BLENDED LEARNING STATION - ROTATION MODEL: EFFECTS ON GRADE 10 STUDENTS' PERFORMANCE IN AND ATTITUDE TOWARD MATHEMATICS

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Abstract

This experimental study was conducted to determine the effects of Blended Learning Station-Rotation Model on Grade 10 students' performance in and attitude toward Mathematics. A quasi-experimental design was utilized to two intact classes consisting of 60 students of City of Bacoor National High School – Green Valley. Two groups of students were exposed to different strategies: the control group was taught using the traditional approach while the experimental group was taught using the integration of Station- Rotation Model. A 40-item multiple choice type DepEd validated test and a modified Fennema-Sherman Mathematics Attitude Scale were used in gathering data. The respondents of both groups were given pretest and posttest to measure their performance in and attitude toward mathematics and then the t-test for dependent and independent samples were used to determine whether there exists significant difference between the respective mean gain scores of the two groups. Findings showed that there is a significant difference in the respective pretest and posttest mean performance of each group although only the experimental group showed significant difference in their attitude toward mathematics. Moreover, there exists a significant difference in the mean gain scores of the two groups as well as in their attitude toward mathematics in favor of the experimental group. Also, a weak positive correlation between the performance and attitude toward mathematics was noted from the experimental group.

1. Introduction

Mathematics is considered the mother of all learning in both arts and sciences. It is not just computation but a tool for understanding structures, relationships and patterns to produce solutions for complex real life problems. It is the part of the experience of all people regardless of how they performed in school. Nowadays, students are intimately familiar with technology. The students that teachers cater to in the 21st century live in a technology-laden environment where every information is just one click away; thus, they are referred to as *digital natives* [1]. These arguments paved the way to different innovations that gave birth to the conception of blended leaning as a powerful teaching method that enables both teachers and students to bridge the digital breach – technology knowledge gap, between what we consider as digital immigrants and digital natives [2]. Therefore, digital immigrants like teachers should be able to match the characteristics of the 21st century learners or digital natives. The importance of integrating the use of technology in the classroom as a way to increase students' motivation and engagement towards learning should be stressed [3].

The popularity of blended learning models as strategy for providing diversity and improvement in students' performance in mathematics and the need for integration of technology in teaching motivated this researcher to conduct this experiment and gather baseline information about the effects of this innovative strategy in the students' pursuit of knowledge.

Blended learning refers to the mixture of using Internet and digital media with face-to-face instruction and interaction between teachers and students [4]. Blended learning models include: rotation, flex, A La Carte and enriched virtual models. There are three sub models under the 'rotation model' which are considered as hybrid innovation. These sub models are flipped classroom, station rotation and lab rotation [5].

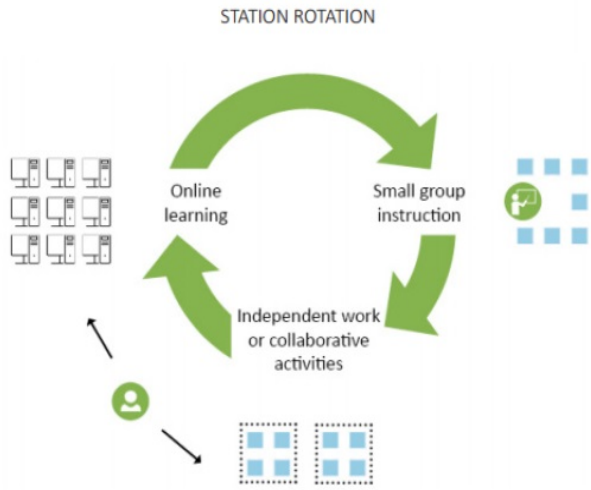

Figure 1. Station Rotation Model

As seen in Figure 1, in a Station Rotation model, students move to different stations with different strategies of teaching and learning to accomplish a certain task and complete the whole cycle of activities; focusing on a single topic or competency. Station 1 is Small Group Instruction facilitated by the teacher, Station 2 consists of Independent work or Collaborative activities and Station 3 is the Online Learning [6].

In addition, since the study used blended learning as pedagogy for the instruction of the targeted skills, this study is also anchored on the Theory of Hybrids which explains how effective blended learning models like station rotation is in delivering the best in education by offering both the benefits of online instruction mixed with traditional teaching.

Another indicator of learning effectiveness is attitude which is "a learned predisposition to respond positively or negatively to a specific object, situation, institution, or person" [7]. Moreover, the use of blended learning helps to diversify the instructional delivery in mathematics curriculum, while exploring the benefits of web-based technologies in mathematics education. The study conducted by [8] revealed that using a blended learning approach improved students' achievement scores as compared to other approaches and had improvement effects on students' attitudes toward mathematics.

A research conducted by [9] found that the academic achievement levels of the group that was taught using the learning stations were significantly higher that the group taught using the conventional education methods. Similarly, the study of [10] found that there was a significant positive difference in the achievement levels of the students so with the attitudes towards studying with the "Learning Stations". It was somehow evident that

the said researchers found the same positive effects of blended learning using interactive applications in general.

In the light of the preceding arguments, this study was conducted to confirm the findings of other researchers and to contribute to the existing studies on blended learning done in government-funded secondary schools and eventually utilize the result to devise ways and means by which students' performance in and attitude toward mathematics can be improved.

Objectives of the Study

This study tried to determine the effects of a specific hybrid innovation, the Blended Learning Station-Rotation, on the performance in and attitude toward mathematics of Grade 10 students of City of Bacoor National High School- Green Valley (CBNHS-GV) during the School Year 2017-2018. Specifically, the study attempted to:

1. describe the performance in and attitude toward Mathematics of the experimental and control groups in terms of their pretest and posttest mean scores;
2. determine if significant difference exists between the pretest and posttest mean scores of each group in the following variables:
   2.1 Performance in Mathematics;
   2.2 Attitude toward Mathematics;
      2.2.1 Personal confidence about the subject matter;
      2.2.2 Usefulness of the subject's content;
      2.2.3 Perception of teacher's attitudes;
3. test the significance of the difference between the mean gain scores of the experimental and control groups in each of the variables; and
4. determine if a significant relationship exists between the students' performance in and attitude toward Mathematics.

Scope and Limitation of the Study

The study utilized two intact groups of Grade 10 students in City of Bacoor National High School – Green Valley, School Year 2017-2018. The study was limited to the Third Quarter topics in Grade 10 Mathematics, namely Permutation, Combination and Probability.

2. Materials and Methods

Research Design

A quasi-experimental method of research was utilized in the study particularly the pre and posttest design. The experimental group was taught using the blended station rotation strategy while the control group was taught by using the traditional method where the teacher delivered the lectures and led the students in understanding the lessons in the classroom.

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Respondents of the Study

Thirty matched pairs from two sections of Grade 10 students enrolled in the City of Bacoor National High School – Green Valley Annex, School Year 2017-2018 served as respondents of the study. Matching was based on their ability level using DepEd Order No. 8 Series of 2015: Policy Guidelines on Classroom Assessment for the K to 12 Education Program.

By random assignment, one section was assigned as the experimental group and the other, the control group. During the experimentation, regular classes were conducted, but

for purposes of this study only the data gathered from the 30 pairs of respondents were considered.

Research Instrument

The data of the study were based on the results of the following:

1. a 40-item multiple-choice type test on Permutation and Combination and Probability that was taken from the Grade 10 Mathematics Learners' Material that was validated by the master teachers of the Department of Education.
2. a modified Fennema-Sherman Mathematics Attitude Scale [11] which consists of three subscales, namely: a confidence scale, a usefulness scale and a teacher perception scale.

Research Procedure

In the conduct of the experiment which used the station- rotation model, no alteration was done in the physical environment of learning and face-to-face instruction was enhanced by mixing it with interactive online activities. The use of technology was maximized with online learning while students go through different stations, where students are given varied ways to learn specific competency or skill.

The study was conducted in three phases: pre-experimental activities, experiment proper and post-experimental activities.

The first phase consisted of administering the pretests on the topics included in the study and the attitude scale after securing permission from the school principal. In the second phase, the experimental group was exposed to the blended learning station-rotation and the control group to the traditional teaching method. The final phase of the study was the administration of the posttests. The same assessment procedure was used for both groups.

To be able to ensure objectivity in the conduct of the study and to remove the effect of the teacher factor, classes were handled by this researcher.

Statistical Treatment

To determine if significant difference exists between the pretest and posttest mean scores of each group, the t-test for dependent samples was utilized. Moreover, the t-test for independent samples was used to find out if significant difference exists between the pretest mean scores as well as the posttest scores of the two groups. The effect size was also computed to determine how much improvement in the scores took place. Lastly, to test for any significant relationship between the performance in and attitude toward mathematics with the integration of the model, Pearson correlation was used.

3. Results and Discussion

Part I deals with the performance in mathematics of each group and Part II deals with their attitude toward mathematics before and after the experiment; while Part III deals with the relationship between their academic performance and attitude toward mathematics after the experiment.

Part I: Performance in and Attitude toward Mathematics

This part deals with the results of the Achievement test in Mathematics and the Attitude Scale administered to the control and experimental groups before and after the experiment which are subjected to the t-test for paired samples.

Table 1. Statistical Data on the Performance in and Attitude toward Mathematics of the Control Group and Experimental Group

Variable		Group	Pretest Mean	Pretest SD	Posttest Mean	Posttest SD	t-value
Performance		Control	10.03	2.50	29.27	3.99	-31.19 (S)
		Experimental	9.80	3.99	32.37	3.13	-23.78 (S)
Attitude Toward Mathematics	Personal Confidence	Control	3.40	0.45	3.54	0.82	-1.026 (NS)
		Experimental	3.39	0.34	4.04	0.49	-8.292 (S)
	Usefulness	Control	3.45	0.38	3.49	0.46	-0.465 (NS)
		Experimental	3.49	0.29	3.91	0.55	-4.563 (S)
	Teacher's Attitude	Control	3.63	0.38	3.94	0.64	-2.345 (S)
		Experimental	3.64	0.39	4.01	0.55	-3.446 (S)

Legend: S – Significant NS – Not Significant $\alpha = 0.05$ (two-tailed) df = 29 $t_{critical} = 1.699$

As shown in Table 1, there is a significant difference between the pretest and posttest mean scores of both groups at the 0.05 level in their performance in mathematics. It can be inferred that although learning occurred using both teaching approaches, a greater improvement is seen in the experimental group. This finding strengthens the claim of [12] that the academic achievement levels of the group that was taught using the learning stations are significantly higher than those of the group taught using the conventional educational methods.

With regard to attitude toward mathematics, there is no significant difference between the pretest and posttest mean scores of the respondents from the control group in terms of personal confidence and usefulness of mathematics, but a significant difference in their perceptions of teacher's attitude.

On the other hand, there is a significant difference between the pretest and posttest mean scores of the respondents from the experimental group in all subscales of the attitude scale. This supports the findings of [10] that there is a significant positive difference in the achievement levels of the students as well as in their attitudes toward Mathematics in studying with the "Learning Stations".

Although the performance pretest mean scores differ by 0.23 in favor of the control group, the computed t-value of -0.363 indicates that there is no significant difference between the two groups at the 0.05 level of significance. The effect size of 0.069 indicates that the respondents in the two groups have almost the same scores. This strengthens the fact that the two groups were comparable at the start of the experiment and this could be accounted for by the matching of the respondents right from the start of the experiment.

On the other hand, there is a significant difference in the performance of the two groups as evidenced by the computed t-value of 3.341 at the 0.05 level in favor of the experimental group. It can also be deduced from Table 2 that there is a significant difference between the mean gain scores of the control and experimental groups at the 0.05 level of significance. From this, it can be inferred that the effect size of 0.794 is large enough such that the difference between their performances is remarkable. This indicates that about 79% of the control group have scores below the mean of the experimental group. This implies that the Station-Rotation Model proved to be a better approach in teaching the

topics under consideration. This supports the findings of [13], [14], [15], and [16] that the blended learning method is more effective than the traditional method in improving academic achievement.

Table 2. Comparison of the Performance in and Attitude toward Mathematics of the Control and Experimental Groups

			Group	Mean	SD	t-value	Effect Size
Performance		Pretest	Control	10.03	2.50	-0.363 (NS)	0.069
			Experimental	9.80	3.99		
		Posttest	Control	29.27	3.99	3.341 (S)	0.794
			Experimental	32.37	3.13		
Attitude Toward Mathematics	Personal Confidence	Pretest	Control	3.40	0.45	-0.059 (NS)	0.025
			Experimental	3.39	0.34		
	Usefulness		Control	3.45	0.38	0.473 (NS)	0.118
			Experimental	3.49	0.29		
	Teacher's Attitude		Control	3.63	0.38	0.100 (NS)	0.026
			Experimental	3.64	0.39		
	Personal Confidence	Posttest	Control	3.54	0.82	2.803 (S)	0.786
			Experimental	4.04	0.49		
	Usefulness		Control	3.49	0.46	3.165 (S)	0.809
			Experimental	3.91	0.55		
	Teacher's Attitude		Control	3.94	0.64	0.482 (NS)	0.139
			Experimental	4.01	0.54		

Legend: S – Significant NS – Not Significant $\alpha = 0.05$ (two-tailed) df = 58 $t_{critical} = 1.679$

The table also shows that the two groups are not significantly different in their pretest mean scores at the 0.05 level insofar as their confidence to learn Mathematics, perception about the usefulness of Mathematics, and their teachers' attitude toward them are concerned. The effect sizes of 0.025, 0.118 and 0.026 indicate that the respondents from the two groups have almost the same attitude toward mathematics at the start of the experiment.

However, there is a significant difference between the posttest mean scores of the two groups in Personal Confidence and Usefulness, while there is no significant difference in their perception of teacher's attitude. The effect sizes of 0.786 and 0.809, in personal confidence and usefulness, respectively, indicate that about 80% of the respondents in the control group have scores below the mean of the experimental group. On the other hand, the effect size of their perception of teacher's attitude is 0.139 which means that the respondents of the two groups have almost the same score.

Clearly, integrating the Station-Rotation Model in teaching mathematics improved the respondents' attitude toward the subject. This supports the findings of [12] that the blended learning method is more effective than the traditional method in terms of improving attitude toward mathematics.

Part II: Relationship between Performance in and Attitude toward Mathematics of the Control Group and the Experimental Group

To determine the relationship between the performance in and attitude toward mathematics of the control group and the experimental group after the experiment, Pearson correlation coefficient was computed for each variable and the results are reflected in the table below.

Table 3. Test of Relationship between the Performance in and Attitude toward Mathematics of the Control Group and the Experimental Group

Group	Attitude toward Mathematics	N	Correlation Coefficient	p-value	Remarks
Control	Personal Confidence	30	0.186	0.326	Not Significant
	Usefulness of Mathematics	30	0.120	0.527	Not Significant
	Perception on Teacher's Attitude	30	0.020	0.916	Not Significant
Experimental	Personal Confidence	30	0.163	0.389	Not Significant
	Usefulness of Mathematics	30	0.280	0.134	Not Significant
	Perception on Teacher's Attitude	30	0.085	0.656	Not Significant

As shown in Table 3, all correlation coefficients indicate a weak nonsignificant but positive relationship between performance in and attitude toward mathematics in both the control and experimental groups at the 0.05 significance level. This implies that the attitude toward mathematics is independent of the method of teaching used and this may be partly attributed to the fact that students have different learning styles.

Conclusion

In the light of the findings of the study, it can be concluded that although the relationship between the variables of the study is positive but weak and non-significant, integration of blended station rotation model in teaching mathematics is more effective than the traditional method of teaching in improving the performance in and attitude toward mathematics of Grade 10 students in CBNGS – GV.

Recommendation

It is recommended, therefore, that teachers be encouraged to integrate the Blended Station Rotation Model in teaching Grade 10 mathematics because of its positive effect on the students' performance in and attitude toward mathematics. Seminars and workshops may be conducted by the school authorities to expose the teachers to different blended learning strategies and get them ready to implement this innovative teaching strategy. Moreover, this study may be replicated in other mathematics subjects using a larger sample to confirm the aforementioned findings.

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