



Application of the Demonstration Method to Improve Concept Understanding and Learning Activities of Students in Physics Subjects

Simun Ozuhu¹, Sehou Zhadiq¹, Iwuella Tharem²

¹Faculty of Education, University of Nigeria, Nigeria

²Education Faculty, National Open University of Nigeria, Nigeria

*Corresponding Author: Simun Ozuhu



Article Info

Article history:

Received 06 July 2021

Received in revised form 25 July 2021

Accepted 14 August 2021

Keywords:

Demonstration Method

Concept Understanding

Learning Activities

Abstract

Using the demonstration technique in conjunction with physics instruction, the purpose of this research is to improve students' comprehension of their ideas. Classroom action research is used in this study, and it is divided into two cycles, with each cycle consisting of six sessions each cycle. It is necessary to prepare ahead, take activities, observe and reflect as part of the research process. Based on the findings, students' comprehension of physics topics improved when they were taught using the demonstrative approach. Cycle I students' understanding score averaged 67 points with a standard deviation of 14.92, while the second cycle students' understanding score averaged 79 points with a standard deviation of 9.84. Students' understanding score increased in both cycles I and II, with the average value of 67 points and the standard deviation of 14.92. On the basis of the study's findings, it is possible to infer that the use of physics learning using the demonstration technique has improved students' comprehension of topics in physics.

Introduction

While students' capacity to memorize information is the primary focus of the classroom learning process, the student's brain is pushed to memorize and store a variety of knowledge without being asked to comprehend the material or connect it to their daily lives (Doyle & Zakrajsek, 2018).

According to the findings of observations conducted, students find it difficult to comprehend the context of abstract physics, and it turns out that students seldom utilize laboratory equipment in the course of their physics education. The interview with the teacher in the field of physics studies revealed that there were issues with the learning activities of students at school, including a lack of awareness among students that they should have handbooks and a lack of willingness among students to learn physics because they believed physics subjects were difficult to accept because they were filled with formulas. For this reason, academics are attempting to determine ways to enhance the active learning of pupils by teaching physics using the demonstrative approach (Eison, 2010). When it comes to studying physics, the demonstrative approach has the potential to be quite effective. It is hoped that by employing this demonstration method, students and teachers will become actively involved in an activity, and that a student will become a questioner, someone who is always on the lookout for answers, because there are questions and curiosity in his or her mind, and that the teacher's role will no longer be that of an information center, but that of an information center. Only offer advice / direction to pupils who express a desire to do so.

As a method of teaching, the demonstration method requires that an instructor or a team of teachers demonstrate and explain a process (relevant to the subject or material being presented) so that all students in the class can see, observe, hear, and possibly grope and feel the process being demonstrated. by the school's principal the demonstration technique is often used in

conjunction with instructional aids such as tiny items, photographs, laboratory equipment, and other similar materials.

Another advantage for using the demonstration technique is that the acceptance of students to the lesson will be more deeply remembered when using the demonstration approach, resulting in a more complete and accurate comprehension. As part of the learning process, students can also observe and pay attention to what is being demonstrated so that they will be more active in learning on their own and discovering the parts that are being emphasized to them; provide activities that stimulate students' curiosity; and assist students in expressing their ideas and thoughts. Students may form a queue to deal with issues that have just been encountered. In addition, the demonstration technique is incorporated in the approach that is utilized when students are used as learning centres.

This is what motivates researchers to look for methods to enhance students' comprehension of topics and participation in class by using the demonstrative approach while teaching physics. When it comes to studying physics, the demonstrative approach has the potential to be quite effective. As a result of using this demonstration method, students and teachers will be actively engaged in an activity, and students will be continuously transformed into questioners, as people who are always on the lookout for answers, because questions and curiosity will always be present in their minds. The teacher's role will no longer be an information centre, but rather an information resource centre. Only offer advice / direction to pupils who express a desire to do so.

As a method of teaching, the demonstration method requires that an instructor or a team of teachers demonstrate and explain a process (relevant to the subject or material being presented) so that all students in the class can see, observe, hear, and possibly grope and feel the process being demonstrated. The demonstration technique is often used in conjunction with instructional aids such as tiny items, photographs, laboratory equipment, and other similar materials (Chi & Wylie, 2014).

Another advantage for using the demonstration technique is that the acceptance of students to the lesson will be more deeply remembered when using the demonstration approach, resulting in a more complete and accurate comprehension. During the learning process, students may also watch and pay attention to what is being shown, which will encourage them to be more active in learning on their own and discovering the information that has been highlighted to them (Selwyn, 2009; Papavlasopoulou et al., 2019)

Methods

This study will demonstrate of Classroom Action Research. Application of the demonstration technique via concept comprehension and learning activities with the phases of planning, executing actions, observing, and reflecting is the activity described in this study.

Implementation of the activity is carried out in conjunction with research efforts using the demonstration methodology (Karim & Arif-Uz-Zaman, 2013). The activities in Cycle I will be implemented over the course of seven sessions, which will be held weekly. When it comes to the first cycle, the learning process will be carried out using the demonstration technique for the first six sessions, and when it comes to the final meeting, it will be carried out by administering a test to assess students' knowledge of physics topics. Prior to that, however, the instructor (researcher) was presented to the pupils who were to be instructed by him.

After reading this introduction, students will be more used to the presence of researchers who will be teaching as substitutes for physics topic instructors at future sessions. When the

researcher reached this level, he made sure not to overlook the need of taking attendance in order to identify each pupil individually.

Also included in this phase is a reflection or review of the research that was conducted as a consequence of the observations and assessments made during the learning process. Participating in research by soliciting input from students on their experiences in the process of putting learning into practice. It is possible to utilize the findings acquired by the researcher as a guideline for carrying out cycle II, ensuring that the results gained in the next cycle are in accordance with expectations and should be better than those obtained in the previous cycle (cycle 1).

In order to reflect on the findings received from both learning outcomes assessments and instructor notes gathered from observation sheets collected during the learning process, the end stage of cycle I and cycle II were conducted at the same time. At each meeting, it is necessary to enhance and develop the aspects of the project that are still missing. At this point, the findings of observations and assessments made throughout the learning process are used to conduct a reflection or review of the study. Discussions were held with those who were present, mainly physics topic instructors and spectators. What aspects of the learning process, as well as the information presentation methods employed by the researchers, do they believe need to be improved, according to them?

The data gathered was then examined using quantitative descriptive statistics in order to determine whether or not students had achieved the indications of comprehending the physics subject in question. The results of the test of comprehending physics ideas were subjected to quantitative descriptive analysis in order to explain the features of the scores achieved by pupils. It is given in the form of statistical tables and frequency distributions how the findings of this quantitative descriptive study were obtained

Results and Discussion

Table 1. Students' Physics Concept Understanding Test Scores

Statistics	Statistics Score	
	Cycle 1	Cycle 2
Subject	31	31
The highest score	85	90
Lowest value	30	50
Average value	67	79
Standard deviation	14.92	9,84
Variance	222,79	96,83
Ideal score	100	100

Student performance in the first cycle is shown in Table 1, with an average score of 67 points compared to the ideal score of 100 that may be attained. Individually, students' scores range from the lowest possible score of 30 to the greatest possible score of 90, with the lowest possible score being 30 and the highest possible score being 90, respectively. gotten a perfect score Students' average scores are still categorized as "incomplete" based on the information provided in this statistic. The average score obtained in the second cycle is 79 points lower than the optimum score that might be reached, which is 100 points higher than the ideal score. Individually, students' scores range from the lowest possible score of 50 to the greatest

possible score of 90 out of a potential maximum score of 100, with the lowest being 50 and the highest being 90. From Students' average scores have reached a plateau and have risen since cycle 1, according to the statistics.

In cycle I, the frequency distribution and percentage of students' physics concept understanding scores are produced by categorizing the students' physics concept understanding scores into five categories, as shown in Table 2.

Table 2. Distribution of Frequency and Percentage of Students' Physics Concept Understanding Scores in Cycle 1

Category	Frequency
Extremely Low	0
Low	2
Moderate	10
High	14
Extremely High	5
Total	31

According to the frequency distribution, 0 percent of the 31 students who completed the first cycle concept comprehension exam fell into the very low category, 6.45 percent fell into the low category, and 32.3 percent fell into the medium group. 45.2 percent of the population falls into this group. 16.1 percent of the population falls into this very high group.

Table 3. Distribution of Frequency and Percentage of Students' Physics Concept Understanding Scores in Cycle II

Category	Frequency
Extremely Low	0
Low	0
Moderate	4
High	13
Extremely High	14
Total	31

According to the frequency distribution, 0 percent of the 31 students who completed the first cycle concept comprehension exam fell into the very low category, 6.45 percent fell into the low category, and 32.3 percent fell into the medium group. Table 3 shows the frequency distribution and percentage of physics learning completeness in cycle 1, with 45.2 percent in the high category and 16.1 percent in the very high category. Table 3 also shows the frequency distribution and percentage of physics learning completeness in cycle 2.

The action was given in the first cycle and it was discovered that 20 students (64.5 percent) were in the incomplete category, 11 (35.5 percent) students were in the complete category, and for the 11th cycle, there were 6 individuals in the incomplete category (19.3 percent). Students who entered the incomplete category included 25 individuals (80.6 percent) while students who entered the full category included 25 persons (80.6 percent).

Table 4. Indicators of Achievement of Physics Concept Understanding Tests in Cycle I

Indicator	Question Number of Cycle I	Students' Achievement
Translation	2, 3, 4, 6, 7, 8, 9, 11	24, 22, 22, 19, 20, 19, 23, 22
Interpretation	1, 5, 12, 13, 14, 15, 16, 17	25, 24, 20, 20, 21, 18, 21, 19

Extrapolation	10, 18, 19, 20	22, 22, 20, 18
Total	20	

It was discovered that, out of 31 students, after the action was given in the first cycle, the translation indicator for question number 2 was 24 students (77.41 percent) who answered correctly and 7 students (22.58 percent) who answered incorrectly, resulting in a translation indicator of 24 students (77.41 percent) who answered correctly and 7 students (22.58 percent) who answered incorrectly. Question numbers 3 and 4 had a total of 22 students (70.96 percent) who were able to respond properly, and 9 students (29.01 percent) who answered wrong. There were 19 students (61.29 percent) who properly answered questions 6 and 8, and 12 students (38.70 percent) who wrongly answered questions 6 and 8. When it came to question number 7, there were 20 students who responded properly (64.51 percent) and 11 students (35.48 percent) who answered wrong. The right answer to question number 9 was given by 23 students (74.19 percent), while the wrong answer was given by 8 students (25.00 percent). When it came to question number 11, there were 22 students who responded properly (70.96 percent) and 9 students who did not answer correctly (29.00 percent).

According to the indicators of interpretation of question number 1, there were 25 students (80.64 percent) who responded properly and 6 students (19.35 percent) who answered wrong. For question number 5, there were 24 students (77.41 percent) who were able to answer properly, and 7 students (22.58 percent) who responded wrong. Twenty students (64.51 percent) responded properly to questions 12 and 13, whereas eleven students (35.48 percent) answered wrongly to questions 12 and 13. When it came to questions 14 and 16, there were 21 students who responded properly (67.74 percent), whereas there were 10 students who answered wrong (32.25%). Question number 15 had as many as 18 students who were able to answer properly (58.06 percent) and as many as 13 students (41.93 percent) who were unable to respond correctly. The right answer to question number 17 was given by 19 students (61.29 percent), while the incorrect answer was given by 12 students (38 percent). Extrapolation indications (extrapolation) showed that for questions 10 and 18, as many as 22 students (70.96 percent) responded correctly, while only 9 students (29.03 percent) answered erroneously, according to the results of the study. Question number 19 has as many as 20 participants students (64.51 percent) who are able to respond correctly, and as many as 11 participants students (35.48 percent) who answer incorrectly. Question number 20 had 18 right responses (58.06 percent) and 13 incorrect responses (41.93 percent) from the students that took the test.

Table 5. Achievement of Physics Concept Understanding Test in Cycle II

Indicator	Question Number of Cycle I	Students' Achievement
Translation	1, 2, 4, 14, 16, 19	24, 23, 24, 20, 20, 22
Interpretation	5, 7, 8, 10, 12, 13, 17, 18, 20	24, 24, 25, 22, 22, 20, 22, 21, 21
Extrapolation	3, 6, 9, 11, 15	24, 23, 23, 20, 22
Total	20	20

According to the results from the second cycle, the translation indicator for question number 1 was 24 students (77.41 percent) who responded properly and 7 students (22.58 percent) who answered erroneously, indicating that the translation indicator for question number 1 was accurate. On question number 2, there were 23 students (74.19 percent) who were successful in answering the question, and 9 students (29.01 percent) who were unsuccessful. Question number 4 had a total of 24 right answers (77.41 percent) and 7 incorrect answers (22.58 percent) among the students that took part in the poll. Twenty students (64.51 percent) responded properly to questions 14 and 16, whereas only eleven students (35.48 percent)

answered wrongly to questions 14 and 16. Answers to question number 19 were given by 22 students (70.96 percent) who were able to respond properly and 9 students (29.01 percent) who gave wrong answers.

There were 24 students (77.41 percent) who responded properly to questions 5 and 7, and 7 students (22.58 percent) who answered erroneously, according to indicators of interpretation. Question number 8 was answered correctly by 25 students (80.64 percent) and incorrectly by 6 students (19.35 percent). There were 22 students (70.96 percent) who responded properly to questions 10, 12 and 17, and 9 students (29.03 percent) who gave incorrect answers to questions 10, 12 and 17. Twenty students (64.51 percent) responded properly to question number 13, whereas only eleven students (35.48 percent) answered wrong to question number thirteen. There were 21 students (67.77 percent) who were able to respond properly to questions number 18 and 20 and 10 students (32.22 percent) who replied wrong to questions number 18 and 20. Extrapolation indications (extrapolation) showed that for question number 3, as many as 24 students (77.4 percent) responded correctly and 7 students (22.58 percent) replied erroneously, according to the results of the study. Participants students who were able to answer questions 6 and 9 were 23 (74.19 percent) and 8 (25.80 percent) respectively. Participants students who answered incorrectly were 8. For question number 11, there were 20 students who answered correctly (64.51 percent) and 11 students who answered incorrectly (35.48 percent) in the class. Question number 15 had a total of 22 right responses (70.96 percent) and 9 wrong responses (29.03 percent).

Using the demonstration approach, researchers conducted a study in which they used learning over two cycles, each consisting of six sessions, to ensure that the actions taken in the first cycle were implemented in the second cycle. In the meanwhile, the activities were repeated six times for the second cycle as well (Hohlbaum et al., 2018). With the exam being administered, there will be 14 meetings total over the course of two cycles. While the action was being carried out, several aspects were evaluated, including the results of the students' understanding of physics concepts, the implementation of learning through the demonstration method, as well as the activities of students who were observed and evaluated at each of the meetings.

Students' results on the exam of comprehending the physics idea have improved, as shown by the rise in the average score and the percentage of the average score (Smith et al., 2009). The average score on the physics concept understanding test was only 67 points in the first cycle and increased to 79 points in the second cycle, indicating that the average results of the students' understanding of physics concepts in the first cycle fell into the incomplete category, whereas the results of the concept understanding test Physics students in cycle II fell into the complete category. As a result, the acquisition of student scores following the implementation of the Demonstration method has increased from cycle I to cycle II, although the increase is still relatively small. However, it is certain that when this method is applied over a long period of time, students' acceptance of the subject matter improves significantly (Vladova et al., 2021). It can be seen in the indicators of achievement on the concept understanding test that students who answered correctly were mostly on the interpretation indicators, with as many as 25 students (80.64%) answering correctly and only 6 students (19.35 percent) answering incorrectly on the interpretation indicators.

Conclusion

It may be inferred, based on the findings of classroom action research that has been conducted, that the integration of physics learning with the demonstration technique can enhance comprehension of ideas and learning activities among students. These findings may be

observed in student concept comprehension test results from cycles I and II, which showed an increase for each person even if there was an increase in fluctuations or outcomes that were not significantly different from prior results. From cycle I to cycle II, there was an increase in all measures of concept comprehension as well. Students' comprehension of topics may be improved by using demonstrative techniques while studying physics.

References

- Chi, M. T., & Wylie, R. (2014). The ICAP framework: Linking cognitive engagement to active learning outcomes. *Educational psychologist, 49*(4), 219-243.
- Doyle, T., & Zakrajsek, T. D. (2018). *The new science of learning: How to learn in harmony with your brain*. Stylus Publishing, LLC.
- Eison, J. (2010). Using active learning instructional strategies to create excitement and enhance learning. *Jurnal Pendidikantentang Strategi Pembelajaran Aktif (Active Learning) Books, 2*(1), 1-10.
- Hohlbaum, K., Bert, B., Dietze, S., Palme, R., Fink, H., & Thöne-Reineke, C. (2018). Impact of repeated anesthesia with ketamine and xylazine on the well-being of C57BL/6JRj mice. *PloS one, 13*(9), e0203559.
- Karim, A., & Arif-Uz-Zaman, K. (2013). A methodology for effective implementation of lean strategies and its performance evaluation in manufacturing organizations. *Business Process Management Journal*.
- Papavlasopoulou, S., Giannakos, M. N., & Jaccheri, L. (2019). Exploring children's learning experience in constructionism-based coding activities through design-based research. *Computers in Human Behavior, 99*, 415-427.
- Selwyn, N. (2009). Faceworking: exploring students' education-related use of Facebook. *Learning, media and technology, 34*(2), 157-174.
- Smith, M. K., Wood, W. B., Adams, W. K., Wieman, C., Knight, J. K., Guild, N., & Su, T. T. (2009). Why peer discussion improves student performance on in-class concept questions. *Science, 323*(5910), 122-124.
- Vladova, G., Ullrich, A., Bender, B., & Gronau, N. (2021). Students' acceptance of technology-mediated teaching—how it was influenced during the COVID-19 Pandemic in 2020: A Study From Germany. *Frontiers in Psychology, 12*, 69