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Mechanism of Studying Mathematics Using Math Lab on Grade Eleven Mathematics Text Book In Case of Some Selected Preparatory School In Ilu Aba Bora Zone

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Abstract: *The purpose of this study was to determine whether or not computer-aided learning using a software program called Math Lab (Pearson, 2010) has a significant difference in students' achievement on mathematics, their comprehension of mathematics, and their prospects for course completion. The study was based on a partial replication of similar recent studies with similar research goals. Based on principles of educational constructivism, the use of software programs must improve learning and acquisition of knowledge. Appropriate implementation of this software into curricular activities enhances students' active engagement in the classroom and increases their participation levels in learning. Participants in this study were grade eleven students who varied in age and socio-economic status. They were randomly placed into either a control group that learned in normal settings using the board and textbooks or a treatment group that was given computer supplemented instruction. The results of this study indicated that there was no statistically significant difference in terms of attitude toward mathematics between students enrolled in classes using the software and students not using the software. The study also showed no effect on course completion between both instructional settings. However, similar to the finding of Loving, (2007), and unlike the finding of Moosavi, (2009), this study showed that students enrolled in developmental math classes using Math Lab performed much better in terms of overall final grade than students in a traditional setting not using the software. These results have implications especially on the effective use of software programs when planning and assessing learning developmental mathematics. The findings of this study have implications on conditions and circumstances associated with effective application of software programs in mathematics for educators and their students.*

Keywords: *Students achievement, Math Lab software, course compl*

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I. Introduction

As mathematics lecturers, we always search for ways to modify and improve our teaching methods in order to meet the learning needs of our students. So far we had managed to minimize lecture time to twenty percent or less, we tended to guide and monitor the learning and the classroom discussion rather than lecturing the whole time. We allowed students to work cooperatively and assigned mathematics projects that were practical and meaningful to the students as some assignments involve other subject matters such as pharmacology for medical assistant students.

Learning as much as possible about our students' learning needs and what may go on in their daily struggles is challenging and sometimes an impossible task, but it makes our job much easier. More and more high schools were implementing computer supplemented instruction in various levels of mathematics and my institution of employment was no different. Facilitating knowledge and planning assignments for developmental mathematics seemed challenging and we were skeptical about the students' reaction to the use of computers in mathematics classes. We saw mixed reactions to the application of computer supplemented instruction in developmental mathematics classes. Some students complained about doing homework online due to availability of the Internet at their homes.

Some students expressed frustration with specificity and complexity of the software such as their answers to questions were rejected if entered in an incorrect form even if it was correct. Some other students praised the use of the programs and they were excited about this application and about the self-paced, individualized guidance and the help it offered them. We heard similar statements and testimonials from other instructors about the application of software in mathematics classes. We became more interested in the advantages and the limitations of these compute raided programs and specifically Math Lab that we used very often in our developmental mathematics classes. We wanted to examine the possible learning benefits and elements of dissatisfaction associated with the use of computers in Mathematics. We also wanted to know what educational rational made us progress toward using computers as a learning choice in mathematics.

The main theoretical framework for this present study was Constructivism, an educational philosophy that might contribute towards understanding how CAI could help student learn mathematics in introductory courses. Constructivist philosophy posits that individuals learn within personal contexts of experiences and interpersonal interactions.

The contemporary generation had been raised on technology and experiences a lesser degree of personal interaction than previous generations, due to electronic modes of communications. According to constructivism, it was appropriate to examine the contributions of computerized programs as well as the educator’s role within the context of the current student body as the so-called “net generation.” As such, this philosophy provided the appropriate framework to examine the learning affected of computerized programs within the classroom in conjunction with teacher interaction.

Constructivism is a theory of knowledge founded on the premise that, by reflecting on our experiences, we construct our own understanding of the world we live in. As constructivist Ausubel stated, “If I had to reduce all of educational psychology to just one principle I would say this: The most important single factor influencing learning is what the learner already knows” (as cited in Bodner, 1986, p. 873-878). This is particularly relevant to mathematical learning as real world situations can form the basis for classroom lessons and help to teach how the lessons are relevant to the learners.

In our country most of the time the teaching and learning of mathematics has been reported to be too teacher centered and that students are not given enough opportunities to develop their own thinking in many secondary schools. This situation invariably results in students becoming passive receivers of information, which in many cases do not result in conceptual understanding. Many students are not able to comprehend what their mathematics teachers teach especially on the topic of Mathematics because mathematics content is taught with the intention of finishing the syllabus and preparing for examination. Little regard is given to how well the students understand Mathematical concepts. On the topic of Mathematics, students encounter difficulties in applying what they have learnt as they were not given enough time to understand the Mathematics concepts. Instead they were just memorizing the concepts. Thus, the researcher wants to investigate the mechanism of using Math Lab on students course Completion and content comprehension of grade eleven Mathematics text book.

Statement of the Problem

Students could not understand Mathematics in one dimension only, the more you know them and interact with them; the easier it is to facilitate acquisition of knowledge for them. As a mathematics instructor, we are also interested in finding the role of embedding technology in instruction toward reshaping students' mindsets about mathematics. Developing countries of the world, in their attempts to achieve modernity and promote industrialization, have placed a heavy emphasis on science based education. This fact is particularly true in the teaching of mathematics, the foundation for general scientific advancement. This is the reason why we study on Mechanisms of studding Mathematics using Math lab in some selected preparatory school in Ilu Aba Bora Zone.

Objective of the Study

General Objective

General objective of our study was to assess the mechanisms of studying mathematics using math lab to be effective on grade 11 students in some selected preparatory school of Ilu Aba Bora zone.

The specific objectives

- To Determine whether learning by math lab is more effective than the current method of teaching with respect to course completion
- To Examine the influence of using math lab on the content comprehension of students.
- To determine the mechanism of studying mathematics using Math lab.
- To describe whether or not the methods of studying mathematics using Math lab has an impact in the understanding of students.

Research Question

1. Is there a significant difference between the levels of comprehension between student enrolled in developmental mathematics classes using Math Lab and that of students in traditional course setting?
2. Is there significant difference between persistence to course completion of student enrolled in mathematics classes with Math Lab and traditional course settings?
3. Is there any contribution of studying mathematics using Math Lab on students’ academic achievement?

Significance of the Study

Some of the benefits obtained from this study were:

- The participating school benefited because the results of the study may use as a guideline for other teachers in their classrooms. So the result of the study will contribute much to help teachers to structure their previous experience so as to make the lesson more practical and student centered.
- The curriculum workers also will also benefit out of this study because it may helps them to get some information using this study as a stepping stone.
- Students are benefit from the study since they learned by using an improved method which enhances their achievement scores as well as their social skills.
- Finally, the results from the study will serve as a springboard for other researchers.

II. Methodology and Procedures

Data source

Target Population

The target populations of this study was grade 11 students in Mettu and Gore preparatory schools in Ilu Abba Bora zone which is located at Western part of Ethiopia in Oromia Regional State. The researcher selected the schools purposely because it is convenient to conduct the research by giving a treatment in a school which has available computer lap and experienced teachers about the study area.

Sampling technique

Purposely sampling techniques was used to identify the two schools participating in the study from the schools. The researchers used random sampling technique since at the start of the academic year; the school assigned the students into different sections of grade 11 based on their previous performance of students. So the researchers took by mixing high, low and medium achievers as well as male and females students almost with equal proportions in all of the sections according to data obtained from the school. Again random sampling techniques were used to assign the selected sample sections in to the experimental and control group.

Instruments of data collection

Two instruments were used to collect data. These were Mathematics Achievement Test(pre - test and post - tests) and questionnaires. One instrument of data collection was questionnaires; issues related to mechanism of studying style included in it.

Procedure of the study

Two teachers having equal qualification, equal teaching experience in teaching mathematics and comparable GPA were selected from each selected preparatory schools purposely. For The teachers who teach the experimental group some sort of training was provide on Math lab by the researcher for five days. Then after the implementation was go on for two months.

Method of data analysis

As an experimental research, there are dependent and independent variables associated with this research.

Dependent variables: The dependent variables need was focused and measured in this research is the students' mathematics achievement, although the intervening variable such as varying motivation of students towards each of the methods. It was one of the treats to experimental research consisting of human subjects.

Independent variables: The independent variables of this research were the mat lab software. The cofounding extraneous variables as sex, age, and students' achievement level (low or high achiever) will thoroughly took care of by the researcher. The collected data was analyzed using SPSS .The total number of responses and the nature of the responses (positive or negative) toward mathematics was summarized. Results from this study were compared to the findings of Moosavi (2009) and also to Loving (2007). Student comprehension and overall class average was compared between both phases of instruction to determine if the second hypothesis was supported or rejected..

III. Data Analysis and Interpretation

Table 1: Significance difference between the mean scores of the experimental and control groups on Pretest

Group	Mean	N	Std. Deviation	Std. Error Mean	t	
Pre test for experimental data	36.83	60	7.973	1.029	-2.56884	
Pre test for non experimental	37.27	60	8.082	1.043		

H0: there is no significance difference between the mean scores of the experimental and control groups
Ha: not Ho (there is significance difference)

From the above output, since p-value is greater than 0.05 we do not reject the null hypothesis. Therefore, we conclude that there is no significance difference between the mean scores of the experimental and control groups on Pretest. Hence, both of the groups were almost to be equal. In order to check for the dependence of the effectiveness of using Math Lab the achievement level of students course completion and content comprehension', it is necessary to see whether there is a significance difference in mean scores of high achievers as well as low achievers of the two groups on pretest. This was a necessary condition so as to compare the results of the posttest score of the two groups.

Table 2: Significance difference between mean scores of high achievers of experimental and control group on pretest

Group	Mean	N	Std. Deviation	Std. Error Mean	t
High achiever of control group on pre test	43.43	30	3.720	.679	1.433
High achiever of experimental group on pre test	43.07	30	3.433	.627	

Interpretation: from Table 2 above since p-value is greater than 0.05, we do not reject Ho, therefore, there is no significance difference between mean scores of high achievers of experimental and control group

Table 3: Significance difference between mean scores of low achievers of the experimental group and control group on pretest.

Group	Mean	N	Std. Deviation	Std. Error Mean	t
Low achiever on experimental group on pre test	30.60	30	6.095	1.113	-2.236
Low achiever of control group on pre test	31.10	30	6.354	1.160	

From the above statistical output since p-value (0.6216) is greater than 0.05 .we do not reject the null hypothesis, therefore, we concluded that there is no significance difference between mean scores of low achievers of the experimental group and control group . After using Math Lab in order to cover some mathematics units for grade 11, the academic achievement of the control group and experimental group was examined through a researcher made posttest. The obtained results are presented as follows.

Table 4: Significance difference between mean scores of the experimental and control group on posttest

Group	N	Mean	Std. Deviation	Std. Error Mean	t
Posttest for experimental group	60	55.63	3.791	.489	43.096
Posttest for control group	60	21.72	8.679	1.120	

From the above statistical output since p-value (0.0000) is less than 0.05 .we reject the null hypothesis, therefore, we concluded that there is significance difference between Posttest for experimental group and Posttest of non-experimental group. That is, Students who thought by using Math Lab were significantly higher test scores than students in the control group.

Table 6: Significance difference between mean post-test scores of high experimental group and control group

Group	N	Mean	Std. Deviation	Std. Error Mean	T
High achiever for Post test for Ex. group	30	58.50	1.548	.283	23.623
High achiever for Post test of control	30	27.87	8.287	1.513	

Two-sample t test with equal variances
Table 6 indicates that, there was a significant difference (t calculated > t critical, $p < 0.05$) for experimental group students between posttest achievement score averages of high achiever of the experimental and control group students after the experiment.

Table 7: Significance difference between mean posttest scores of low achievers of the experimental group and control group

Group	Mean	N	Std. Deviation	Std. Error Mean	t
Low achiever for posttest of Ex group	52.77	30	3.137	.573	120.583
Low achiever for posttest of control	15.57	30	2.515	.459	

Table 7 reflects that at the end of the experiment, the difference was significant at p = 0.05 levels between the mean scores of low achievers of experimental and control groups on retention test in favor of experimental group

IV. Discussion

From the results obtained, a number of implications can be forwarded in the interest of improving the mechanism of studying Mathematics using Math lab to improve the academic achievement of grade eleven students. The significant differences in Mathematics achievement of the experimental group as compared to the control group indicate that studying Mathematics using Math lab improves academic achievement of students at the grade eleven level. This observation can therefore encourage classroom teachers and even curriculum developers of the potential of the Math lab as effective tool in learning Mathematics.

Firstly, the significant difference of the pretest and posttest mathematics achievement test indicates that Math lab is possibly contributing in the learning Mathematics. This will further encourage teachers on the potential of using Math lab as an effective tool in learning mathematics. These result is consistent with the Teoh & Fong (2005) study among high school algebra students, which reported that the mean post-test scores of the experimental group was significantly different with the control group. They also found out that the effects of using Math lab in teaching and learning of quadratic function does enhance the students learning. According to the same study, the researcher encouraged teachers to continue using the software or to start if they have not. The only issue is about teachers' enthusiasm and willingness in the usage of Math lab. Almeqdadi (2000) , Embse (1996) and McClintock (2002) have also found Math lab to be effective in learning by the way of visualization in the various areas in mathematics. Almeqdadi further suggested the increase usage of Math lab in investigating mathematical problems. The result of this study also supports the findings of Lester (1996) which mentioned that Math lab provides intelligent capabilities for improving teaching and learning. NorainiIdris(2001) also conducted a quasi-experimental research on the effects of a van-Hiele based instructional activities with Math lab on van Hiele levels. The result she obtained indicated a significant difference between the treatment and control groups in rank on van Hiele levels from pre-test to post-test. The researcher concluded that the significant improvement of Mathematics achievement using the specially prepared van Hiele based instructional with Math lab indicated the need to provide more interactive and hands on learning activities for Mathematics learning in lower secondary schools.

In addition, the increase in scores from the pretest and posttest also indicates that the students usage of Math lab does help in graphing of functions. Math lab was a tool in improving students understanding in mathematics concepts in relevant topics. According to NCTM (1999), "Calculators don't think, students do". This also applies to the Math lab. Students need to understand the mathematics problem they are solving. With that information, then only they can decide what operations to use and take the next action. Therefore, software like Math lab does make students to think and explore to find the solutions. Purdy (2000) also discovered that in a maximum-volume problem Furthermore, he discovered that his students have been lead to a deeper understanding of the problem and its solution as a result of their exploration.

Secondly, the significantly better results in the Attitude Test (perception of students) achieved by the experimental group of students implied that the learning of graphs functions with the Math lab had been beneficial and useful for the students. The students seems to have a more positive attitude in the graphing of algebraic functions, trigonometric functions and absolute value functions while using Math lab. Students are enjoying the lessons of graphing functions and also able to interpret the properties of the graphs of the functions better with Math lab. These findings support the results of Groman (1996) that students reaction is overwhelmingly positive on using Math lab in mathematics class. Furthermore, the usage of Math lab indicated a more positive reaction from both the students and instructors in developing conjectures and constructions. Garofalo&Bell (2004) showed how Math lab could be extended and expanded to different levels to enrich the teaching and learning of mathematics.

According to Rahim (2002) in his study on classroom use of Math lab by pre-service teachers showed that the attitude of the teachers range from uncertainty to overconfidence about the potential of the software. Most of the teachers agreed that the software is useful in investigating and discovery and it would be useful to use in other areas of mathematics such as trigonometric, geometry and algebra.

V. Conclusions

Initially, there was no significant difference in the pre-test scores for experimental or control group achievements. However, throughout the study, the experimental group had higher geometry achievement than the control group, and the difference was statistically significant. The research question has clearly been answered positively. Moreover, the results of the study agree with other researches (Zaranis and Ntziahristos , Yousef , Melczarek) which state that ICT helps students' understanding of Mathematics relationships, making mathematical generalizations and allowing them to focus on concepts of the problems. In addition, the current research shows that the stratification of students groups according to their improvement in the testing (*low*, *medium*, *high*) is inversely proportional to the level of their success. Students enrolled in classrooms using Math Lab performed better than those enrolled in classrooms not using Math Lab based on overall final results

In conclusion, this study suggests that the use of Math Lab in the mathematics classroom is useful in helping students perform better in mathematics topics. Furthermore, students have a positive attitude towards learning of mathematics and other topics of mathematics with the usage of Math lab. Consequently, the Math lab also encourages students to learn Mathematics in a more enjoyable and interesting way.

VI. Recommendations

The use of software technology programs in the classroom and specifically in mathematics are designed to amplify the students' visual and mental capacities. These tools are meant to increase the students' involvement in learning and expand their cognitive abilities. Computer supplemented instruction like any educational tool, requires proper planning and implementation into the course curriculum. Further research is needed on the use of Math lab and other programs to properly identify more advantages and limitation of this technology and to better meet the need of the learner. Educators and learners seeking to use software programs in their classrooms may consider the following:

1. Computer supplemented instruction must be carefully crafted to the college curriculum
2. Students and Teachers must have minimal experience with computers and the programs
3. Assignments must be designed in a way that it serves individualized, self paced learning need of every student
4. Teachers should not rely on software programs as the main form of student assessments

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