SCIENCE LEADERBOARD IN TEACHING EARTH SCIENCE FOR GRADE 7 STUDENTS OF BAHILE NATIONAL HIGH SCHOOL FOR SCHOOL YEAR 2018 – 2019

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ABSTRACT

One of the teaching-learning strategies is cooperative learning. During the 4th quarter of the School Year 2018-2019, this study investigated the impact of using Science Leaderboard, a cooperative learning technique, in teaching Earth Science on the academic performance of Grade 7 students at Bahile National High School. This study was conducted using an experimental method, specifically a pretest and posttest control group design. In this study, a total of 100 students were respondents divided into two groups. Fifty students were taught using Science Leaderboard (experimental), and fifty students were taught without it (control). The mean, standard deviation, and T-test were used to analyze the results using the software SPSS 14.0. The mean and standard deviations were used to determine the students' pretest and posttest results when Science Leaderboard was used and when Science Leaderboard was not used. The difference between the pretest and posttest performances of the two sections was determined using a paired T-test for correlated means. The difference between the two sections' posttest performances was determined using an independent T-test for correlated means. The results showed that the posttest results of the two groups were significantly different. Teachers in any subject area should consider using Leaderboard as a cooperative learning technique in the classroom because it has been shown to improve student success and motivation for lessons.

Keywords: Science leaderboard, Cooperative learning, Earth Science, Experimental study, Philippines

INTRODUCTION

Science Education is vital for global progression. However, Filipino students' performance is consistently poor, according to international assessment studies on TIMSS 1995,1999, and 2003. High school students struggled with intelligence, logical comprehension, and reasoning. It was also evident in the Department of Education's 2006 National Achievement Test for high school students (Philippine Basic Education, 2013). That is why in the Philippines, the K-12 curriculum under the Republic Act 10533, otherwise known as "The Enhanced Basic Education Act of 2013," was implemented. The purpose of this is to equip students with a set of skills that will be useful in the workplace. It is stated that "Science content and science processes are intertwined in the K to 12 Curriculum." Science concepts and skills are implemented in a spiral progression, increasing in complexity as students advance through the grades, allowing for a deeper understanding of core concepts. Integration of scientific and non-scientific topics will increase understanding of concepts and their application to real-world scenarios.

However, despite the government's efforts, studies show that many of our Filipino learners are still lacking in functional literacy, making it difficult for them to handle the difficulties offered by our quickly changing world. As evidenced by learners' achievement on the National Achievement Test, Science remains to be the most challenging subject in basic education.

Many ways are being done to improve the performance of the students in Science. One of these is the integration of different strategies and approaches in teaching. The acquisition of domains in Science Education is promoted using the "multi/interdisciplinary approach, science technology-society approach, contextual learning, problem/issue-based learning, and inquiry-based approach," according to the conceptual framework of the K to 12 Curriculum Guide in Science (2016). Constructivism, learning style theory, brain-centered learning, and the social cognition learning model are all based on sound educational pedagogy. "More hands make for lighter work"; "Two heads are better than one"; "The more, the merrier." These adages speak about why students perform better in groups. Collaborative learning, according to Caruso and Wooley (2008), can assist students in developing a variety of abilities that are becoming increasingly crucial in the workplace. Students learn through experiences and contacts with others, according to Lev Vygotsky (1962), a Russian teacher and psychologist. He looked at the impact of social contexts on the learning process. Vygotsky (1962) also proposed that learning occurs because of students' experiences with their peers, instructors, and other experts. As a result, teachers should create a learning environment where students can engage in discourse, cooperation, and feedback.

One of the techniques in Cooperative Learning is through Science Leaderboard. It is a scoring board that shows the level of performance of different groups in the class. Here, students were grouped into different teams. Members of the team must work cooperatively in every activity and endeavor in Science to get extra points. The attendance, written works, and performance tasks of the students were considered in giving points. Science Leaderboard was shown to the class to be aware of their points before the class began. After each class, their points were tallied, and they were ranked. The daily winning team and the top student or the MVP earned ribbons as recognition. At the end of the quarter, their points from day one to the last day were tallied, ranked, and recognized. The best group and the MVP earned a trophy, certificates, and medals. The first runner up and the second runner up also received recognition.

"Unity in policy and diversity in practice" is the motto of the current curriculum. The minimum competency level is centralized, while the curriculum material, processes, and evaluation process are decentralized. This new curriculum tries to deal with the overburdened curriculum by integrating methods, material, and assessment procedures, reducing instructional time, and decentralizing methods, content, and assessment procedures. This study aimed to resolve some of the students' concerns about learning at Bahile National High School due to the teachers' methods of instruction. Furthermore, this research may assist teachers in improving Science teaching by using a cooperative learning strategy, which is an essential step toward improving overall outcomes and quality education for all students. Previous studies have shown the value of cooperative learning strategies and their contribution to education; hence, the goal of this action research was to see how using Science Leaderboard as an Earth Science teaching strategy affected Bahile National High School Grade 7 students' academic performance in the 2018-2019 school year. This research focused solely on teaching 4th quarter Earth Science, and participants were drawn from two different sections of Grade 7.

OBJECTIVES OF THE STUDY

The overall goal of this research is to determine the effectiveness of the Science Leaderboard in teaching Earth Science to selected Grade 7 students enrolled at Bahile National High School in S.Y. 2018 - 2019. The following goals, in particular aimed at: 1) examine the students' performance on the pretest and posttest after being taught Earth Science without the use of Science Leaderboard; 2) examine the students' performance on the pretest and posttest after being taught Earth Science with the use of Science Leaderboard; 3) determine the difference in students' pre-and posttest scores after they have been taught Earth Science without the use of Science Leaderboard; 4) assess the difference between the students' pretest and posttest performances after being taught in Earth Science with the use of Science Leaderboard, and 5) determine the significant difference between the

students' posttest performances taught in Earth Science with and without the use of Science Leaderboard.

METHODOLOGY

This research used an experimental design to determine the impact of the use of Science Leaderboard on students' academic performance in Earth Science. The subject of this study was a total enumeration of 100 Grade-7 students of Bahile National High School in the Schools Division of Puerto Princesa City, who were enrolled in the School Year 2018-2019. They were divided into two groups; Grade 7 – Benevolence formed the experimental group, while Grade 7 – Altruism formed the control group with 50 respondents each. Grade 7 Benevolence was taught using Science Leaderboard, while Grade 7 Altruism was taught without using Science Leaderboard. The school principal was written a letter requesting permission to perform the study. After receiving approval from the authority, the researcher administered the pretest to the two groups of respondents at the beginning of the 4th quarter for Science 7. The objectives and topics were similar in both classes, but the teaching strategy used was not.

The topics spanned Unit 4's three chapters (Earth Science). To evaluate students' performance, they were given a Pretest and a Posttest. The test consists of 40 multiple choice questions with four choices each. The experimental group was exposed to the use of Science Leaderboard, while the control group was employed with the usual way of teaching. In the control and experiment, all groups were given the same lesson, same written works, same performance tasks, and same contact time. At the end of three chapters, a posttest was administered to the two groups—students in both groups were given a posttest to assess their academic performance. The mean, standard deviation, and T-test for Correlated Means were used to make the findings of this study more accurate. Standard deviation and mean were used to calculate the students' pretest and posttest results without the use of Science Leaderboard. They were also used to decide how well students do on pre-and posttest in Earth Science classes using Science Leaderboard. The significant difference between the two sections' pretest and posttest performances was determined using the Paired T-test for Correlated Means, and the significant difference between the two sections' posttest performances was determined using the independent T-test.

RESULTS AND DISCUSSION

1. Grade 7 Altruism's pretest and posttest performances taught in Earth Science without the use of Science Leaderboard

Table 1
Grade 7 Altruism's pretest and posttest performances taught in Earth Science without the use of Science Leaderboard

		Mean	N	Standard Deviation	Standard Error Mean
Pair 1	Pretest 1	10.62	50	5.070	0.717
	Posttest 1	18.06	50	5.392	0.763

For Grade 7 Altruism, the pretest and posttest average scores were 10.62 and 18.06, respectively, with a standard deviation of 5.070 and 5.392 for the pretest and posttest, respectively. Despite the fact that both standard deviations were almost identical, meaning that the majority of the students' scores were close to the average mean, it was discovered that Grade 7 Altruism's posttest score increased even without the use of Science Leaderboard.

2. Grade 7 Benevolence's pretest and posttest performances taught in Earth Science with the use of Science Leaderboard

The pretest and posttest average means for Grade 7 Benevolence were 11.54 and 31.96, respectively.

Table 2
Grade 7 Benevolence's pretest and posttest performances taught in Earth Science with the use of Science Leaderboard

		Mean	N	Standard Deviation	Standard Error Mean
Pair 1	Pretest 2	11.54	50	5.429	0.768
	Posttest 2	31.96	50	3.505	0.496

The standard deviation of their post-test scores was also 3.505, indicating that the majority of their results were similar to the average mean. It was clear that the use of Science Leaderboard resulted in higher scores on both measures, demonstrating that the more students were exposed to teaching techniques, the better they performed in class.

3. Difference of Grade 7 Altruism's pretest and posttest performances taught in Earth Science without the use of Science Leaderboard

3.1 Paired Samples correlations of Grade 7 Altruism's pre-test and post-test performances taught in Earth Science without the use of Science Leaderboard

Table 3
Paired Samples correlations of Grade 7 Altruism's pre-test and post-test performances taught in Earth Science without the use of Science Leaderboard

		N	Correlation	Sig.
Pair 1	Pretest 1 & Posttest 1	50	.567	.000

The paired samples correlations of Grade 7 Altruism pretest and posttest results are shown in Table 3. Both measurements were found to be meaningful at 0.000 level, with a moderately positive correlation value of 0.567, indicating that although the posttest score was higher, some of the scores were still closely linked to the pre-test scores.

3.2 Paired Differences of Grade 7 Altruism's pretest and posttest performances taught in Earth Science without the use of Science Leaderboard

Table 4
Paired Differences of Grade 7 Altruism's pretest and posttest performances taught in Earth Science without the use of Science Leaderboard

Paired differences									
		Mean	Standard Deviation	Standard Error mean	Difference's 95% confidence interval		t	Df	Sig. (2-tailed)
					Lower	Upper			
Pair 1	Pretest 1	-7.440	4.824	.682	-8.811	-6.069	-10.905	49	.000

The Paired Differences between Grade 7 Altruism's pretest and posttest performances are shown in Table 4. The estimated t-test value for this t-test was-10.905, with a 0.000 p-value. Since the p-value was less than the alpha value of 0.05, both experiments were substantially different from each other. Furthermore, the mean difference of both measurements was 7.440, and the confidence interval's lower level was -8.811, and the upper level was -6.069, and it did not cross to 0, indicating that a difference existed. Melihan and Sirri (2011) came to the same conclusion, claiming that cooperative learning is more successful than conventional methods of enhancing academic achievement.

4. Difference of Grade 7 Benevolence's pre-test and post-test taught in Earth Science with the use of Science Leaderboard

4.1 Paired Samples correlations of Grade 7 Benevolence's pre-test and post-test performances taught in Earth Science with the use of Science Leaderboard

Table 5
Paired Samples correlations of Grade 7 Benevolence's pre-test and post-test performances taught in Earth Science with the use of Science Leaderboard

		N	Correlation	Sig.
Pair 1	Pretest 2 & Posttest 2	50	.057	.695

The correlation between Grade 7 Benevolence's pretest and posttest results is shown in Table 5. Both tests were found to be significant at the 0.695 level, with a trivial positive correlation value of 0.057, indicating that the average mean scores of both tests are not close to each other. The majority of students improved their post-test scores as compared to their pretest scores.

4.2 Paired Differences of Grade 7 Benevolence's pretest and posttest performances taught in Earth Science with the use of Science Leaderboard

Table 6
Paired Differences of Grade 7 Benevolence's pretest and posttest performances taught in Earth Science with the use of Science Leaderboard

Paired differences									
		Mean	Standard Deviation	Standard Error mean	Difference's 95% confidence interval		t	Df	Sig. (2-tailed)
					Lower	Upper			
Pair 1	Pretest 2 Posttest 2	-20.420	6.292	.890	-22.208	-18.632	-22.947	49	.000

Table 6 indicates the difference in pretest and posttest results in Earth Science taught to Grade 7 Benevolence using Science Leaderboard. The computed t-value for this t-test was -22.947, with a 0.000 p-value. Since the p-value was less than the alpha value of 0.05, both experiments were significantly different from each other. Also, the mean difference of both measurements was 20.42, and the lower level of the confidence interval was -22.208, and the upper level was -18.632, and it did not cross to 0, indicating that there was a difference. Furthermore, this may imply that students who have been exposed to Science Leaderboard in the classroom while teaching Earth Science have improved their scores and performances more than those who have not. According to Shimazoe & Aldrich (2010), cooperative learning facilitates deep learning of materials and aids students in achieving better grades.

5. Difference of Grade 7 Altruism's and Benevolence's posttest performances taught in Earth Science without and with the use of Science Leaderboard

5.1 Group Statistics of Grade 7 Altruism's and Benevolence's posttest performances taught in Earth Science without and with the use of Science Leaderboard

The Group Statistics of both posttest results of Grade 7 Altruism and Benevolence are shown in Table 7. Grade 7 Altruism had an average mean score of 18.06, while Grade 7 Benevolence had an average mean score of 31.96. Grade 7

Benevolence has a lower standard deviation of 3.505 compared to Grade 7 Altruism's standard deviation of 5.392, which explains why most of their ratings were close to the average mean.

Table 7

Group Statistics of Grade 7 Altruism's and Benevolence's posttest performances taught in Earth Science without and with the use of Science Leaderboard

	Posttests	N	Mean	Standard Deviation	Standard Error mean
Scores	Altruism	50	18.06	5.392	0.763
	Benevolence	50	31.96	3.505	0.496

It was also discovered that using a Science Leaderboard has a significant effect on students' learning and success. In cooperative learning groups, students achieve more, demonstrate superior learning skills (Johnson & Johnson, 2008), have more favorable interactions among group members and between students and the instructor, and have higher self-esteem and attitudes about the subject area (Slavin, 2011).

5.2 Independent Samples Test of Grade 7 Altruism's and Benevolence's posttest performances taught in Earth Science without and with the use of Science Leaderboard

Table 8

Independent Samples Test of Grade 7 Altruism's and Benevolence's posttest performances taught in Earth Science without and with the use of Science Leaderboard

		Equality of Variances (Levene Test)		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Standard Error Difference	Difference's 95% confidence interval	
									Lower	Upper
Scores	Equal variances assumed	.330	005	-15.283	98	.000	-13.900	.910	-15.705	-12.095
	Equal variances not assumed			-15.283	84.131	.000	-13.900	.910	-15.709	-12.091

Table 8 shows the independent samples of posttest performances of both sections, Grade 7 Altruism and Benevolence. It revealed in assumed equal variances that the calculated t-value was -15.283 and the p-value for this t-test was 0.000. It means that both posttests were significantly different from each other because the p-value was lower than the alpha value of 0.05. Obviously, Grade 7 Benevolence's posttest average mean score was 13.90 higher than to Grade 7 Altruism's score. For the confidence interval, the lower level was -15.705, and the upper level was -12.095, and it does not cross to 0, that means there was a difference. Cooperative learning has been shown in studies to help students learn more effectively and achieve higher academic achievement than other teaching methods (Johnson et al., 1985). Cooperative learning is often touted as a way to improve thinking skills and promote higher-order thinking (Slavin, 2013) that results to an increased academic performance of the students.

CONCLUSIONS

The following statements are based on the results of the study:

1. In the pretest, the two groups of students, one taught in Earth Science without using Science Leaderboard (Altruism) and the

other taught in Earth Science with Science Leaderboard (Benevolence), performed moderately. Grade 7 Benevolence slightly outperformed Grade 7 Altruism, according to the findings.

2. The findings of the pretest were used to compare the two groups at first. This indicates that the two sections were heterogeneous at the start of the study and that their overall performance was identical.
3. The posttest results for Grade 7 Altruism taught in Earth Science without the use of Science Leaderboard were better than the pretest results.
4. After using Science Leaderboard to teach Earth Science to Grade 7 Benevolence, their posttest results improved dramatically.

The posttest results for Altruism and Benevolence in Grade 7 were significantly different. Students who were taught using Science Leaderboard performed higher than students who were not taught.

RECOMMENDATIONS

The following suggestions were made because Science Leaderboard was found to be effective in teaching Earth Science to Grade 7 students at Bahile National High School in the School Year 2018-2019, as evidenced by the above-mentioned results:

1. Science teachers should consider and device creative cooperative learning techniques that are appropriate for students' learning needs.
2. The use of leaderboard should be considered as a cooperative teaching technique by teachers in every subject area because it improves student interest, encouragement, and attitude toward the lessons.
3. Administrators could host seminars or workshops to teach teachers how to incorporate Leaderboard into their Science lessons.
4. Future researchers may perform further research on the use of Science Leaderboard as a cooperative learning technique in learning to test its efficacy with a larger sample size, different grade levels, and different fields of Science to confirm the findings of this study.

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