

Effect of Carousel Strategy on the Academic Achievement in Earth and Space Science of Grade Six Pupils

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ABSTRACT

Science as a subject requires an accurate teaching approach to learn the science content and processes better. This study determined the effect of the carousel strategy approach on the academic achievement in earth and space science of grade six pupils. The pretest-posttest control group quasi-experimental design was employed in this study with two intact classes. One of these groups was the experimental group, wherein carousel strategy (CS) was employed; the other was the control group, wherein the conventional teaching approach (CTA) was used. Pretest and post-test achievement tests and the daily lesson log (DLL) in earth and space science were used as research instruments. The data were analyzed using descriptive and parametric statistics, including the independent samples *t*-test and paired samples *t*-test. The results indicated a significant difference between the pretest and post-test of the CS and CTA. The results also showed higher academic achievement of students in the CS group over the CTA group. This study concluded that the carousel strategy is an effective intervention and learning in Earth and Space Science.

Keywords: *academic achievement, carousel strategy, cooperative learning strategy, quasi-experimental design, and earth and space science*

INTRODUCTION

Science education in the Philippines aims to develop scientific, technologically, and environmentally literate Filipino learners. The Department of Education (DepEd) envisioned the science curriculum as learner-centered and inquiry-based, emphasizing the use of evidence in constructing explanations. The ideas and skills in the matter, living things, and their environment, force, motion, energy, Earth, and space were presented in spiral progression so that the school-age children could have a deeper and profound comprehension of key concepts and their applicability to real-world scenarios. Even though the planners of the science curriculum have crafted it intelligently and teachers were trained on the approaches they will employ in facilitating their lessons, elementary pupils still fell behind the expected outcome.

The Philippines' fifteen-year-old pupils scored lower in reading, mathematics, and Science than children in most countries and economies participating in the 2018 International Student Assessment (PISA) Program. The country's average scores in reading,

mathematics, and science were 340, 357, and 354, respectively. Out of the 79 countries, the Philippines settled at the bottom in reading while second to the last in Mathematics and Science. This means that the Philippines ranked poorly in the 2018 PISA, and over 80% of pupils in the country did not achieve a minimum level of reading competence, making it one of the countries with the highest proportion of low performers among PISA participants [Organisation for Economic Cooperation and Development (OECD), 2018].

Furthermore, according to the Bureau of Education Assessment of DepEd [(DepED-BEA), 2016], the National Achievement Test (NAT) in Science for Grade Six verified that some learning abilities were below the level of achievement. Based on the data, the mean percentage score (MPS) of the Division of Romblon in Science was 37.05% (S.Y. 2015-2016) and 29.76% (S.Y. 2016-2017). Concurrently, the MPS of the whole MIMAROPA region in Science during the S.Y. 2017-2018 was 30.94%. These data only showed that the MPS for three consecutive years was far behind the 75.00% national standard, describing a poor Science achievement level.

Unfortunately, there were also elementary grade pupils who were not motivated to participate in the lesson because they were not interested and bored and displayed behavioral problems during the teachers' course of instruction in Science. There were also times that during the giving of the teacher's formative assessment, pupils could not achieve the needed learning competencies of the day. Moreover, some

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pupils still have fairly satisfactory grades in Science, indicating that even frequent remedial classes and peer mentorship were not adequate to address the low-performance level in a given learning skill that did not fulfill expectations.

To address the issue, many strategies have been studied to improve the achievement of elementary students. According to Peniero and Toshihiko (2020), many instructional materials are used in teaching Science in the Philippines, such as textbooks, laboratory activities, activity sheets, and visual aids, where textbooks are commonly used references. These resources bring together and support instruction (Janovsky, 2019). Teachers work hard to provide quality and interesting methods but are still hooked on traditional approaches due to a lack of facilities. However, the teacher-centered approach, which usually uses blackboards and chalkboards, is still prevalent. Also, the additional functions of teachers hinder them from reviewing students' achievements (Peniero & Toshihiko, 2020).

The aforementioned facts become the basis of this research on the need for appropriate learning strategies to improve the academic achievement of grade six pupils. One solution to these problems is employing the carousel strategy (CS) as one of the newest trends in the K12 curriculum. This cooperative learning strategy is a communicative and interactive opportunity for pupils to get up and move around a room, similar to a carousel, and stop intermittently in each station to comment, discuss, and give ideas about the activities posted in each station inside the room.

The researcher intended to employ CS since it can improve pupils' thinking, social skills, camaraderie, communication skills, and knowledge. The implementation of CS can improve the students' higher-order thinking skills and the students' learning outcomes. There are numerous studies regarding the positive outcome of using CS. Owen and Thomas (2019) averred that pupils were very engaged in completing the activities at each workstation. The pupils demonstrated a high level of autonomy and responsibility for running the activity in each station. In general, Owen and Thomas (2019) found out in their study that pupils' levels of motivation and achievement when participating in the carousel activity were high.

At present, researchers have disputes regarding using CS as a pedagogical intervention in teaching and learning in a primary school. According to Lin (2013), student engagement in cooperative learning experiences like CS is also a barrier to teacher implementation. Teachers need to be aware that adopting the aforesaid strategy does not guarantee deep student engagement and cooperative learning instruction requires deep planning and consideration of student learning style.

Therefore, this study wants to determine if CS affects the academic achievement in Earth and Space Science of grade six pupils at Santa Fe Central Elementary School, Poblacion, Santa Fe, Romblon.

METHODOLOGY

Research Design

The researcher used the pretest-posttest control group quasi-experimental design because two intact classes were used while participants were not assigned randomly. Besides, Weirsmas (2006) stated that quasi-experimental is the design suggested to be appropriate in intervention studies done in a school setting. Furthermore, the aforesaid design is more practical in real life when dealing with groups like students who are already in classes.

The CS represents the experimental group, while CTA represents the control group. The AA1 represents the pretest achievement test in Earth and Space Science, while the post-test represents AA2 for the experimental and control groups. The CS intervention is represented as X, while CTA is represented as O (Table 1).

Table 1. The Research Design showing the Quasi-Experimental Design

Group	Pretest	Intervention	Post-Test
Carousel Strategy (CS)	AA1	X	AA2
Conventional Teaching Approach (CTA)	AA1	O	AA2

Where:
 AA1 pretest for achievement test
 X the experimental group for teaching the intervention (CS)
 O the control group for teaching the CTA
 AA2 post-test for achievement test

To reconcile the research gap, quantitative research design was used. The grade six pupils in experimental and control groups were given a pretest and a post-test to investigate whether there would be significant differences and increases between the CS and CTA groups. After the pretest was administered, the pupils under the CS group were given the CS intervention to facilitate the lessons in Earth and Space Science. In contrast, the control group was taught using CTA. Same teacher taught both groups in two consecutive periods for four weeks.

Research Locale and Time of the Study

This study was conducted in Santa Fe Central Elementary School, Barangay Poblacion, Santa Fe, Romblon. The preparation and construction of academic assessment multiple test items, daily lesson logs (DLL),

and the permit requests were done from October 2019 to December 2019, while the actual experiment was conducted from January 2020 to February 2020.

Population and Sample of the Study

The study included 60 grade six pupils who were allowed by their parents to participate. Thirty (30) from section Camellia and another 30 from section Carnation participated in the study. They belong to the Basic Education Curriculum with heterogeneous class grouping. The distribution of the population by section is shown in Table 2.

Table 2. Population and Participants of the Study

Sections	Population	Grouping
Camellia	30	Experimental (CS)
Carnation	30	Control (CTA)
Total	60	

Research Instruments

Achievement Test. A researcher-made test consisting of 50 items was administered to CS and CTA groups to determine the pupils' academic achievement before and after the study. A table of specifications was prepared following the revised Bloom's taxonomy of learning domains. The achievement test was developed covering the lessons in Earth and Space Science, particularly in the following learning competencies: describe the changes on the Earth's surface as a result of earthquakes and volcanic eruptions (S6ES-IVa-1), enumerate what to do before, during, and after an earthquake and volcanic eruption (S6ES-IVb-2), Describe the different seasons in the Philippines (S6ES-IVc-3), discuss appropriate activities for specific seasons in the Philippines (S6ES-IVd-4), demonstrate rotation and revolution of the Earth using a globe to explain day and night and sequence of seasons (S6ES-IVe-f-5) and compare the planets of the solar system (S6ES-IVg-h-6). Items in the academic assessment were distributed as follows: Remembering (17), Understanding (18), Applying (2), Analyzing (8), Evaluating (2), and Creating (3). The achievement test was a multiple-choice type in which each correct answer received one point. The same achievement test was used for pre and post-test.

Daily Lesson Log Incorporating the Carousel Strategy. Daily lesson log (DLL) is a format used by teachers to record portions of their lessons and activities. All teachers with at least a year of teaching experience who handle subjects with accessible learning materials or teaching guides must fill out daily lesson logs (DDL) every week (DepEd, 2016). The DepEd supports the role of K12 teachers as facilitators of learning; therefore, using DLL allows teachers to reflect on what learners need to learn, how to learn, and how best to facilitate the

teaching, learning, and assessment process. The DLL covers a day or weeks' worth of teaching and contains the objectives, content, learning resources, procedures, remarks, and reflection.

Carousel Strategy. The CS, in the context of the experiment, featured a cooperative learning strategy wherein pupils worked in small groups. The teacher started the lesson by eliciting, reviewing previous lessons, and presenting the new lesson. Then, engaged the curiosity and interest through asking questions, presenting pictures or illustrations, and conducting guessing games.

Moreover, the teacher employed the CS in the exploring part of the lessons, wherein pupils were given opportunities to work together and build concepts through their first-hand experience. Pupils were grouped into four. Each group was assigned to each station where simulation, puzzles, describing activity, and answering questions were performed. The group members discussed each task and wrote their ideas using a colored marker or post-its. Then, the group moved from one station to another as they heard the music timer. In addition, each group received a chart paper with ideas of the four groups. The group members collaboratively summarized the thoughts and ideas written and posted by the other group. The summarized ideas were posted in their respective station before moving to the next station to see and read the output of other groups. This part of the lesson lasted for 16 minutes. The teacher then further explained the lessons by processing the outputs made by each group to help the pupils build the lesson's concept and knowledge. This was done by asking questions and adding information to elaborate the lessons and apply their learnings. The teacher also did the extended part of the lesson wherein pupils applied what they had learned. Finally, a short formative evaluation was given to check pupils' mastery of the lesson. This is a five-item multiple-choice or enumeration test at every lesson's end. Results were checked and recorded but not graded to assess if the students had mastered the competencies of the day.

In CTA, the usual way of teaching-learning was followed wherein the lessons in Earth and Space were taught. Students in this group received the same instruction as in the CS following the context of DLL, incorporating the 7E's: elicit, engage, explore, explain, elaborate, extend, and evaluate. During the exploring part, the students were grouped into four, each given the same task. Members of the group worked independently and lasted for 16 minutes.

Validation and Reliability of the Research Instruments

The content of the research instrument was validated with the assistance of master teachers working at the elementary school with ten years in the service.

They were consulted to determine whether the points were clear and grammatical mistakes were present in the instrument. The suggestions were incorporated into the revised form in consultation with the researcher's adviser. The instrument was pilot tested among grade seven pupils of Santa Fe National High School during the S.Y. 2019-2020. The data from the pilot test were used to calculate the instrument's internal consistency, which was used to see if all the items in the questionnaire measured the same thing. Cronbach's alpha was used to measure the reliability of the research instrument. According to the data analysis, the test was valid, and its test characteristics are within the permitted range values for index discrimination of 0.43 and index of difficulty of 0.60. Furthermore, the achievement test's reliability score is 0.80, indicating that the instrument is excellent and reliable.

Data Collection Procedure

The study procedure involved three phases: the pre-activity phase, the experimental phase, and the post-activity phase. The pre-activity phase consisted of a given pretest on Earth and Space Science to assess the pupils' academic performance before the conduct of the study. The experimental phase is characterized by using CS in the CS group, scheduled from 7:00 to 7:50 in the morning. The traditional teaching method, including lectures and discussion, was scheduled during 7:50 to 8:40 in the morning and was used in the CTA group. The post-activity phase was conducted by administering post-tests on both CS and CTA groups. The results of the pretest and post-test of the two classes were analyzed. Table 3 shows the specific dates and activities of data collection.

Table 3. Schedule of Data Collection Activities

Date	Data Collection Activities	
	CS	CTA
A. Pre Activity Phase		
October 28-30, 2019	Preparation of Daily Lesson Log for CS and CTA Group	
November 10, 2019	Sending Letter of Permissions to Conduct Study	
November 11, 2019	Crafting of Achievement Test with TOS	
January 6, 2020	Validating the Achievement Test with TOS	
January 8, 2020	Pilot Testing of Achievement Test	
January 16, 2020	Orientation to Pupils on the conduct of study	
January 17, 2020	Conducting Achievement Test (Pretest)	
B. Experimental Phase		
	7:00 AM-7:50AM	7:50AM-8:40AM
January 20-24, 2020	Lesson 1 to Lesson 5	Lesson 1 to Lesson 5
January 28-31, 2020	Lesson 6 to Lesson 10	Lesson 6 to Lesson 10
February 3-7, 2020	Lesson 11 to Lesson 15	Lesson 11 to Lesson 15
February 10-14, 2020	Lesson 16 to Lesson 20	Lesson 16 to Lesson 20
C. Post Activity Phase		
February 17, 2020	Conducting Achievement Test (Posttest)	
February 19- April 2020	Data Processing and Analysis	

Data Analysis

In this study, the researcher used a quantitative data analysis technique using the Statistical Package for Social Sciences (SPSS) program. The mean and standard deviation were used to determine the level of academic achievement in Earth and Space Science of grade six pupils in both CS and CTA groups using the results of the pretest and post-test. On the other hand, the paired sample *t*-test was used to determine the significant difference in the pretest and post-test, and the post-test mean gain achievement of the pupils of Earth and Space Science under the CS and CTA. Lastly, paired

sample *t*-test was used to compare both groups' significant increase in pretest and post-test achievement.

RESULTS AND DISCUSSION

Table 4 shows the descriptive statistics of pupils' academic achievement, measured by the number of correct responses on the 50-item achievement test developed by the researcher. The table presented the increase in post-test mean scores of pupils in the CS group ($M = 14.70$) compared to those in the CTA group ($M = 2.13$). The result denoted a more proficient

performance shown by the CS pupils in their academic achievement compared to the CTA group. Across groups, a slight difference of 0.80 on their pretest mean scores were found. After the intervention, the CS group obtained higher post-test score ($M = 30.70$, $SD = 5.09$) than the CTA group ($M = 17.33$; $SD = 4.03$). Both groups showed an increase from pretest to post-test. However, the CS group consistently scored higher and has improved their mastery level than the group taught with CTA, which has low improvement.

Table 4. Academic Achievement of Grade Six Pupils Exposed to Carousel Strategy (CS) and Conventional Teaching Approach (CTA).

Group	Mean	SD	Mean Percentage Score	Description
CTA Group				
Pretest	15.20	4.00	30.40	Low
Posttest	17.33	4.03	34.66	Low
CS Group				
Pretest	16.00	4.50	32.00	Low
Posttest	30.70	5.09	61.40	Average

An examination of the findings in Table 5 reveals that the results of the independent sample t -test for the pretest academic achievement of the CS and CTA group did not show a significant difference ($F(58) = .520$, $p = 0.47$). This means that both groups have the same level of achievement prior to the experiment.

Table 6 illustrates the results of the independent sample t -test of the post-tests in CS and CTA groups which revealed a statistically significant difference, $F(55) = 2.870$, $p < .01$. It means that there is a significant difference between the post-test academic achievement of grade six pupils exposed to CS and CTA in facilitating Earth and Space Science lessons. The result also shows that the pupils under the CS group produced a more significant overall improvement in post-test academic achievement in Earth and Space Science. The study of Doymus (2008) discussed that pupils taught using the carousel strategy have more significant achievements in Earth and Space Science than those taught through the traditional teaching approach. The result of this study is also consistent with the findings of Sahin (2010), which show that cooperative learning leads to improved academic performance.

Comparing the participants' pretest and post-test academic achievement, Table 7 shows a significant difference between the pretest and post-academic achievement of the pupils in the CS group ($t(49) = 11.91$, $p = 0.00$). Based on the results obtained, it could be argued that CS significantly increased pupils' academic achievement in the CS group. This could be due to the teacher's ability to design a series of

measurable activities in carousel strategy. This study is supported by Owen and Thomas (2019) who affirmed that the carousel strategy illustrated a pupil-centered approach since they put pupils at the heart of their learning and give them locus of control. So, the learners' attention and interest captured such presentation, thus, improved pupils' performance. Also, Avisteva (2017) found out that because pupils have the opportunity to contemplate and revise their responses before presenting them, the carousel activity engages them. This statement further agrees with what Joni (2015) concluded: through the implementation of the carousel activity, pupils academic achievement achieved a fairly positive impact. Agreeing with this, Yusmanto et al. (2017) revealed that the carousel strategy can improve students' learning outcomes.

Table 8 reveals a significant difference between the pretest and post-test academic achievement scores of pupils in the CTA group ($t(29) = 2.33$, $p = 0.03$). This denotes a significant increase between the pretest and post-test achievement of grade six pupils exposed to CTA in Earth and Space Science.

Table 9 shows the result of the independent sample t -test applied to compare the post-test mean gain of pupils in the CS and CTA groups. The table discloses a statistically significant difference ($t(58) = 8.18$, $p = 0.00$). This indicates that grade six's mean gain achievement exposed to CS and CTA in Earth and Space Science are significantly different. It also indicates that the CS group's mean academic achievement is higher than the CTA group. Owen and Thomas (2019) support this finding and found that CS has positively impacted pupils' learning outcomes. Consequently, Avisteva (2017) found out in his study that pupils become more active during the CS since pupils work in groups to improve their critical thinking skills about previous learning and generally improve their achievement. Thurston et al. (2010) also found that the quasi-experimental investigations he analyzed found any statistically significant detrimental effects on pupils' academic achievement. Below are some of the pupils' reflections about carousel strategy:

“Ang ganda ng Carousel Strategy na ginamit ni Ma'am sa kanyang pagtuturo dahil napaisip ako sa mga gawain sa bawat istasyon. Madali akong natuto sa ganitong pamamaraan ng pagtuturo”.

(The teaching approach used by Ma'am was absolutely great because it helped me think of the varied activities in each station. I learned a lot every time Carousel Strategy was used.)

“Ang pamamaraan sa pagtuturo na ginamit ng aming guro ay hindi boring. Ako ay nagaganyak

na makisali sa talakayan sa klase. Mas marami kaming ginawa kaysa sa kanya.”

(The teaching approach employed by my teacher was not boring. It motivated me to participate in the class discussion. We have done a lot than the teacher did.)

“Mas lalong nahasa ang aking pag-iiisip, pakikibahagi at ang pakikipagtalakayan sa aking kaklase dahil sa pinakitang makabagong paraan ng pagtuturo, ang Carousel Strategy.”

(The way I think, share and discuss with my classmates were sharpened and enhanced because of Carousel Strategy.)

“Naibahagi ko ng malaya ang aking ideya tungkol sa paksa gamit ang mga makukulay na papel at panulat. Masaya kong naibahagi ang aking nalalaman sa mga miyembro ng pangkat. Excited akong pumasok at matuto dahil sa

Carousel Strategy na ginagamit ng aming guro.”

(I have shared freely my thoughts using the colored marker and post its. I am happy sharing all the things I've learned with my classmates. I am also excited to go to school and learn because of the carousel strategy that was used by the teacher.)

“Dati-rati ako ay nahihiyang tumayo at makisalamuha sa talakayan sa klase. Noong ginamit ng aking guro ang Carousel Strategy sa kaniyang pagtuturo, ako ay tuwang tuwa dahil nagkaroon ako ng pagkakataong mag-isip at maibahagi ang aking opinyon.”

(I am shy to stand and participate in the class discussion. I am very much a glee with glow every time the teacher employed the carousel strategy in our class.)

Table 5. Result of Independent Sample *t*-test on the Difference between the Pretest on Academic Achievement of the Pupils in Earth and Space Science for both groups.

Group	Levene's Test for Equality of Variances		t-test for Equality of Means			Interpretation	Decision
	F	Sig.	T	df	Sig. (2-tailed)		
Pre-test of CTA Group and CS Group	Equal variances assumed	.520	.474	-.728	58	.470	Not Significant Accept Ho

Table 6. Result of Independent Sample *t*-test on the Difference of the Post-test Academic Achievement of Pupils in Earth and Space Science for Both Groups.

Group	Levene's Test for Equality of Variances		t-test for Equality of Means			Interpretation	Decision
	F	Sig.	T	df	Sig. (2-tailed)		
Post-test of CTA Group and CS Group	Equal variances not assumed	2.870	.096	-11.283	55.109	.000	Significant Reject Ho

Table 7. Results of the Paired *t*-Test to Compare the Pretest and Post-test Academic Achievement of Pupils in Earth and Space Science of Carousel Strategy Group.

Category	N	Mean	MD	t	df	Sig. (2-tailed)	Interpretation	Decision
Post-test of Control Group Using Carousel Strategy	30	30.70	14.700	11.91	29	.000	Very Significant	Reject Ho
Pre-test of Control Group Using Carousel Strategy	30	16.00						

Table 8. Results of the Paired Sample *t*- Test to Compare the Pretest and Post-test Academic Achievement of Pupils in Earth and Space Science of Conventional Teaching Approach (CTA) Group.

Category	N	Mean	MD	T	df	Sig. (2-tailed)	Interpretation	Decision
Post-test of Control Group Using Conventional Teaching Approach	30	17.33						
			2.13	2.333	29	0.027	Significant	Reject Ho
Pre-test of Control Group Using Conventional Teaching Approach	30	15.20						

Table 9. Results of Independent Sample *t*-Test on the Post-test Mean Gain of Academic Achievement of Pupils in Earth and Space Science for Both Groups.

Group	N	Mean Gain	Levene's Test for Equality of Variances		t-test for Equality of Means			Interpretation	Decision	
			F	Sig.	t	df	P			
Mean Gain Post	CS	30	14.23	0.886	0.350	8.183	58	.000	Very Significant	Reject Ho
	CTA	30	1.87							

CONCLUSION

Using a quasi-experimental research design, this study examined the effect of the carousel strategy on the academic achievement of grade six pupils in Earth and Space Science. Because of the collaboration that occurs during learning activities such as receiving help from classmates, influencing peers, modeling, observing, and interacting with others, which are typical features of social and cultural theories of learning, the carousel strategy has been found to be effective in teaching earth and space science topics. This strategy has the potential to provide an engaging and interactive way of facilitating science lessons. It can also make science lessons more meaningful and enjoyable, as well as motivate and engage students throughout the lesson. It is suggested that this strategy be investigated and documented in other disciplines.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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