Technology-Based Learning Approach and Academic Performance of Grade 8 Students in Science During Pandemic

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ABSTRACT

The general objective of this study was to determine the effect of technology-based learning approach on the academic performance of Grade 8 students in Science during the COVID-19 pandemic. A pre-test-post-test research design was employed, and 90 students served as the respondents of the study. Mean percentage score (MPS) and t-test were used to describe the collected data and further draw conclusions. Prior to the experiment, both experimental group and control group had the same level of academic performance in Science. Students in the experimental group significantly increased their level of academic performance after being exposed to the technology-based learning approach using video lessons. Students in the control group subjected with the modular learning approach employing self-learning module also increased their academic performance. However, the mean gain scores of experimental group were significantly higher than the control group. Thus, the use of technology-based learning approach was more effective than the use of modular learning approach in improving students' academic performance in Science.

INTRODUCTION

Rapidly increasing technologies have posed serious challenges to the entire world, particularly in developing countries such as the Philippines, which are really making an extensive effort to keep up with rapid social development. Managing technological development entails not only acquiring and improving advanced equipment and modern technology, but also the knowledge and skills required to meet the demands of a highly competitive and scientific society (Criswell & Greg, 2018; Abo, 2023).

Due to the cyclical movement of globalization, the primary concern of the Department of Education (DepEd) is the quality of science education. In the midst of the COVID-19 pandemic, using a modular learning approach and a technology-based approach to assist public schools in navigating the maze of new normal classrooms while maintaining quality education is highly desirable. Teachers have been forced to implement alternative teaching methods, such as creating video lessons, crafting instructional modules, and designing appropriate teaching methods and pedagogies, as a result of the massive school closures caused by the COVID-19 pandemic on March 15, 2020, and classes being postponed until October 5, 2020. Online classes, homeschooling strategies, minimal personal interaction between teachers and students, and other non-physical teaching methods are desired for the School Year 2020-2021 (Abdullah, 2020).

As a result, it is very necessary to investigate the effect of technology-based learning approach using video lessons and modular learning approach employing self-learning modules on students' academic performance during this COVID-19 pandemic.

Statement of the Problem

This study determined the effect of technology-based learning approach using video lessons and modular learning approach employing self-learning module as the two major delivery modes of instruction during COVID-19 pandemic to improve Grade 8 students' academic performance in Science at Esperanza

National High School, Esperanza, Sultan Kudarat, Philippines.

Specifically, this study answered the following questions:

1. What is the level of the academic performance of Grade 8 students in the pre-test and post-test of the experimental group and control group?
2. Is there a significant difference in the pre-test and post-test scores of the experimental group and control group?
3. Is there a significant difference in the mean gain scores of the experimental group and control group?

METHODOLOGY

Research Design

The study utilized a pre-test-post-test design to determine the effect of technology-based learning approach on the academic performance of Grade 8 students in Science during the COVID-19 pandemic.

Respondents of the Study

The respondents of this study were the selected 90 Grade 8 students of Esperanza National High School. Further, two sections of Grade 8 students (45 students per section) were the final respondents to test the effect of technology-based learning approach on their academic performance.

Data Gathering Methods

A researcher-made test was employed to describe the extent of Grade 8 students' academic performance in Science. Academic performance of students were determined using their pre-test and post-test scores which were converted into mean percentage score (MPS) and were dichotomously categorized, described and interpreted following the criteria adopted from National Educational Testing Research Council (NETRC).

Mean Percentage Score (MPS)	Descriptive Rating
96 – 100	Mastered (M)
86 – 95	Closely Approaching Mastery (CAM)
66 – 85	Moving Towards Mastery (MTM)
35 – 65	Average Mastery (AM)
15 – 34	Low Mastery (LM)
5 – 14	Very Low Mastery (VLM)
0 – 4	Absolutely No Mastery (ANM)

RESULTS AND DISCUSSION

This section presents, analyses and interprets data categorically arranged according to the order of the statement of the problem.

Academic Performance of Grade 8 Students in Science

Tables 1 and 2 present the level of academic performance of the experimental group and control group before and after the experimentation.

Table 1. Level of Academic Performance of Students in the Experimental Group
Before and After the Experimentation

Topics	Before		After	
	MPS	Description	MPS	Description
Law of Inertia	25.86	LM	91.07	CAM
Law of Acceleration	24.74	LM	88.23	CAM
Law of Interaction	23.09	LM	87.86	CAM
Overall MPS	**24.56**	**LM**	**89.05**	**CAM**

Legend:

96 – 100	Mastered (M)
86 – 95	Closely Approaching Mastery (CAM)
66 – 85	Moving Towards Mastery (MTM)
35 – 65	Average Mastery (AM)
15 – 34	Low Mastery (LM)
5 – 14	Very Low Mastery (VLM)
0 – 4	Absolutely No Mastery (ANM)

As shown, Grade 8 students' academic performance in the experimental group improved from Low Mastery (LM) to Closely Approaching Mastery (CAM), with pre-test and post-test mean percentage score (MPS) of 24.56 percent and 89.05 percent, respectively. This indicates that students' exposure to a technology-based learning approach through video lessons assisted them in mastering the first quarter lessons in Grade 8 Science.

Gegone (2020) had a similar research finding in which students exposed to reciprocal peer tutoring performed better after the experimentation than the control group subjected to traditional method of instruction. He suggested that Science teachers should expose their students to various modern collaborative learning approaches that are supplemented with contextualized instructional materials (IMs).

Table 2. Academic Performance of Students in the Control Group
Before and After the Experimentation

Topics	Before		After	
	MPS	Description	MPS	Description
Law of Inertia	25.90	LM	80.02	CAM
Law of Acceleration	23.98	LM	75.15	CAM
Law of Interaction	24.07	LM	81.23	CAM
Overall MPS	**24.65**	**LM**	**78.80**	**CAM**

Legend:

96 – 100	Mastered (M)
86 – 95	Closely Approaching Mastery (CAM)
66 – 85	Moving Towards Mastery (MTM)
35 – 65	Average Mastery (AM)
15 – 34	Low Mastery (LM)
5 – 14	Very Low Mastery (VLM)
0 – 4	Absolutely No Mastery (ANM)

As shown, the pre-test of students in control group acquired an overall MPS of 24.65 percent, which was classified as Low Mastery, and the post-test registered a mean percentage score (MPS) of 78.80 percent. This implies that students in the control group had no prior knowledge of the topics covered in the first quarter.

However, after being exposed to the modular learning approach, their academic achievement improved from Low Mastery (LM) to Moving Towards Mastery (MTM).

Although, both experimental group and control group registered an increase in the level of academic performance, the former had a higher increase of learning output and it was attributed to the fact that students in the experimental group were motivated to study their lessons which were aided by video lessons.

This research finding is consistent with Simpal's (2020) study, which found out that the control group had a low performance in Physics prior to the conduct of his experiment. Gegone (2020) backs up the preceding data and found out that students in the control group had very little knowledge of Science topics before he began the experimentation stage of his study. The two researchers agreed that receiving low pre-test scores is a common occurrence in experimental research since most students are unfamiliar with the topics.

Analysis on the Academic Performance of Grade 8 Students in Science Before and After the Experimentation

Tables 3 and 4 present the t-test analysis on the academic performance of Grade 8 students in Science before and after the experimentation.

Table 3. t-test Analysis on the Academic Achievement of Students Before and After Experimentation

Leaning Modalities during Pandemic	Before	After	$t_{computed}$	$t_{critical}$	p-value
Technology-Based Learning Approach	24.56	89.05	34..867	1.988	0.000
Modular Learning Approach	24.65	78.80	15.057	1.988	0.000

*- significant @ 0.05 level

The results revealed that the academic performance of students exposed to technology-based learning approach increased significantly from 24.56 percent to 89.05.62 percent, as denoted by the computed t-value of 34.867 which is greater than the critical t-value of 1.988 (p-value = 0.000 < 0.05). The academic performance of students subjected with modular learning approach improved significantly from 24.65 percent to 78.80 percent, as evidenced by the computed t-value = 15.057 that is greater than critical t-value = 1.98 (p-value = 0.000 < 0.05).

This finding implies that students' exposure to the two different learning modalities improved their academic performance. This study is consistent with the findings of Paghubasan (2017), who found out that students in the experimental group improved their performance and retention after being exposed to game-based and activity-oriented instruction. She also concluded that, while both traditional instruction and game-based and activity-oriented instruction improved students' performance and retention, the experimental group had a higher mean gain score than the control group.

Table 4. t-test Analysis on the Mean Gain Scores of Experimental Group and Control Group

Groups	Mean Gain Scores	$t_{computed}$	$t_{critical}$	p-value
Experimental Group	64.49	28.243*	1.988	0.000
Control Group	54.15			

* - significant @ 0.05 level

The computed t-value = 28.243 is greater than the critical t-value = 1.98 (p-value = 0.000 < 0.01), signifying that the technology-based learning modality was more effective than the modular learning modality

during pandemic. This implies that the practical work activities in the video lessons significantly improved students' academic performance in Grade 8 Science.

Simpal (2020) backs up the above research findings. He concluded that students who were subjected with traditional instruction made little progress in problem-solving performance when compared to students who were exposed to computer-assisted instruction.

This study supports the ideas of Abdullah (2020) and Paculanan (2013), who emphasized that modern teaching approaches and learning materials allowed students to apply principles taught in schools to real-world situations in the community. They also stated that students should be encouraged to use modern technology so that they do not become ignorant of newly invented devices and mobile applications in the modern world.

Previous tables strongly confirmed that the academic performance of Grade 8 students in Science significantly improved due to technology-based learning approach using video lessons. Gegone (2020) affirmed this finding when he recommended that Chemistry and Physics teachers should employ interactive video lessons in delivering lessons so that students can experience the best learning opportunities despite the COVID-19 pandemic. He further stressed that modular learning approach should be intertwined technology learning approach so that students of different learning interests can choose the best learning opportunities.

As emphasized by Simpal (2020), improving the problem solving skills and attitudes of students in Physics and Chemistry can be done through modern teaching approach accompanied self-paced learning materials that encourage independent and collaborative learning. Paculanan (2013) added that attitudes of students in Mathematics and Science can be enhanced through technology-related instruction.

In relation to the above finding and to enhance learners' representational knowledge and skills, classroom facilitators themselves need to be confident, expert and competent in localizing instructional materials which are in consonance with the interest of the students. Technology learning approach using video lessons are very relevant to this blended learning modalities. Aman (2020) reported that students' difficulties can be lessened with the use of self-instructional modules.

Thus, this present study is in response to the demand of the 21st century skills in which teachers should serve as facilitators of learning and be proficient enough to employ modern teaching approaches to develop the 21st century skills of students and to be not behind with the demands of the global market of competencies and skills.

Conclusion

Students in both experimental group and control group had no prior knowledge of the first quarter lessons in Grade 8 Science before the experimentation began. Both groups significantly improved their academic performance after being exposed to technology-based learning approach and modular learning approach during pandemic. Further, the experimental group's mean gain scores were significantly higher than the control group. This implied that the technology-based learning approach using video lessons was more effective than the modular learning approach during the pandemic.

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