucial because it aids in teaching and learning mathematics and other related subjects. In conclusion, it is not surprising that several researchers have conducted studies to explore its effects on academic achievements of learners in various field of study. It has therefore become urgent to analysis the research methods, the purposes and the verdicts from such studies and evaluate them in order to come out with collective and more efficient impact and use of the strategy in our quest of recommending and deploying learners' development.

II. METHODOLOGY

The study was a meta-analysis on effects of mastery learning strategy (MLS) on academic achievement of students by researchers in previous studies between 2008 and 2020among students at various levels in education in connection to their respective purposes and findings or conclusions. Meta-analysis is a statistical analysis of a large collection of analysis and results from individual studies for the purpose of integrating the findings (Glass, 1976 as cited in Haidich, 2010). Similarly, meta-analysis is a quantitative, formal, epidemiological study design used to systematically assess the results of previous research to derive conclusions about that body of research (Haidich, 2010). Typically, but not necessarily, the study is based on randomized, controlled clinical trials. Outcomes from a meta-analysis may include a more precise estimate of the effect of treatment or risk factor for disease, or other outcomes, than any individual study contributing to the pooled analysis. Identifying sources of variation in responses; that is, examining heterogeneity of a group of studies and generalizability of responses can lead to more effective treatments or modifications of management, as well as examination of heterogeneity is perhaps the most important task in meta-analysis (Haidich, 2010).First, we reviewed 13 related literatures taken from journal articles and abstracts which were accessed through electronic means for reading purposes. The journal articles were from journals like Eurasia Journal of Mathematics, Science & Technology Education; International Journal of Behavioral Social and Movement Sciences; British Journal of Education; etc. The study settings were Kenya; Nigeria; India; and Ghana. Yet, we opted for seven studies for the meta-analysis all been quantitative method in nature specifically experimental design. The study was conducted in three phases. First, literatures were access electronically via education resources information centre (ERIC), google scholar, research gate, and ask.com. Following this was the phase we downloaded complete version of the articles and printed out to aid exhaustive reading to foster succinct and precise understanding relating to abstracts, purposes and objectives, methodologies and findings/conclusions of the seven studies. Finally, the concept of mastery learning strategy (MLS) and its impacts on learners' academic achievements were identified and linked with their respective methodologies.

III. ANALYSIS OF STUDIES ON EFFECTS OF MASTERY LEARNING STRATEGY (MLS) ON ACADEMIC ACHIEVEMENTS OF LEARNERS

First, Wambugu & Changeiywo (2008) conducted a study to found out the effects of Mastery Learning Strategy (MLS) on students' achievement in Physics. In their study, they use dquasi-experimental and Solomon four non-equivalent control group design. The target population comprised of secondary school students in Kieni East Division of Nyeri District. The accessible population was form 2 students in district co-educational schools in the division. The purposive sampling was used to obtain a sample of four co-educational secondary schools. Each school provided a "form 2" groups for the study hence a total of 161 students was involved. The students were taught the same Physics topic "Equilibrium and Centre of Gravity". In the experimental groups, MLS teaching method was used while the Regular Teaching Method (RTM) was used in the control groups. The experimental groups were exposed to MLS for a period of three weeks. The researchers trained the teachers in the experimental groups on the technique of MLS before the treatment. Pretest 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 alpha reliability coefficient r=0.76 was obtained. Experts ascertained their validity before being used for data collection. Data wereanalyzed using t-test, Analysis of Variance (ANOVA) and Analysis of Co-Variance (ANCOVA). Hypotheses were failed to be rejected or to be rejected at significant level of 0.05. The results of the study show that MLS teaching method resulted in higher achievement but gender had no significant influence on their achievement. The researchers concludes that MLS is an effective teaching method, which physics teachers should be encouraged to use and should be implemented in all teacher education programmes in Kenya. In fact, they did a thorough work with the design they used and also ensuring that teachers are well taught and therefore recognize the use of MLS. Their recommendations base on their findings is therefore highly recommended for generalization.

Sood (2013) also presented an investigation to find out the effect of mastery learning strategies viz. Bloom's Learning for Mastery (LFM) and Keller's Personalized System of Instruction (PSI) on concept attainment in geometry among high school students. For achieving the objectives of the study, a random sample of 105 students studying in ninth grade class was selected and "Three Groups: Randomized Matched Subject Pretest-Posttest Design" was employed. The sampled students were divided into three homogeneous groups on the basis of their non-verbal intelligence level by administering Raven's Standard Progressive Matrices (SPM). The first group and second group were taught through

Bloom's LFM and Keller's PSI respectively and thus, termed as experimental groups. The third group was imparted instruction through conventional method of teaching and named as control group. The data were collected by administering self-developed concept attainment test in geometry with 95 objective test items. The items were validated on experts' judge with r=0.856 using test-retest method. The statistical technique of ANOVA and ANCOVA were employed to analyze the data. The results revealed that both Bloom's LFM and Keller's PSI were significantly more effective in attainment of geometrical concepts as compared to conventional method of teaching. It was further inferred that Bloom's LFM was significantly better in attainment of geometrical concepts in comparison to Keller's PSI. It can clearly be inferred from the four studies discussed that, mastery learning strategies have positive effect on pupils' achievement in school. We therefore posit that, the study's result is imperative and recommend the outcome to be embrace since the researcher thorough conducted the effectiveness of MLS by comparing it to other effective and efficient method as well as the conventional teaching method. Moreover, we salute the researcher for his capacity in deploying randomized groups.

Similarly, Agboghoroma (2014) in a study which aimed at finding the effects of Mastery Learning Strategy (MLS) on students' Achievement in Integrated Science found out that, MLS teaching method resulted in higher achievement. The researcher concluded that MLS is an effective teaching method, which Integrated Science teachers should be encouraged to use and should be implemented in all teachers' education programmes in Nigeria and other African nations. In the study, Quasi-experimental Non-randomized Pretest-Posttest Control Group Design was used. The target population comprised of Junior Secondary School Students (JSS) in Delta Central Senatorial District of Delta State, Nigeria. The accessible population was JSS 3 Students drawn from the district co-educational schools in the Senatorial District. Purposive sampling technique was used to obtain a sample of four coeducational secondary schools. Each school provided one JSS 3 class for the study, hence a total of 120 students were involved. The students were taught the same Integrated Science topic of Drug Abuse and Metabolism in the Human body. In the experimental group MLS teaching method was used while the conventional method was used in the control group. The experimental group was exposed to MLS for a period of four weeks. The researcher trained the teachers in the experimental group on the technique of MLS before the treatment. Pretest was administered before treatment and a posttest after four weeks of treatment. The instrument used in the study was Integrated Science Achievement Test (ISAT) to measure students' achievement. The instrument was pilot tested to ascertain the reliability. The reliability co-efficient alpha was 0.74. Data was analyzed using ANCOVA statistics. Hypothesis was failed to reject or rejected at 0.05 significant level. Although, only two groups were used it can be inferred to be comprehensive study as the earlier studies analysis, because the study could established the initial state of the groups through pre-test.

Adeniji, Ameen, Dambatta, & Orilonise (2018) also examined the effect of mastery learning on senior secondary school students' achievement and retention in circle geometry. They conducted the study in Ilorin, Kwara state, Nigeria and adopted a quasi-experimental, non-randomized, pre-test, post-test control group design. A sample of 172 senior school 2 students was drawn from four co-educational schools using multi-stage sampling technique. Instrument for data collection was Circle Geometry Achievement Test (CGAT) which was validated by experts and reliability index of 0.82 was obtained using test-retest method. The result showed that senior school students' achievement in Geometry improved significantly when taught circle geometry using mastery learning approach. There was no gender difference found as well as no difference in the achievement of low, medium and high scoring students when taught with mastery learning approach. They also found out that, there was a significance difference in the post test means score and retention score of students taught circle geometry using mastery learning approach. It was recommended among others that trainings should be given to mathematics teachers on how to effectively use mastery learning strategy in mathematics classroom if better performance is desired.

Similarly, Yemi (2018) in a study inquired on the effect of Mastery learning Strategy (MLS) in enhancing the academic achievement of mathematics. The results of the study showed that, the students who were exposed to mastery learning had enriched academic achievement in mathematics. Apparently, results on the posttest mean scores of the students revealed that there is a significant effect on the academic achievement of the experimental group in which the MLS had been introduced. As such, students exposed to MLS performed better than students who were taught in the traditional teaching method. Moreover, results exemplify that there is a significant relationship between the students' attitudes toward mathematics and their academic achievement in mathematics. The researcher used eighty first-year senior secondary schools (SS 1) students were used as subjects of the study. MLS was used in the treatment group (N=40) while the traditional teaching method was employed for the control group (N=40). This investigation utilized the quasi-experimental design. The findings were clearly as the anticipated findings before reaching the climax of the study. It can be notice that, though intact groups were used there was equal and fair distribution of respondents in each group.

Bala (2019) presented a research paper which was aimed to find the effectiveness of Mastery Learning Strategy (MLS) on the Achievement in mathematics of students with Mathematical Difficulties (MD). The researcher compared the effect of MLS and Conventional Method (CM) of teaching on the Achievement in Mathematics of students with Mathematical Difficulties. The pre-test, Post-test equal group experimental design was used for the present study. The

sample of the study was selected by using simple random sampling technique. Sixty students of the fifth grade class with MD were selected as the sample of the study from two randomly selected Govt. schools of Chandigarh. Those sixty students were further divided into two groups with thirty students in each control and experimental group. The tools used for the study were teacher referral form, and Achievement test in mathematics prepared by the researcher. The equal groups of students with MD were selected on the basis of previous two years academic record of mathematics, teacher referral forms and pre-test achievement test in mathematics. The statistical techniques used in study were mean, S.D. and t-test. The results revealed that MLA was more effective as compared to Conventional Method of teaching because there was a significant difference in the Pretest and Post-test achievement scores of the experimental group. The study was similar to Sood's (2013) study which used the true experimental design as sample respondents were randomized. However, the test items were not reported to have been validated with no r-index given. It could have limited the findings but since the findings were equally similar to the other studies used for the meta-analysis we high recommend the study's findings for generalization purpose.

Similarly in terms of findings, Arhin (2020) conducted a study to explore the effects of mastery learning strategy on pupil's mathematics achievement in Asante Akim North District. In the study, he used a quasi-experimental pre-test post-test, non-equivalent control group design. The respondents in the study were JHS pupils. The target population was 160 pupils from two JHSs. However, he adopted 24 and 30 pupils through purposive sampling procedure and randomly assigned them into experimental and control groups respectively. The instrument used for the study was MATs with r-index = 0.75. Data to answer research questions were analyzed using descriptive statistics (means, standard deviations, min. and max. scores) derived from run independent sample t-test. He found out that, MLS has positive effects on pupils' mathematics achievement. Again, pupils who are taught with MLS differ in terms of ability and that pupils with high ability excel more than pupils with low ability. He then recommended in the study base on the findings that, NaCCA through MoE should adjust the curriculum and ensure to plan instruction with MLS. Again, GES should provide TLRs to support teaching and learning with MLS. Lastly, he recommended that mathematics teachers should embrace MLS in their instructions in order assist pupils gain mastery in content to aid achievement of learning objectives which in a long term will play vital role in the development of the nation.

In summary, these studies have relevant purposes, appropriate methods, good analysis and discussion and imperative findings and recommendations as well as higher confident level of various results since very little limitations were identified in this meta-analysis. It is also obvious from the studies that, mastery learning strategy has positive effect on the achievements of students in these seven studies between 2008 and 2020 in different continental settings.

IV. COMPARATIVE ASSESSMENT OF KEY COMPONENTS

The studies conducted on the effect of mastery learning strategy (MLS) between 2008 and 2020 were expected to differ in purposes or general objectives, methodologies and findings/recommendations. The question now is "was it so?" In the meta-analysis, all the seven studies appears to be similar in terms of purposes as "exploring the effects of MLS on academic achievement" although they were carried out in different subjects and unique settings. On the subject area, Wambugu & Changeiywo (2008) was carried out in Physics while Agboghoroma (2014) in Integrated Science, the rest (5) were in Mathematics. It can therefore be inferred that, the studies were replicated and that MLS is largely used in experimental studies on mathematics-related subjects.

The second component that was compared in the meta-analysis was the research methodologies adopted by the researchers in the respective studies. It has been reported earlier in methodology section that, all the seven studies adopted quantitative method specifically experimental research design. Both Sood (2013) and Bala (2019) used true experimental design as they randomized the respondents however Sood used three groups while Bala used two groups. The rest of the researchers in the five studies used the quasi-experimental design in their respective studies. In quasi-experimental design, respondents were not randomized but intact groups were used to represent various groups in the study. However, Wambugu & Changeiywo (2008) used the Solomon four design of the quasi-experimental which used four groups but conduct pre-test for only two groups (one experimental and one control group) while the other four used two groups each (experimental and control).

Apart from Bala (2019), all the researchers used self-developed tests validated by expert with appropriated r-index. According to Fraenkel, Wallen, & Hynn (2012) $r \geq .60$ is fair indication of a good internal consistency. The researchers estimated their reliability by using either test re-test method or cronbach alpha method which estimates stability or internal consistency respectively. Bala (2019) did use self-developed tests but did not report whether the items were validated or not. On the whole, the sample sizes used in the respective studies were appropriate for experimental study.

Finally, the third component (findings/recommendations) was reported to be similar throughout since all the studies were carried under similar purposes as reported earlier. All the studies found out that, MLS is effective in ascertaining better academic achievements among learners from different levels however in mathematics-related subjects. Moreover, some studies try to find out the impact of gender but it was established that, gender as well as abilities of students do not influence the effect. On a whole, researchers recommended

the use of MLS in the teaching and learning in various subjects.

V. CONCLUSION AND RECOMMENDATIONS

In conclusion, all the studies presented in the meta-analysis found out that, MLS has positive effects on learners' academic achievements. In fact, the empirical evidence from this meta-analysis warrants a generalization in relation to effects of MLS on learners' academic achievement without hesitation. It can also be concluded that, a large amount of studies on effects of MLS on academic achievements deployed experimental design. Finally, majority of the researchers who have conducted studies into effects of MLS on academic achievements used self-developed tests which have their items validated by experts and also their reliability estimated with cronbach alpha or test re-test method. Based on these conclusions, we recommended that teachers and educationalists should embrace the use of MLS. Again, future researchers who deem to replicate a study on effects of MLS on academic achievements should deployed mixed method design in order to assess the qualitative aspect of purpose of future research related to the purposes of these studies under this meta-analysis. Finally, we suggest to future researchers not to repeat the wrongful act of Bala (2019) but should validate their test items or either adopt or adapt test items used by scholars in this area.

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