

VIDEO-ASSISTED LEARNING AND ACADEMIC PERFORMANCE OF FOURTH-GRADE SCIENCE STUDENTS

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ABSTRACT: This study aimed to investigate the relationship between the inquiry-based approach with video lessons and academic performance in Science among Grade 4 learners at a Philippine central school. The study utilized a quasi-experimental design with a pretest-posttest control group. In the experimentation, two groups were formed. The experimental group was exposed to the inquiry-based approach with video lessons, while the control group was exposed to the inquiry-based approach without video lessons. Then, the mean pretest and posttest scores were recorded, and the mean gain score was calculated for each group. The results showed a significant difference between the mean post-test scores and the mean gain scores of both groups. These findings suggest that the inquiry-based approach with video lessons is effective in improving the academic performance of Grade 4 learners in Science. The use of video lessons provides a significant advantage over the inquiry-based approach without videos. This further implies that video lessons are an essential component in the inquiry-based approach to achieving better academic performance in Science. The study highlights the importance of inquiry-based learning in Science education and its potential to develop 21st-century skills among learners. It also emphasizes the need for teachers to use varied teaching strategies.

Keywords: Inquiry-based approach, Video lessons, pre-service teachers, Science Education

1. INTRODUCTION

One of the challenges of the Department of Education (DepEd) is the inferior quality of science education, which is evident in the low academic performance of Filipino students in Mathematics and Science compared with students from other countries. As part of the Quality Basic Education reform plan and as a step towards internationalizing Philippine primary education, the Philippines officially joined the Organization for Economic Co-operation and Development's (OECD) Programme for International Student Assessment (PISA) in 2018. Results revealed that the Philippines scored 353 in Mathematics, 357 in Science, and 340 in Reading, all below the average of participating OECD countries [1]. The OECD (2019) reported that the performance of the Philippines in Science was ranked 78th out of 79 participating countries in the 2019 Programme for International Student Assessment (PISA), demonstrating the need for enhanced Science education in the nation. Asians are the ones topping the Trends in International Mathematics and Science Study (TIMSS). These include the country's East Asian neighbors like Singapore, Taiwan, South Korea, Hong Kong, and Japan [2]. The same report also showed that in the 1999 TIMSS report, the Philippines ranked 36th in Science out of 38 countries tested. By 2003, the country yielded similar devastating results in the same study, ranking 23rd among 25 countries in Grade 4 Science.

Also, The Philippines ranked 42nd in 2nd year Science for high school level among 45 countries. The results of the 2015 TIMSS assessment showed that Asian nations like Singapore, Korea, Japan, Hong Kong, and China continue to dominate the top ranks [3]. The latest TIMSS results in 2019 revealed that among 58 countries, the Philippines ranked last in Grade 4 Math and Science. The country scored 297 in Math and 249 in Science, which is lower than the scores in 2003 [4]. According to former Education Secretary Leonor Briones, the results of the National Achievement Test (NAT) for Filipino children "gravitate towards the low proficiency levels," particularly in

Science, Math, and English [5]. For three successive school years, NAT results for elementary public schools showed that Science got the lowest mean percentage scores (MPS) among other subjects [6]. For the school year 2012-2013, the MPS was 58.46 %, and for 2013-2014, it was 69.95. Both scores indicated low performance in the subject. For the school year 2014-2015, the MPS increased to 81.06, but still the lowest among the five subjects.

The use of video courses is one of many recent initiatives of DepEd in the region. In the Leyte Division, a production team was formed to create video lessons that included science topics. Aral TV is a project of the DepEd Leyte Division in collaboration with PRTV 12 Tacloban, a local TV station. Through this initiative, Leyte Division has assisted learners in completing their modules and learning activity sheets during the pandemic.

Despite those initiatives, knowing that complex concepts are hard to understand for elementary learners, it is therefore advisable for teachers to make interventions in the teaching-learning process. One of these interventions could be the use of technology such as simulations, interactive media, and video presentations to deliver the lesson, resulting in meaningful learning, in addition to inquiry-based learning, which is often used in teaching science concepts. As a primary science teacher at a central school, the researcher had first-hand experience with the poor performance of fourth graders in terms of human body systems. The mean percentage scores during the second quarter indicate that they struggle to understand abstract concepts. Learning is not maximized, maybe due to many factors, such as the teaching strategies utilized by the teacher. Magtolis's [7] study about students' conception of human organ systems showed that most learners could identify the internal organs but could not indicate their relationship. Some learners even placed the organs randomly [8].

Given these challenges, it is necessary to investigate efficient teaching techniques, including video lessons, to enhance

science education in the Philippines. Thus, this study was conceptualized to determine the effectiveness of ICT-assisted instruction, specifically video lessons, in helping fourth graders better understand human anatomy concepts. The study will specifically investigate if the video lessons could raise learners' academic achievement in Science and increase their motivation and involvement.

2. MATERIALS AND METHODS

This study used a quasi-experimental design since some of the variables were beyond the researcher's control. Specifically, a non-equivalent control group design was utilized in this investigation. In this study, the use of video lessons to teach concepts about human anatomy was examined to see how well ICT-assisted instruction works. Two groups of Grade 4 pupils were given a pre-test and a post-test in Science. Classes 1 and 2 were assigned randomly as experimental and control groups, respectively. ICT-assisted instruction utilizing video lessons instruction was administered to the experimental group by exposing them to multimedia presentations such as simulations and interactive media about topics concerning the body's major organs such as bones, muscles, stomach, intestines, kidneys, heart, and brain. Videos were shown on the explanation and elaboration part of the lesson in the 7Es Learning Model. The control group was taught the same topics through inquiry-based learning; however, they were not exposed to multimedia presentations or videos.

The participants of the study were Grade 4 learners from a central school. This study utilized a researcher-made Science Achievement Test (SAT) as a pre-test and post-test. This test comprises elementary Science competencies in Grade 4, specifically skills on the parts and functions of the body's major organs: bones, muscles, stomach, intestines, kidneys, heart, and brain. To test the validity and reliability of the test, the researcher conducted a pilot test on thirty (30) learners from 2 different schools. As part of the process in the item analysis, each item was analyzed for its difficulty and discrimination index. Through discriminant analysis, the researcher selected the final 40 items for the pre-test and post-test out of the 80 items.

Lesson plans were submitted to the Master Teachers and Grade 4 Science teachers for critiquing and content validation using a standardized validation tool from DepEd. The lesson plans for both groups followed the 7 Es Learning Cycle Model: elicit, engage, explore, explain, elaborate, evaluate, and extend. The video lessons were integrated during the elaboration phase of the lesson to enhance the fourth graders' learning further. These video lessons were downloaded from DepEd Aral TV and YouTube. In the videos, some virtual teachers discussed topics using multimedia presentations.

These videos were also interactive, allowing learners to engage in the activities actively.

For the pre-experimental stage, both groups of learners were given the validated Science Achievement Test as the pre-test. In the experimental stage, the selected Grade 4 Science teacher carried out the developed lesson plan incorporating videos in delivering the lessons to the Grade 4 pupils under the experimental group. On the other hand, for the control group, inquiry-based learning without the use of videos was utilized by the same teacher. Only one Grade 4 Science teacher handled both classes under study. During the post-experimental stage, the achievement test was administered to the two groups of learners as a post-test. The data collected from the pre-test and post-test were analyzed using descriptive and inferential statistics through the Statistical Package for the Social Sciences (SPSS) software. The raw data were fed into the software, and statistical results were generated. Statistical analysis showed that for the pre-test scores, the data revealed a normal distribution curve indicating the use of parametric tests such as the t-test for independent samples to determine if there is a significant difference between the mean pre-test scores of learners exposed to video lessons and to those learners who were not exposed to the video lessons. If the p-value is less than or equal to alpha at a 0.05 level of significance, then the null hypothesis is rejected.

However, for the post-test results, statistical analysis revealed a non-normal distribution of data, indicating the use of a non-parametric test as the statistical tool to determine whether the null hypotheses will be rejected or accepted. Specifically, the Mann-Whitney U Test was utilized to test if there was a significant difference between the mean pre-test and post-test scores of learners from the two groups. This non-parametric test can be used to determine if two sampled groups belong to the same population in a manner conceptually similar to the t-test. The Mann-Whitney U frequently proves to be more appropriate when data do not adhere to the t-test's parametric assumptions [9]. The test does not assume any properties regarding the distribution of the dependent variable in the analysis [10]. This makes the Mann-Whitney U-test the appropriate statistical test to use when analyzing dependent variables on an ordinal scale.

3. RESULTS AND DISCUSSIONS

This chapter presents the analysis and interpretation of the data obtained following the six-week delivery of Science classes to fourth graders, with one group exposed to video lessons and the other not.

3.1 Performance Level of the Grade 4 Learners in Science (Pre-test)

The mean pre-test scores, shown in Table 1, assessed the performance level of Grade 4 Science learners.

Table 1 shows the pre-test scores and MPS scores of the fourth graders, with one group exposed to video lessons and the other group not exposed to video lessons. The mean pre-test score for the group without video lessons was 11.25, with a standard deviation of 5.55, while the mean pre-test score for the group with video lessons was 11.88, with a standard deviation of 3.70. For the MPS scores, the score of the control group was 29.69, with a standard deviation of 9.24, while the experimental group's score was 28.13, with a standard deviation of 13.88. There is a slight difference in the mean pre-test scores of the two groups. The group exposed to inquiry-based learning with video lessons exhibited slightly higher mean pre-test and MPS scores than those without video lessons.

The results indicate that both groups had mean pre-test scores below 50%, suggesting that they were initially performing below average. This is based on the qualitative description provided by the DepEd, which categorizes mean percentage scores below 50% as indicative of low-performing students. It is important to note that the pre-test was administered before the delivery of the Science lessons, indicating that the learners had limited knowledge of the concepts at the beginning of the study.

The Department of Education has established the following performance levels for learners based on the mean percentage score:

Mean Percentage Score	Qualitative Description
75%-100%	High Performing
51%-74%	Average Performing
50% and below	Low Performing

3.2 Performance Level of the Grade 4 Learners in Science (Post-test)

The performance level of Grade 4 learners in Science was

Table 1

Mean Scores of Fourth Graders Exposed to Inquiry-based Learning with and without Video Lessons.

Scores	Group Without Video		Group With Video	
	M	SD	M	SD
Pre-test scores	11.25	5.55	11.88	3.70
MPS	28.13	13.88	29.69	9.24
Post-test scores	26.98	6.07	35.28	5.28
MPS	67.44	15.19	88.19	13.14
Mean Gain Score	15.73	4.04	23.40	4.5

Legend: M=mean,SD=standard deviation

further evaluated through the mean post-test scores, as shown in Table 1. The performance levels of the two groups based on the post-test results were compared based on their post-test scores and Mean Percentage Scores (MPS). The results indicate notable differences in the mean and standard deviation values of the two groups. Based on the results in Table 1, the learners who watched video lessons got an MPS of 88.19 %, which denotes a high level of achievement in Science. Those who were not exposed to videos got an MPS of 67.44 %, indicating that their performance was only average. These findings suggest that the group with video

lessons had a higher level of performance than the group without video lessons.

3.3 Mean Gain Scores of Learners with and without Exposure to Video Lessons

The experimental group of this study was exposed to inquiry-based learning with video lessons for six weeks. The post-test was administered to the two groups of Grade 4 learners after the six-week teaching duration. The performance level of Grade 4 learners in the pre-test and post-test is shown in Table 1. The percentage scores and the corresponding gain for the experimental and control groups exposed to inquiry-based learning with and without video lessons are also

Table 2

Difference Between the Pre-test and Post-test Scores Within the Group

Variable	Pretest		Posttest		Wilcoxon Test	p-value	Decision
	M	SD	M	SD			
Inquiry-Based Learning Without Video Lessons	11.25	5.55	26.98	6.07	-5.52	<0.001	Significant
Inquiry-Based Learning With Video Lessons	11.89	3.70	35.28	5.28	-5.52	<0.001	Significant

Legend: M=mean, SD=standard deviation

reflected in the above table. The data analysis shows that the mean percentage scores for both groups in the post-test have increased compared to the pretest. The mean gain score of the control group, without exposure to the video lessons, was 39.31%, indicating an improvement in their learning outcomes even without the video lessons. On the other hand, the experimental group, with exposure to video lessons, showed a higher mean gain score of 58.50%. Furthermore, when comparing the average mean percentage scores of the learners in the pre-test, both groups initially demonstrated a low level of performance. However, in the post-test, the fourth-grade learners showed improvement, as shown in their mean percentage scores.

Table 2 shows that there was a significant difference in the pre-test and post-test scores within groups. The pretest score for the control group was 11.25, while the post-test score was 26.98. It implies that even without video, learning was evident. In fact, at the start of the study, the control group got an MPS of only 28.13%, which indicated a low performance in Science. After the lessons were conducted using inquiry-based learning without videos, the MPS of the control group increased to 67.44 %, which is the average performance. This implies that inquiry-based learning is effective for better performance in Science.

However, inquiry-based learning with videos is more effective because the post-test MPS was 88.19%. This may be attributed to the use of videos as supplementary materials. The statistical results have shown that there was a significant difference in the pre and post-test scores in this group, indicating that the learners have gained knowledge of the lessons. Garnering an MPS of 88.19%, the control group showed high performance after the study was conducted. At first, they showed low performance, but with the aid of video

lessons, they were able to show high performance in Science through their post-test scores. This further indicates that video lessons have a positive impact on the academic performance of Grade 4 learners in Science.

Moreover, the statistical analysis shown in Table 3 below aims to determine whether there are significant differences between the mean scores of fourth graders exposed to inquiry-based learning with and without video lessons.

Table 3

Difference Between the Mean Gain Scores of Fourth Graders Exposed to Inquiry-Based Learning With And Without Video Lessons

	Group				Mann-Whitney U Test	p-value	Decision
	Without Video		With Video				
	M	SD	M	SD			
Pre-test scores	11.25	5.55	11.88	3.70	719.50	0.44	Not Significant
Post-test scores	26.98	6.07	35.28	5.26	194.00	<0.01	Significant
Gain Mean Score	15.73	4.04	23.40	4.55	120.50	<0.01	Significant

Results from the previous tables have shown that the mean scores and MPS between the two groups in the pre-test and post-test differ. However, whether the difference is significant or not needs to be analyzed. The comparison of the pre-test, post-test, and MPS scores between the two groups is shown statistically.

The significant differences between the two groups were assessed using the Mann-Whitney U Test, a non-parametric test. Based on the analysis of the curve's normality, the post-test scores had an uneven distribution. Thus, the researcher opted to use a non-parametric test to determine the significant differences in the test scores.

The results of the analysis show a p-value of .44, which indicates that there were no significant differences in the mean pretest scores between the groups. This implies that prior to the intervention, the performance levels of the two groups were comparable, and any observed differences in their post-test scores cannot be attributed to initial disparities in knowledge. Since the p-value is more significant than the level of significance, which is 0.05, the null hypothesis that there is no significant difference in the mean pre-test scores of learners exposed to inquiry-based learning with and without videos is accepted. This shows that prior to the intervention, the performance levels of the two groups were comparable. The two groups' post-test results, however, revealed a significant difference (p-value<0.01), with the group with video lessons having a mean score that was much higher (M=35.28) than the group without video lessons (M=26.98). Since the obtained p-value was less than the alpha level (p-value=0.05), the null hypothesis, which states that there is no significant difference in the mean post-test scores of learners exposed to inquiry-based learning with and without video, is therefore rejected.

This shows that the video lessons had a beneficial effect on the learners' post-test results. Additionally, there was a significant difference between the MPS of the two groups (p-value <0.01), with the group that received video lessons

having a significantly higher mean score (M=88.19) than the group that did not receive video lessons (M=67.44). This indicates that the video lessons had a positive impact on the learners' overall learning gains. This result is consistent with earlier studies that showed how video-based training can improve students' learning and performance[11]. Overall, the findings imply that using video classes significantly improved post-test scores and learners' overall learning gains. These results also support an earlier study by LeSage et al. [11] that showed the value of video-based instruction in improving student learning outcomes. Comparing learners who were taught via lecture approach and learners who were exposed to video lessons, the latter group performed better on post-tests in the subject of Mathematics. The mentioned studies support the researcher's findings about the benefits of video lessons in teaching science. This result then leads to the consensus that there is a benefit to employing science videos to improve learners' academic achievement.

These findings are also consistent with previous studies on the effectiveness of video-based instruction and inquiry-based learning approaches [12]. The use of multimedia resources, such as video lessons, not only stimulates students' interest but also provides visual representations and real-life examples that facilitate comprehension and application of scientific concepts. Furthermore, several studies have emphasized the effectiveness of video-based instruction in enhancing students' understanding and retention of scientific concepts. For example, a survey by Jeremias and Carretero [13] investigated the impact of video-based instruction on the performance of Grade 8 students in learning Mathematics at Guruyan National High School in the province of Sorsogon.

The results revealed that students who received video-based instruction achieved significantly higher post-test scores compared to those who received traditional instruction methods. The students were able to better understand and apply mathematical ideas after watching video courses that explained them. These video courses can aid in a better understanding of the subject as long as the videos include the appropriate material. This suggests that video-based instruction can effectively enhance students' learning outcomes. Integrating multimedia resources, such as video lessons, into inquiry-based learning aligns with the principles of constructivism. According to Piaget's constructivist theory, students construct knowledge through hands-on experiences and interactions with their environment. Computer-assisted instructions and video lessons are used in constructivist classrooms [14]. The study of Pilli and Aksu [15] showed that computer-assisted instruction improved the fourth graders' math achievement, and their attitudes toward computer-assisted learning were all positive. Video lessons allow students to explore, observe, and reflect on scientific phenomena, fostering critical thinking and problem-solving skills. However, it is essential to note that the effectiveness of video-based instruction depends not only on the presence of videos but also on their quality, relevance, and alignment with the curriculum objectives. Teachers should carefully select and design video lessons that are engaging, informative, and closely aligned with the learning goals of the inquiry-based approach. The learners' enthusiasm for

technology use may serve as an avenue for the teachers to engage the learners in the teaching of science using the digital platform to address the learning gaps in the subject further.

4. CONCLUSIONS

Based on the findings of the study, it can be concluded that inquiry-based learning can be an effective tool in teaching human anatomy at the elementary level. However, learners exposed to inquiry-based learning with videos as supplementary materials have shown better academic performance among the learners. The significant difference observed between the pretest and posttest scores of the control and experimental groups, with the experimental group demonstrating higher mean post-test scores and mean gain, highlights the positive impact of video lessons. Integrating video lessons into inquiry-based learning can enhance students' learning outcomes in science education. Hence, this study provides compelling evidence that the use of video lessons significantly improves the academic performance of fourth-grade learners in Science. The results underscore the potential of video-based instructional materials to enhance teaching and learning in the field of science education at the elementary level.

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