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Increasing Mathematics Performance of Grade 8 Learners through Computer-Based Interactive Learning Activities

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Abstract: This study aims to determine the effectiveness of Computer-Based Interactive Learning Activities (CBILA) in Increasing Mathematics Performance of Grade 8 Learners. The pretest-posttest quasi-experimental design and purposive sampling technique were used. A total of 80 heterogeneous learners were the subjects of this study, 40 students in the CBILA group and 40 students in the Traditional Methods of Teaching (TMT) group. The experimental group was exposed to CBILA with guided learning materials that include activities and exercises in audio-visual presentations and interactive multimedia format. The scores were taken from the pretest-posttest of Quarter 4 Math 8 subject. Students' performance in mathematics was described from the mean scores. A t-test analysis was conducted to determine the significant difference between the pretest and posttest scores of the two groups. Findings showed that before the conduct of the study, the two groups have the same performance at the beginning of the experiment. The posttest scores in the CBILA group were noted to be significantly better compared with those in the TMT group. The performance in Mathematics of the learners taught using CBILA was better than those students taught using TMT. The results of this study showed that technology-based teaching and learning when introduced to and utilized by learners were effective in increasing the mean percentage score. Hence, it is recommended to use CBILA in other learning areas to confirm the result of the experiment. Furthermore, CBILA can be implemented in other schools to supplement its effectiveness and to maximize its use in the future.

Keywords: Computer-Based Interactive Learning, Traditional Method of Teaching, Mathematics Performance, Comparative Study

INTRODUCTION

Technology plays a vital role in everyone's life now. At present, it can be observed that most if not all have their gadget with them, whether it be a computer, a mobile phone, or a pad or tab. All of these had become a part of human lives, not only as a want, but it has been a necessity in every household, office, more so in the school or university. In addition, the society is technology-driven, information and communication technologies (ICTs) which include radio and television as well as digital technologies like computers that had been said to be as potentially a powerful enabling tool for educational change and reform (Galutira, 2013).

In the study conducted by Cannon, (2005) mathematical tools should be provided to all students to improve their mathematics achievements. In dealing with computations inside the classroom, calculators should be allowed to use by the student. If possible, the availability of computers for demonstration purposes and the student-related task should always be considered. Instructions should be provided to students on how to use these tools to process, investigate, and perform operations for problem solving.

Several studies have been conducted to prove the positive effect of CBL in learning mathematics. Liao (2007, p. 216) conducted a meta-analysis approach and compared 52 research studies on computer-based learning which revealed a positive on learners.

The traditional method of teaching mathematics was engaged in rote memorization of mathematical concepts through demonstration of the procedure to solve specific mathematical concepts and problems on the board. The

teacher utilized the "drill and kill" method from the beginning up to the end of the class period until all the concepts were covered. The following day, the teacher repeatedly does the very same procedure over again but in different mathematical concepts. This method of mathematics instruction is habitually done by the teacher on his or her everyday lesson. Skills students required to function in society in the 20th century are different than the skills required of students in the 21st century. With this change in skill, requirement comes a need for change in how students are taught (Chapko & Buchko, 2004).

The problem with traditional instruction is the concept of rote learning. Marshall (2006) takes the definition of "rote" from the Oxford English Dictionary which defines rote as, "in a mechanical manner, by routine; especially by the mere exercise of memory without a proper understanding of, or reflection upon, the matter in question." Through traditional mathematics instruction, children are expected to use a mathematical concept before they have been able to experience it primarily focusing on how the teacher "told" them how to use it. This style of teaching is what Michael Battista says is common in American schools, is "ineffective" and "seriously stunts the growth of students' reasoning and problem-solving skills" (as cited by Marshall, 2006, p. 357).

Ever since the Philippine education system was established, problems have always been a part of its operation. Inquirer.net issue dated July 20, 2013, revealed that the National Achievement Test (NAT) conducted by the Department of Education National Educational Testing and Research Center (DEPED-NETRC) for the secondary schools had a mean percentage score (MPS) of 48.9% which is very far from the 75% goal of the department (Pangilinan, 2015).

In connection with this, Jipapad National High School (JNHS) had been observed to have low a Mean Percentage Score (MPS) from the Division Monitoring Evaluation and Adjustment Report for the last 3rd and 4th Grading Period from the previous school year 2017-2018 recorded as 51% and 54% respectively. It was noted that based on that data, JNHS had been consistently at the top of the bottom 5 lists of all the public and private secondary schools in the division with a bracket of 35-65 % MPS in all learning areas, especially in Mathematics. With this alarming situation, the researcher is persuaded to do something to elevate its standing when it comes to the students' performance in the said area, thus adapting technology as an aid to improve the student's performance in MPS.

According to Guillermo (2012), that the appropriate use of Information and Communication Technologies (ICTs) could help expand the horizon and access to education, strengthen the relevance of education in an increasingly digital workplace, and raise educational quality, helping make teaching and learning into an engaging active process. Aside from this, Niess (2006) pointed out that the learners' utilization of technology in learning mathematics at all levels will appropriately, fluently, and efficiently prepare them in dealing with technology-based learning environments in the future. Teachers should create something that would catch learners' attention. Moreover, Lao (2018) reiterated that many schools now are taking advantage of AV technology to teach their students. This equipment can be of great help to present information to students daily that made them proficient in using technology. Non-exposure of learners to technology is depriving them of learning important opportunities that could benefit them in life sooner. Thus, this research was conceived to address the low turnout of the student's MPS, particularly in their Mathematics subject, to have an alternative way of teaching through the CBILA instead of relying on the chalk and board method of teaching or a traditional method of teaching (TMT).

OBJECTIVES OF THE STUDY

The main objective of this study was to determine the effectiveness of Computer-Based Interactive Learning Activities (CBILA) in Increasing Mathematics Performance of Grade 8 Learners. Specifically, it has the following objectives:

1. Determine the difference between the pretest, mean score of the students taught using Computer-Based Interactive Learning Activities (CBILA) and Traditional Method of Teaching (TMT) Mathematics.
2. Find out the difference of the posttest mean scores of the students' performance taught using CBILA and TMT.
3. Identify the difference between the pretest and posttest mean scores of the students taught using CBILA and taught using TMT.
4. Determine the difference between the mean gain scores of the students taught using the CBILA and students taught using TMT.
5. Develop instructional material using computer-based interactive learning activities that can improve the performance of the grade 8 students in teaching Mathematics.

HYPOTHESIS OF THE STUDY

This study had advanced the following hypothesis:

$H0_a$: There is no difference of the pretest mean score of the students taught using Computer-Based Interactive Learning Activities (CBILA) and the Traditional Methods of Teaching (TMT) Mathematics;

$H0_b$: There is no difference in the posttest mean scores of the student's performance taught using CBILA and TMT;

$H0_c$: There is no difference between the pretest and posttest mean score of the students taught using CBILA;

$H0_d$: There is no difference between the pretest and posttest mean score of the students taught using TMT;

$H0_e$: There is no difference between the mean gain scores of the students taught using CBILA and students taught using TMT.

RESEARCH DESIGN & METHODS

The researcher employed a pretest-posttest quasi-experimental study which determined the level of mastery of students using computer-based interactive learning activities for mathematics among Grade 8 classes. The researcher will test the effectiveness of a computer-based interactive learning activity material based on the pretest results of the students. Before the experimentation started, the pretest will be administered to both the experimental and control group. This is to determine the extent of the initial knowledge of the topics in Mathematics. The formal instruction to both groups is undertaken. The experimental group is exposed to computer-based interactive learning methods of teaching, while the control group will be taught the traditional method of teaching. After experimentation, the post-test is administered to both experimental and control groups. Scores are treated statistically and analyze and interpret to form conclusions and recommendations.

LOCALE OF THE STUDY

The study was conducted at Jipapad National High School among the grade 8 students. The school is the only secondary school in the municipality of Jipapad, Eastern Samar which offers the Revised K to 12 Basic Education Curriculum. It was established in 1978 named Community High School. The current school year 2018-2019 has five sections from Grade 7, five sections from Grade 8, and three sections from Grade 9 up to Grade 12 respectively with a total number of students of 1,132 enrollees according to DepEd Learner Information System (LIS) portal as of August 2018

PARTICIPANTS OF THE STUDY

Table 1.

Number of respondents per bracket for each group

Bracket	CBILA Method (Pearl)	Traditional Method (Topaz)
75-80	5	5
81-85	15	15
86-90	15	15
91-95	5	5
Total	40	40

This study involved two (2) classes of heterogeneous Grade 8 high school students of JNHS as shown in Table 1. They were chosen to constitute the CBILA and TMT groups. Grade 8 Pearl (CBILA) was exposed to the use of CBILA method of teaching while Topaz (TMT) was taught using the traditional method of teaching. Only 40 students were identified from each section.

SAMPLING PROCEDURE

The purposive sampling was used in which a subset of individuals (a sample) was chosen from a larger set (a population). A total of 80 students were the subjects of the study, 40 from Grade 8 Pearl who assigned to the experimental group and another 40 from Grade 8 Topaz belong to the control group were identified by purposive sampling from the ranked second grading math grades. Both the experimental and the control groups have the same population of 40 respondents. The respondents were selected according to the bracketing system based on their grades in the second grading period (5 from 75-80, 15 from 81-85, 15 from 86 - 90, 5 from 91 - 95). Both groups will be taught with the same subject matter until the end of the study and are handled by the same teacher.

RESEARCH INSTRUMENTS

The instrument that used in this study were; (1) a Chapter/Unit Test found in the learner's module in Mathematics. This is a multiple-choice test consisting of fifty items with four options for each item. The test covers all the selected topics in Grade 8, The Fourth Grading Lesson on Parallelism & Perpendicularity, Measures of Central Tendency & Measures of Variability and will serve as the pretest and posttest of the study. (2), brief lesson plans for both methods were prepared using the topics mentioned above. (3) CBILA -the computer-based or program materials which will provide the students guided learning materials for Mathematics. This will include audio-visual presentations of activities and exercises that are given and whose performance is assessed.

This instrument was personally made and used by the researcher himself and utilized in facilitating learning for the experimental group or the Grade 8 Pearl class for the entire fourth grading lesson found in the curriculum guide and learning modules. The CBILA was created as self-learning interactive activities that design for the students even the teachers were not around in the classroom and can be used at the ICT learning hub.

DATA ANALYSIS

Descriptive statistics were utilized in the study, particularly the mean. The result of the student grade percentage in a specific grading period was computed by getting the quotient of the sum of scores of learners divided by the total number of test-takers as computed mean, then divide the computed mean by the total number of items multiplied by 100. This approach determines the results of the pretest and the posttest moreover, the standard deviation was also used in the study. To find out if there is a significant difference between the CBILA and TMT in terms of their pretest and posttest, a two-tailed T-test was used and tested at 0.05 level of significance, two-tailed test allots half of the alpha to testing the statistical significance in one direction and the other half to testing statistical significance in the other direction. This means that .025 is in each tail of the distribution of the test statistic. When using a two-tailed test, regardless of the direction of the relationship it hypothesizes, you are testing for the possibility of the relationship in both directions.

RESULTS AND DISCUSSION

T-TEST RESULT OF THE PRETEST PERFORMANCE OF THE CBILA AND TMT GROUPS

As presented in Table 2, the two groups under study have the same performance at the beginning of the experiment. With a mean difference of 0.1, it revealed a p-value of 0.09 which is greater than the significance level of 0.05 accepting the null hypothesis.

This result is good since the baseline data before the use of CBILA suggest that the students have similar intellectual abilities which will be very crucial for trying out the experiment in the teaching approach. The data suggest that the groups are very ideal for the experiment since they possess similarities before the conduct of the experiment.

Table 2.

The difference in the pretest performance of the Experimental and Control Groups

Groups	N	Mean	SD	Mean Difference	p	Interpretation
CBILA	40	16.1750	3.30413	0.1	.09	not significant
TMT	40	16.0750	3.74431			

T-TEST RESULT OF THE POSTTEST PERFORMANCE OF THE CBILA AND TMT GROUPS

Table 3 shows the performance of the control and experimental group in their posttest. The mean of the posttest scores obtained by the two groups taught using CBILA and TMT are 27.550 and 22.025 respectively revealing a mean difference of 5.525. The p-value of 0.001 which is less than the significance level at 0.05 indicates that there is a significant difference in the posttest scores of the two groups under study thus rejecting the null hypothesis.

Table 3.

The difference in the posttest performance of the Experimental and Control Groups

Groups	N	Mean	SD	Mean Difference	p	Interpretation
CBILA	40	27.550	7.39352	5.525	.001	significant
TMT	40	22.025	6.38704			

The result showed that the post-test scores of the experimental groups taught with CBILA are remarkably better as compared to those which were taught the traditional approach. Looking at the mean difference, it signifies that the mean of the experimental group was bigger than that of the control group which suggests that the students' intellectual ability was likely improved unlike in the pretest result. Cannon (2005), disclosed that the use of the computer-based learning method is recognized as a resource to enhance learning. To better understand mathematics, technology should be used in two ways: to aid in the understanding of mathematical principles, and as a tool to solve realistic mathematical problems.

THE DIFFERENCE IN THE PRETEST AND POSTTEST PERFORMANCE OF THE EXPERIMENTAL GROUP

As presented in Table 4, after the experimentation, the group of students who were taught using CBILA obtained higher scores in their posttest as compared to their pretest. From the mean of 16.175 in their pretest to 27.550 in their posttest, it revealed a mean difference of 11.375. With this very high mean difference, a p-value of 0.000 was obtained, disclosing a significant difference in their performance and so, we reject the null hypothesis.

Table 4

The difference in the pretest and posttest performance of the Experimental Group

CBILA	N	Mean	SD	Mean Difference	p	Interpretation
PRETEST	40	16.175	3.30413	11.375	.000	significant
POSTTEST	40	27.550	7.39352			

The results of this study showed that technology-based teaching and learning are more effective in comparison to the traditional teaching approach. This is because the integration of ICT in facilitating instruction will

prepare an active learning environment that is more interesting and effective for both teachers and students. Teachers must enrich lessons with simple integration strategies utilizing Information and Communications Technology (ICT) that are developmentally appropriate. Instruction and assessment processes can be made more collaborative with ICT, which teachers can implement with the tools and equipment available in their schools (DepEd, 2016)

THE DIFFERENCE IN THE PRETEST AND POSTTEST PERFORMANCE OF THE CONTROL GROUP

Table 5

The difference in the pretest and posttest performance of the Control Group

TMT	N	Mean	SD	Mean Difference	p	Interpretation
PRETEST	40	16.0750	3.74431	5.95	.000	significant
POSTTEST	40	22.025	6.38704			

As gleaned in Table 5, after the duration of the experimentation, the group of students who were taught the traditional way, attained higher scores in their posttest as compared to their pretest. From the mean of 16.0750 in their pretest to 22.025 in their posttest, it showed a mean difference of 5.95. With this high mean difference, a p-value of 0.000 was obtained, therefore, we reject the null hypothesis because it has a significant difference in their performance. The results presented in table 3, Table 4, and Table 5, it implies that learning took place in both groups.

THE DIFFERENCE IN THE MEAN GAIN SCORES OF THE EXPERIMENTAL AND CONTROL GROUPS

The mean gain scores of the experimental and control groups, 11.375 and 5.950 respectively, show a mean difference of 5.425 as presented in Table 6. The ***p***-value of 0.000 uncovers that their performance still shows a significant difference. This implies that though learning took place in both groups, the performance of the group of students exposed in the use of CBILA performed better than the group of students taught using the TMT.

Table 6.

The difference in the Mean Gain Scores of the Experimental and Control Groups

TMT	N	Mean Gain	SD	Mean Difference	p	Interpretation
CBILA	40	11.375	6.20458	5.425	.000	significant
TMT	40	5.950	5.73764			

The null hypothesis of this study states that there is no difference between the mean gain scores of the students taught using CBILA and students taught using TMT was rejected. The above table provides the answer to this problem that students performed better if the teachers create something that would catch learners' attention Lao (2018). Thus, the researcher points out the study of Taiwo (2009) stated that the use of technology motivates and engages students and provides an alternative way of presentation and a more exciting learning environment. And that according also to Lee (2012), CBL improves students' attitudes, motivation, and academic achievement.

In general, the above table shows that according to Stratham and Torell (2010) stated that computer technology stimulates increased student interaction and encourages cooperative learning, collaboration, problem-solving, and student inquiries. Thus, making the result reveals that the use of computer-based interactive learning activities is effective and increases the academic performance of the students in a class.

The outcome of the data analysis revealed the following significant findings; the t-test result in the difference of the pretest performance of the CBILA and TMT groups under study have more or less the same performance at the beginning of the experiment since no instruction and discussion happened yet (Arceno, 2011). Thus, the null

hypothesis that there is no difference of the pretest mean score of the students taught using Computer-Based Interactive Learning Activities (CBILA) and the traditional methods of teaching (TMT) Mathematics was accepted as the result showed that it has no significant difference.

The mean of the posttest scores obtained by the two groups taught using CBILA and TMT revealed that there is a significant difference in the posttest scores of the two groups under study. Thus the results showed that the group in the CBILA performed better in the posttest compared to the TMT group and so, the null hypothesis that there is no difference in the posttest mean scores of the student's performance taught using CBILA and TMT was rejected.

The difference between the pretest and posttest mean scores of the students taught using CBILA showed that the group of students who were taught using CBILA obtained higher scores in their posttest as compared to their pretest.

The difference between the pretest and posttest mean scores of the students taught using TMT revealed that the group of students who were taught the traditional way, attained higher scores in their posttest as compared to their pretest.

The null hypothesis stating that there is no difference between the pretest and posttest mean scores of the students taught using CBILA and taught using TMT was rejected.

The results of this study showed that technology-based teaching and learning are more effective in comparison to the traditional teaching approach. This is because the integration of ICT in facilitating instruction will prepare an active learning environment that is more interesting and effective for both teachers and students.

The mean learning gains scores of the experimental and control groups proved that computer-based interactive learning activities are more effective than the traditional method of teaching in teaching mathematics 8 because the mean learning gains of the CBILA and TMT showed there is a significant difference. This implies that though learning took place in both groups, the performance of the group of students exposed in the use of CBILA performed better than the group of students taught using the TMT and so, the null hypothesis was rejected.

CONCLUSION

Based on the findings of the study, the pretest mean scores of the respondents in the experimental group has a very small difference that of the mean scores of the respondent in the control group which can be concluded that their knowledge on mathematics 8 taught using CBILA and TMT, prior to the conduct of the study have more or less the same performance at the beginning of the experiment, the posttest of the mean scores of the same respondents showed a big difference. Meaning, the students in the experimental group showed a significant improvement in their scores from the pretest to posttest as compared to the students in the control group. Thus, the academic performance in mathematics of the students taught using computer-based interactive learning activities was better than that of the students taught using the traditional method of teaching. There is no significant difference between the pretest mean scores among groups taught using CBILA and TMT using the same lesson. There is a significant difference between the post-test mean scores among the two groups taught with the same lesson using CBILA and TMT. Throughout the facilitation of instruction, students exposed to the use of computer-based learning activities performed better or their academic performance is significantly improved compared to that of the traditional method of teaching.

RECOMMENDATIONS

Based on the findings and conclusions of the study, the following recommendations were traced, If the target is to increase the MPS, the use of CBILA is highly recommended as the study revealed its effectiveness. The use of computer-based interactive learning activities in teaching Mathematics 8 may be used to increase the mean percentage scores and eventually improve their academic performance. The same experiment may be conducted if the target is to increase the mean percentage score and improved the academic performance in other subjects or year level to verify the result. Finally, it is highly recommended to have a comparative study on the use of CBILA in both public and private schools.

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