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The Effect of Mastery Learning Strategy on Learning Retention of Secondary School Students in the Subject of Mathematics

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Abstract
This study aimed to investigate the effect of Mastery Learning Strategy (MLS) on learning retention of secondary school students in the subject of Mathematics by comparing it with Conventional Teaching Method (CTM). The study was carried in Mardan district of Khyber Pakhtoonkhwa, Pakistan. The purpose of the study was to identify an instructional strategy that might effect on learning retention of students. The design of the study was quasi-experimental. Sample was selected through purposive and convenient sampling. The sample size was 90. Experimental group (N=45) was exposed to MLS and control group (N=45) was taught through CTM. Data was collected through pre-test, post tests and retention test. Data was analyzed through independent sample t-test. Significant difference was found in the learning retention of students in favor of experimental group. It was recommended that teacher may use MLS for teaching of mathematics at secondary school level.
Keywords: Mastery learning strategy, effect, short-term learning retention, long-term learning retention

1. INTRODUCTION

Learning retention is one of the most interwoven and complex issues for students and teachers. It is a general observation that students learn quite well in the classroom but fail to perform well in the monthly tests and annual examinations. In other words students fail to retain learned material after a specific interval of time. According to Gains (2001) retention is crucial for transfer of knowledge, because if the students do not retain previous knowledge then most of the teacher' time is spent in reviewing and re-teaching.

Learning retention is defined as the quantity of knowledge retained by an individual after a specific interval of time (Bruno, Ongaro & Fraser, 2007). According to Filgona, Filgona and Sababa (2017), retention of learned material is the ability of the students to comprehend the acquired knowledge of a particular subject. They further say that retention is exhibited by the learners through successful performance in the tests organized to measure their achievement.

Learning retention has two main types: short-term retention and long-term retention. short-term retention means that information are stored in specific part of brain i.e. in prefrontal lobe for relatively short period of time and long-term retention is just another way to say that information is stored in long-term memory, where information retains from hours to years (Symons, 2016).

There are many variables that affect students' learning retention. These include type of contents organized for a particular learning task, the quantity of previous learning, the instructional strategies adopted, the time-span of retention interval, form of examination and individuality of learners (Ferr, 1986; Semb , Ellis & Araujo ,1993). Marshal J. Ferr (1986) further says that time is an important factor of learning. Longer duration gave more opportunities of practice and more chances for understanding of learning material and integrating it into the existing memory data base.

May (2013) argues that retention of learned material depends upon the type of instruction. An elaborative (deep) instruction process involves forming associations between old and new information, with an effort to make elaborative connections of new information with existing knowledge to increase retention power of learner. Kulhavy and Anderson (1972, as cited in Bruno, Ongaro and Fraser, 2007) found positive effect of immediate feedback on leaning retention of students.

On the basis of above literature, poor learning retention could be attributed to many factors i.e. poor organization of learning material, inappropriate instructions, insufficient time for learning, unsuitable type of assessment, delayed feedback, ignoring individual differences, and disregard for their previous knowledge. So there is a need for adopting an instructional strategy that could accommodate all those factors which are necessary for enhancing learning retention.

Mastery learning is a teaching strategy that works on the principal of "take your time". It allows multiple opportunities to demonstrate mastery of the content taught (Wambugu & Changeiywo, 2007; Adeyemo & Babajide, 2014; Filgona, Filgona & Sababa,2017). It involves breaking down and then sequential organization of learning material into small units with predetermined objective. The learner passed through each unit in organized fashion. Every student is allowed the required time to master a given piece of task before moving to the next unit. At the end of each unit student pass though formative assessment followed by feedback and corrective assignments. Students must demonstrate mastery on unit tests before moving on to next (Bloom, 1968). Feedback point out learning difficulties (Bloom, Hastings, & Madaus, 1971) and "corrective assignment" correct these difficulties of learners (Guskey, 2005).

Mastery Learning Strategy works in psychological order of learning. Learner proceeds from easy to difficult. According to Bloom's taxonomy of behavioral objectives learner proceeds from lower to higher order of cognitive domain, i.e. from knowledge to comprehension and so on (Filgona, Filgona & Sababa, 2017). If lower order of cognitive domain is not mastered, this could deter a learner to proceed to the next higher order of cognitive domain (Bruno, Ongaro & Fraser, 2007). Therefore Bloom's (1968) mastery learning stress on ensuring that all learners should have a better understanding of the concepts taught before moving to the next level.

The concept of mastery learning is rooted in ancient Greek philosophy but the prominent work on mastery learning is done by John B. Carroll and Benjamin Samuel Bloom. Carrol (1963) present theoretical model of mastery learning and Bloom (1968) convert it into the practical model of school learning.

After Bloom's (1968) mastery learning model, educationist and researcher start working on this concept. Most of the work has been done on cognitive and effective learning outcomes. Very few studies considered learning retention which is indispensible variable for transfer of new knowledge (Gain, 2001).

Wentling (1973) conducted experimental study titled "mastery versus non-mastery instruction with varying test item, feedback items" and found higher achievement scores for both immediate achievement (short-term learning retention) and for long-term learning retention.

Sut (1990) studied the "effects of mastery learning on Science achievement, retention, attitudes and self-concepts with special focus on educationally disadvantaged students". On the basis of data analysis he concluded that mastery learning has positive effect on immediate achievement ((short-term learning retention), long-term retention, self concept and attitude of students.

May and Kahnweiler (2000) conducted a study titled "the effect of a mastery practice design on learning and transfer in behavior modeling training". He compared mastery practice design with the conventional behavior modeling workshop practice and found improvements in retention and behavioral demonstration measures under the effect of mastery practice design.

Shanbhag (2002) conducted a study on mastery learning to investigate its effect on concrete to abstract learning continuum of competencies in Mathematics at primary level and found positive effects of this approach on the acquisition and retention of competencies in the subject of mathematics by the students.

Peladeau, Forget, & Gagne (2003) conducted an experimental study on "the relative benefits of mastery learning, over learning, and fluency-building instructions for academic performance and long-term retention. The results declared that besides the improvement of other variables, over learning improved students' long-term retention.

Ezinwanyi (2013) studied the use of master learning for enhancing mathematics achievement secondary school level and recommended this approach to be adopted by Mathematics teachers during instructions to promote learning and retention of mathematics concepts of learner at secondary level.

Hussain (2016) conducted a study on the "effect of Bloom's mastery learning approach on 9th grade students' academic achievement in English at secondary level". On the basis of data analysis the researcher concluded that as compare to traditional approach, mastery learning is more successful and effective in the six levels cognitive domain and it its effects on retention power of the students is greater than the traditional approach.

Filgona, Filgona and Sababa (2017) found that mastery learning is not only successful in different levels of cognitive domain but also useful to retain concepts better than conventional teaching.

Meta analysis studies (Guskey and Gates,1986; Guskey and Pigott,1988) also indicated positive effects of mastery learning in the areas of achievement and learning retention.

Students' ability to retain learned information is increasingly becoming more relevant topic for researcher (Darland, & Carmichael, 2012). The study in hand focuses on learning retention in the subject of mathematics at secondary school level.

1.1 STATEMENT OF THE PROBLEM

Mathematics is the most important subject in school curricula and its importance can't be ignored at secondary school level, but the poor learning retention of mathematical knowledge at this level lead to the poor performance at annual examinations. This is really disappointing. Therefore the researcher designed a study to explore the effectiveness of MLS on learning retention of the secondary school students in the subject of Mathematics at Mardan, district of Khyber Pakhtoonkhwa, Pakistan

1.2 PURPOSE OF THE STUDY

The present study aims to investigate the effect of MLS on learning retention of the secondary school students in the subject of Mathematics. The specific objectives of the study were:

1. To investigate the effect of MLS on students' short-term learning retention in the subject of Mathematics.

2. To investigate the effect of MLS on students' long-term learning retention in the subject of Mathematics.

1.3 RESEARCH HYPOTHESES

The following null hypotheses were formulated for testing.

1. There is no significant difference in the short-term learning retention of students taught through MLS and taught through CTM.
2. There is no significant difference in the long-term learning retention of students taught through MLS and taught through CTM.

1.4 SIGNIFICANCE OF THE STUDY

The present study will be helpful for the teacher to change their instructional process and accommodate individual differences exist in class rooms. The application of mastery learning in class room will raise the level of learning retention of the students and will be very helpful to achieve instructional objectives by all the students**.**

2. RESEARCH METHODOLOGY

The study was experimental and quantitative. The study aims to investigate the effect of MLS on learning retention of secondary school students by comparing it with CTM and experimental design is most excellent for comparison the performance of two or more groups (Best, 1986; Farooq, 2001).

2.1 POPULATION

The target population for the study was all secondary school students of district Mardan. According to the Annual statistic report, in district the total number of Government High Schools is 152 (85 Boys & 67 Girls) and total number of Government Higher Secondary School is 48 (26 Boys & 22 Girls) (Government of KP, 2016).

2.2 SUBJECTS/ PARTICIPANTS

A public school, Govt. Girls High School No.1 Mardan was selected through purposive and convenient sampling from district Mardan. Two sections of 9th grade from that school comprised the subject for the study. The prior setting of classes was not disturbed because the students in two sections were already distributed on the basis of academic achievement in previous final exam. One section was treated as experimental group and other was as control group. The number of subjects in each group is given below:

- Experimental Group N = 48
- Control Group N = 48

2.3 RESEARCH DESIGN

Quasi-experimental, pre-test post-test non equivalent control group design was adopted for testing hypotheses. Intact classes were taken as experimental and control groups. According to Farooq (2001) quasi experimental design is best for experimental studies in enact classes.

The experimental design is represented as follows:

O_1 X O_2
O_3 C O_4

where:

- O_1 and O_3 are Pre-test Scores and
- O_2 and O_4 are post test scores
- X represent experimental treatment
- C represents control treatment

2.4 RESEARCH INSTRUMENTS

The following tools were used for date collection during this study:

1. Pre test = Administered before starting treatment.
2. Post test 1 = Administered at the completion of firstchapter.
3. Post test 2 = Administered at the completion of second chapter.
4. Retention test = Administered after two months of treatment period.

2.5 DATA COLLECTION PROCEDURE

Pre-test was administered to all the groups at the beginning of experimental period. Experimental groups were than exposed to MLS and control groups to CTM. For this purpose two chapters from grade 9th mathematics were selected. At the completion of first chapter data was collected through Pre-test 1 and after the completion of

second chapter post-test 2 was administered to both groups. Short-term learning retention was calculated by taking mean score of post-test 1 and post-test 2 for each student. Long-term learning retention was calculated by administering retention test after two months of the experimental period.

3. RESULTS AND DISCUSSION

Data was analyzed through the Statistics Program of Social Science (SPSS) version 18. Independent sample t-test was applied to determined significant difference in the learning retention of two groups. Significance level of 0.05 was used to test the null hypotheses.

3.1 Analysis of pre-test scores

Table 1: T-test on Mean Achievement scores of Experimental and Control Groups

Groups	N	Df	Mean	SD	T-value	P-value
Group III	48	94	17	7.58	.389	.698
Group IV	48	93.99	17.6	7.63		

Table value of t at 0.05 = 1.9855

Table 1 shows pre-test data analysis of experimental and control groups. The mean achievement scores of experimental and control groups are 17 and 17.6 respectively. The difference between two scores is not significant at .05 level as p-value is .698 > .o5. Hence both groups are measurable.

3.2 Analysis of learning retention

Table 2: T-test on Short-term Retention Scores of Experimental and Control roups

Groups	N	Df	Mean	SD	T-value	P-value
Group III	48	94	36.49	6.46	7.59	.000*
Group IV	48	83.69	24.07	9.32		

Table value of t at 0.05 = 1.9855 * significant

Table 2 reveals statistically significant difference in the mean short-term learning retention scores of experimental and control groups. The mean short-term learning retention scores of experimental and control groups are 36.49 and 24.07 respectively. P-value is .000 less than 0.05, therefore significant.

Testing hypothesis 1

$H_0$1: There is no significant difference in the short-term learning retention of students taught through MLS and taught through CTM.

In table 2 the calculated t-value is 7.95 greater than the tabulated value of t (1.9855) and p-value is .000 < .05. Therefore the first null hypothesis was rejected. And it was accepted that the short-term learning retention of experimental group was improved under the effect of MLS.

Table 3: T-test on long-term Retention Scores of Experimental and Control Groups

Groups	N	Df	Mean	SD	T-value	P-value
Group III	48	94	36.64	7.89	8.450	.000*
Group IV	48	87.97	20.81	10.31		

Table value of t at 0.05 = 1.9855 * significant

Table 3 reveals statistically significant difference in the mean long-term learning retention scores of experimental and control groups. The mean long-term learning retention scores of experimental and control groups are 36.64 and 20.81 respectively. P-value is .000 < 0.05, therefore significant.

Testing hypothesis 2

$H_0$2: There is no significant difference in the long-term learning retention of students taught through MLS and taught through CTM.

In table 3 the calculated t-value is 7.89 that is greater than the tabulated t-value (1.9855) and p-value is .000 < .05. Therefore the second null hypothesis was also rejected. And it was accepted that the long-term learning retention of experimental group was improved under the effect of MLS.

Retention is integral part of learning because learning retention provides base for new knowledge and learned knowledge is also required for application in new situation. The present study aims to investigate the effect of MLS on learning retention. The result implies that MLS is more effective in enhancing learning retention of the students as compared to CTM. These findings are in line with the findings of Wentling (1973), Sut (1990), and Shanbhag (2002) who found higher scores for immediate achievement and long-term learning retention under the mastery learning conditions. The findings of this studies are also consistent with findings of Ezinwanyi (2013), Hussain (2016), and Filgona, Filgona and Sababa (2017) who found positive effect of MLS on learning retention of the students in different subjects. Peladeau, Forget, & Gagne (2003) found the benefit of MLS on enhancing long-term retention. This result is also in line with the finding of the present study. Besides the above findings it was also observed that both low and high ability student were benefited by the application

of MLS.

MLS offered re-teaching and re-testing that encouraged students to correct their learning difficulties and mastered the contents that provided a base for learning new information and students feel no difficulty to assimilate new information with existing knowledge.

4. CONCLUSION AND RECOMENDATIONS

The MLS had been found an effective and efficient in enhancing learning retention of secondary school students in the subject of mathematics. MLS has a potential to improve learning retention of learner through multiple opportunities for learning, feedback on assessment, and corrective procedure. Therefore MLS is recommended to be adopted by the teacher of mathematics in their class rooms. Teaching manual on MLs may be developed by text book board and training on MLS may be arranged by training institutes.

REFERENCES

Adeyemo, S. A. and 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.

Bloom, B. S. (1968). Learning for mastery. *Evaluation Comment (2),* 1-5.

Bloom, B. S., Hastings, J. T., & Madaus, G. (1971). *Handbook on formative and summative evaluation of student learning*. New York: McGraw-Hill.

Bruno, P., Ongaro, A., and Fraser, I., (2007). Long-term retention of material taught and examined in chiropractic curricula: its relevance to education and clinical practice. *The Journal of Canadian Chiropractic Association, 51*(1), 14-18.

Carrol, J. B. (1963). A model of school learning. *Teacher college record,* 64(8), 723-733.

Darland, D. C. and Carmichael, J. S. (2012). Long-Term Retention of Knowledge and Critical Thinking Skills in Developmental Biology. *Journal of Microbiology and Biology Education, 13*(2): 125–132.

Ezinwanyi, I. U. (2013). Enhancing mathematics achievement of secondary school students using mastery learning approach. *Journal of Emerging Trends in Educational Research and Policy Studies, 4*(6): 848-854. Retrieved on Jan. 12, 2014 from: http://jeteraps.scholarlinkresearch.com/articles/Enhancing%20Mathematics.pdf

Ferr, M. J. (1986). *The long-term retention of knowledge and skills: a cognitive and nstructional perspective.* Institute of Defence Analysis.

Filgona, J., Filgona, J., &. Sababa, L. K., (2017). Mastery Learning Strategy and Learning Retention: Effects on Senior Secondary School Students' Achievement in Physical Geography in Ganye Educational Zone, Nigeria. *Preprints*. doi:10.20944/preprints201702.0018.v1

Gains, M. (2001). What Factors Effect Retention in the Classroom?. Retrieved on July 5, 2017 from:: https://gse.gmu.edu/assets/docs/lmtip/vol3/M.Gaines.doc

Government of Khyber Pakhtoonkhwa (2016). *Annual Statistical Report of Government Schools: 2015-2016*. Education Management Information System (EMIS). Elementary & Secondary Education Department, Peshawar.

Guskey, T. (2005). Formative classroom assessment and Benjamin S. Bloom: Theory, research andImplications. *Paper presented at the Annual Meeting of the American Educational ResearchAssociation, Montreal, Canada.*

Guskey, T., & Gates, S. (1986). Synthesis of research on the effects of mastery learning in elementary and secondary classrooms. *Educational Leadership, 43*(8), 73-80. Retrieved on November 15, 2011, from http://www.eric.ed.gov/PDFS/ED490412.pdf

Hussain, I. (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.

May, C. P. (2013). *Memory: A Five-Day Unit Lesson Plan for High School Psychology Teachers.* American Psychological Association. Retreived on July 5, 2017 from: https://www.apa.org/ed/precollege/topss/lessons/memory.pdf

May, & Kahnweiler,W.(2000). The effect of a mastery practice design on learning and transfer in behavior modeling training. *Personnel Psychology*, *53*(2), 353-373. Retrieved on July 5, 2017 from http://search.proquest.com/docview/220140236?accountid=28682

Peladeau, Forget and Gagne. (2003).The relative benefits of mastery learning, overlearning, and fluency-building instructions for academic performance and long-term retention. *College students, American Educational Research Journal*. 40 (3), 769-801.

Semb, G., Ellis, .J, Araujo, J., (1993). Long-term memory for knowledge learned in school. *J Educ Psychol. 85*(2), 305–16.

Shanbhag, S. P. (2002). *Effectiveness of mastery learning Instructional strategy based on concrete to abstract learning continuum of Competencies in mathematics at primary level*. (Doctoral dissertation, University of

Mysore, Mysore) Retrieved on Nov. 02, 2011, from: http://dspace.vidyanidhi.org.in:8080/dspace/handle/2009/3146

Sut, H. (1990). A study of mastery learning and its effects on science achievement, retention, attitudes and self concepts with special focus on educationally disadvantaged students (Masters' thesis). Chinies University of Hong Kong.

Symons, B. (2016, March 30). Long Term Memory and Retention in eLearning. Retreived On July, 5. 2017 from: https://learnbig.com/2016/03/30/longtermmemoryandretentioninelearning/

Wentling, T. (1973). Mastery versus nonmastery instruction with varying test item feedback treatments. *Journal of Educational Psychology, 65*(1), 50-58.