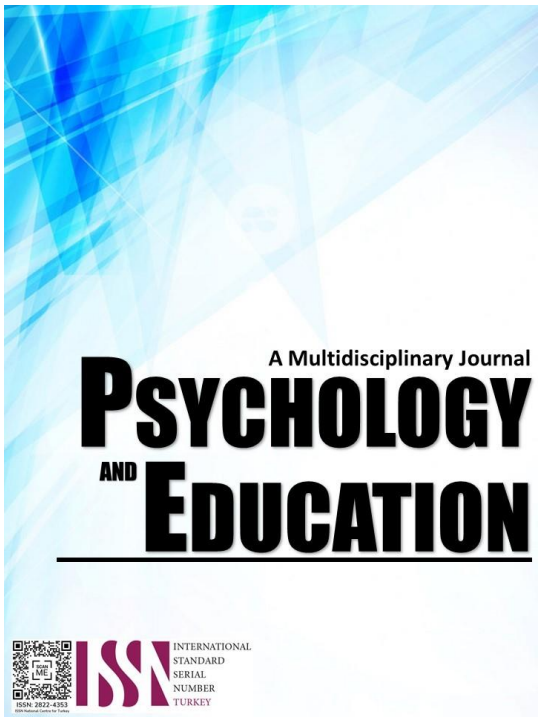
THE USEFULNESS AND EFFICACY OF THE CENTER-BASED LEARNING APPROACH IN THE CLASSROOM FOR TEACHING SCIENCE SUBJECTS ON THE STUDENTS' ACADEMIC PERFORMANCE: A QUASI- EXPERIMENTAL STUDY



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Research Article

The Usefulness and Efficacy of the Center-Based Learning Approach in the Classroom for Teaching Science Subjects on the Students' Academic Performance: A Quasi- Experimental Study

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Abstract

A typical classroom frequently consists of a single learner who is not all that interested in the subject at hand. Traditional classroom settings generally favor direct, unilateral instruction. According to the conventional view, learners must amass a predetermined body of information. This study aimed to evaluate the usefulness and effectiveness of the center-based learning approach in the classroom for teaching science subjects on students' academic performance after exposure to two approaches, the center-based learning approach, and the conventional approach. The study also looked at junior high school science teachers' perceptions of the center-based learning approach's effectiveness to students' learning capabilities based on the Proven Effectiveness Framework (PEF). The research employed a descriptive and quantitative approaches with a quasi- experimental research design. The total population size of the respondents are 60 Grade 10 students out from the 2 sections of San Vicente National High School. The test covered learning competencies found in the Grade 10 junior high school science curriculum. The learning competencies under the MELCs covered topics about volcanoes, earthquakes, epicenters, and mountain ranges. The assessment test consists of 50 multiple-choice questions. Based on the findings, there is a large difference in the results of the experimental group when exposed to CBLA, the mean score is 47.10 with a standard deviation of 4.87 and a p-value of 0.000. Furthermore, after the assessment in the posttest, the control group has a mean score of 30.05, resulting in being highly significant, and mastery level of the students' academic performance after the test is 60.23. This means that the perceptions of the junior high school science teachers in the said indicators were afflicted based on the criteria given. The center-based learning approach outperformed the conventional approach in producing better learning performance in teaching science subjects in junior high school levels, particularly in Grade 10.

Keywords: *science, usefulness, efficacy, perception, CBLA, conventional learning approach, PEF*

Introduction

In today's world, current information and technological development links are scientifically increasing daily. Technology innovation is rapidly spreading, as seen in the education sector, particularly in the science department, where technology plays a key role in the future of the communities and has an equal impact on all of them. Furthermore, science is seen as an important course area. Wherein it is a region with a high development priority from a national viewpoint. Science is taught in elementary and secondary schools, and it has been developed mostly in higher education, which is in state universities and colleges. This is a key subject that has its own conceptual complexity and significant approaches. The premise is that all humankind must attain a level of scientific literacy to enable them to fully engage in a contemporary society through the inclusion of science in the new curriculum (Karamustafaoglu, 2010; Dimaano, 2012; Dagasaan, 2022).

Studies show that many Filipino students struggle to develop functional literacy, making it difficult for them to manage the demands of a rapidly changing environment. Students continue to regard science as the most difficult subject in elementary school and secondary school, ahead of mathematics, according to their performance on the National Achievement Tests (NAT). In both science (34.91%) and mathematics (378.33%), students successfully answered fewer than 50% of the questions, according to the Second Year High School NAT results from 2010 to 2011 (Department of Education, 2011; Bulbul, 2010).

The Third International Mathematics and Science Analysis found that the Philippines ranked 36th out of 38 countries in the second year of high school science (TIMSS, 2012). In elementary science, the country was ranked 23rd out of 25 countries by 2003. The instability in the Philippine educational system then spread throughout the country. At the high school level, the Philippines finished 42nd out of 45 nations in the second year of science. Fewer disciplines were covered in the science curricula of countries that performed well in the Third International Mathematics and Science Study (TIMSS), while the Philippines did not take part in the 2007 TIMSS (Dela Cruz, 2012). In the Philippines, the 2011 National Secondary Achievement Test's national mean score in science was only 34.91% (NSAT). The students' responses suggested that this was a challenging subject for them;

hence, more contact time and creative teaching methods should be developed (DepEd, 2011; DepEd, 2012).

Enhancing students' academic performance at school requires the use of the center-based learning approach (CBLA), which serves as the basis for a teacher to achieve short- or long-term academic goals. The main objective of our educational institutions is for students to attain academic success. Thus, topic interest, getting students involved in extracurricular activities, motivation, etc. are all variables that contribute to boosting students' academic performance. Student-centered learning environments' main and most important element would be this (Narad & Abdullah, 2016). With a student-centered learning method, the emphasis of activities is shifted from the teacher to the students. According to Kulieva's (2018) study, a learner-centered approach involves all students in the challenging, disorganized, and demanding labor of learning. Teachers can teach their students to examine, solve problems, and evaluate their environment by using this method. The student-centered approach includes active learning, cooperative learning, and an inductive method of instruction. In a variety of ways, such as social adjustment, problem-solving, increased comprehension, and creating their own learning preferences, the student-centered approach assists children in preparing for the future. Although this method is not well structured and regimented, experts have observed that it is acceptable for children (Narad & Abdullah, 2016; Ohle et al., 2015).

The traditional classroom, in comparison, frequently resembles a one-man show with a learner who is not particularly engaged. Direct and unilateral instruction is frequently predominant in traditional classroom settings. The proponents of the traditional approach believe that the learner must acquire a set corpus of knowledge. The teacher expects the students to accept the information they are provided without question (Stofflett, 2018). There is little room for student-initiated inquiries, independent thought, or peer interaction because the teacher tries to convey ideas and meanings to the passive learner (VAST, 1998; Hurd, 2015). Activities in subjects with an activity-based approach are performed in groups, but they do not promote conversation or study of the concepts at hand.

This frequently ignores the critical thinking skills and unifying ideas necessary for genuine science literacy and appreciation (Yore, 2011). There are various types of inquiry learning. This teacher-centered approach to instruction assumes that all students can acquire the content at the same rate and with the same level of prior knowledge (Bulbul, 2010). In a structured inquiry, the teacher gives the students a problem to research and provides the methods and resources. A specific topic, knowledge, or ability is taught using this method of inquiry-based learning, which eventually leads to an open inquiry in which the learner creates his own challenge to research. Based on Piaget's theory of cognitive learning, the Learning Inquiry Cycle Model is an illustration of a structured inquiry learning technique (Bevevino, Dengel, & Adams, 2009).

In terms of the state of science education and young people's aspirations toward a profession in science, countries and regions significantly vary. Numerous extensive international surveys involving students from developed, emerging, and less developed nations were conducted by the Organization for Economic Co-operation and Development (OECD), the International Association for the Evaluation of Educational Achievement (IEA, the TIMSS studies), and the Norway-based International Relevance of Science Education (ROSE) project. These studies offered valuable information on the standard of science instruction and student interest in the subject. Their findings indicate that improving low performance and raising high performance go hand in hand and that excellence in reading is a prerequisite for math and science brilliance (ICSU, 2011). It is also obvious that the ICSU and its members benefited greatly from these studies in terms of learning important lessons about how to teach science in various countries and cultural contexts.

Both teaching and learning are interdependent. Teachers must constantly learn new things, especially with the concepts and data in various scientific fields evolving rapidly. Therefore, consistent, high-quality professional development for teachers is essential for ensuring that their students receive a good education. Examples of this include: deepening and enlarging knowledge of science content; demonstrating how to teach new material using best teaching practices like inquiry, constructivism, integrating the theory of multiple intelligences, authentic assessments, etc.; preparing teachers to engage their students in scientific investigations; and promoting this kind of learning among teachers (Lacanilao, 2012).

When employing the center-based learning strategy, one must learn new material while investigating the many learning centers, including the computer center, art and activity center, journal and writing center, reading center, and manipulative center. The Computer Center uses ICT, or information and communication

technology. It extensively uses lessons with lots of pictures and computer-assisted learning modules. The learning procedures in the various centers heavily rely on constructivism, which was developed by Piaget, Vygotsky, Bruner, and other constructivists. Thanks to the five centers, which also aid in developing and enhancing the learners' multiple intelligences, learning is carried out in accordance with the learners' preferences and learning styles. The researcher has long ago taught the method to teachers and student teachers in the various Department of Education (DepEd) institutions using a variety of interactive curriculum technologies. Neither formal research has been conducted yet regarding the approach's effectiveness, despite the researcher having extensively disseminated it to their student teachers and teachers in the various Department of Education (DepEd) schools using a variety of interactive curriculum software for elementary, secondary, and tertiary levels (Salandanan, 2009).

The purpose of the study is to take advantage of this possibility to investigate and assess the educational approaches mentioned in "The Center-Based Learning Approach" with reference to junior high school science subjects. The study's goal was to ascertain whether CBLA is a procedure that makes it easier to attain deeper understanding and effective learning. One cannot overestimate the importance of instructional strategies. Teachers who desire to have a fulfilling and pleasant career in the classroom acknowledge and accept this adage. Being adept at choosing a strategy to use and effectively putting it into practice is very satisfying and gratifying for a teacher. Teachers should therefore be aware of the factors that affect decisions about the strategy or approach to use.

Research Objectives

This study evaluated the usefulness and effectiveness of the center-based learning approach in the classroom for teaching science subjects on students' academic performance after exposure to two approaches, the center-based learning approach, and the conventional approach. The study also looked at junior high school science teachers' perceptions of the center-based learning approach's effectiveness to students' learning capabilities based on the Proven Effectiveness Framework (PEF).

1. To determine the students' academic performance in science subjects when exposed to both learning approaches;
2. To attest the usefulness and efficacy of the center-based learning approach in science subjects in a classroom environment; and
3. To explicitly know the perceptions of the junior high school science teachers on the center-based learning approach in terms of highly intellectual tasks and activities, a supportive learning environment, learner diversity, and connection to a social educational context and learning experiences.

Methodology

The study employed descriptive and quantitative approaches with an experimental research design. A quasi-experimental research design was utilized to compare the students' academic performance on the two learning approaches, which are the center-based learning approach and the conventional learning approach, and to attest the usefulness and efficacy of each. Furthermore, the data gathering tool used in this study was the 50-item knowledge assessment test, conducted as the pretest and posttest with an experimental and control group design that fits the study. Also, the study has been assessed in the 1st grading period of the Department of Education calendar year 2022–2023.

The test covered learning competencies found in the Grade 10 junior high school science curriculum. The learning competencies under the MELCs covered topics about volcanoes, earthquakes, epicenters, and mountain ranges. The assessment test consists of 50 multiple-choice questions. Nonetheless, the test items were shown and reviewed in accordance with the level of the Grade 10 students who will take part in the assessment, and there are three (3) science teachers in the study's locale, which is the San Vicente National High School. In this manner, before the assessment test was given to the respondents, permission, and approval to conduct the study were secured from the school principal in the said school. After which, it was presented to the involved participants and explained the assessment procedure and consent in detail to them.

The test was explicitly administered personally by the researchers. The researchers used ANCOVA to determine and implement the difference in academic performance between the two involved sections, which are the experimental and control groups in Grade 10 students at the mentioned school. This was assessed

for the exposure to the two learning approaches, which are the center-based learning approach and the conventional learning approach.

For the data analysis, the researcher computed and tabulated the mean of the responses of the teachers on their respective perceptions of the center-based learning approach (CBLA). The three (3) science teachers from the said school in the Department of Education during the academic year 2022-2023 assessed and analyzed the usefulness and efficacy of the center-based learning approach based on the criteria presented in the Proven Effectiveness Framework (PEF).

Additionally, the research endeavor was conducted in accordance with ethical norms. The researchers looked at the concepts and ideas of the authors in order to avoid plagiarism, and they honored their rights by properly attributing them. The researchers will remove the data they have gathered after the study is finished and the results are in.

Results and Discussion

The results have been calculated and analyzed based on the main objectives of the study to determine the usefulness and efficacy of the center-based learning approach to the academic performance of the Grade 10 students in science. The assessment test conducted on the involved participants was gathered during the first grading period, which certainly modified the MELCs, the learning competencies. Based on the findings from the pretest and posttest assessments, on the pretest, the control group had a sample of 30 with a mean score of 8.27 and a p-value of 0.000, which means highly significant. During the pretest, the mastery level in the control group was 17.58, which is very low. Whereas, in the pretest, the experimental group had a mean score of 10.12 with the same p-value of 0.000 and a mastery level of 22.49. This means that there is a difference between the results of the control group and the experimental group. However, the ability to synthesize the pretest results in the control and experimental groups is not entirely high, implying that students in Grade 10 struggled to learn science subjects when exposed to learning resources from the center-based learning approach (CBLA) and conventional learning approach.

Table 1. *Pre-Test and Post-Test of the Students' Academic Performance in the Science Subject When Both Are Exposed to Learning Approaches in the Classroom*

Group	*Sample (N)*	*Percentage (%)*	*Mean Score*	*SD*	*p-Value*	*Mastery Level*	*Remarks*
Pre-Test							
Control Group	30	27.56	8.27	1.27	0.000	17.58	Highly Significant
Experimental Group	30	33.73	10.12	1.02		22.49	
Post-Test							
Control Group	30	50.08	30.05	4.25	0.000	60.23	Highly Significant
Experimental Group	30	78.50	47.10	4.87		81.22	
OVERALL	60	100	23.89	2.85	0.000	45.38	Highly Significant

Furthermore, after the assessment in the posttest, the control group has a mean score of 30.05 with a standard deviation of 4.25 and a p-value of 0.000, resulting in being highly significant, and the mastery level of the students' academic performance after the test is 60.23, whereas there is a large difference in the results of the experimental group when exposed to CBLA, the mean score is 47.10 with a standard deviation of 4.87 and a p-value of 0.000. The changes in the students' performance following the posttest test have increased their understanding and comprehension of the exam under posttest.

Valencia (2020) stated that the pretest performance revealed that the students did not have any thoughts or ideas about the subject matter or the main purpose yet. which means the students have not yet encountered such learning competencies in any discussion or reference material or might have forgotten the said competencies. The results are also supported by the study by Candra and Irianto (2016). In their findings, it was shown that the students' learning performance affected the learning competencies utilized by the teachers, along with the touch of contextualization that is certainly available in a conventional learning approach.

Table 2. *Analysis of Covariance Results Based on the Assessment*

Variations	*SS*	*df*	*Mean Square*	*f-value*	*p-value*
Pretest and Posttest (Covariate)	11.258	1	111.285	50.729**	0.000
Error	1877.523	59	37.112		
OVERALL	1888.871	60			

Table 2 presents the analysis of covariance results based on the assessment. The findings showed that the pretest and posttest had obtained a p-value of 0.000, which is highly significant. As per the result, the sum of squares is 11.258 with a degree of freedom of 1. Thus, the error that has been attested is 1877.523 in the sum of squares (df = 59).

Considering the findings, Campbell (2011) claims that teachers can adapt a variety of lessons using both conventional and new media; address post-modern educational concerns like multiculturalism, diversity of perspectives, respect for the individual learner, and critical thinking as strategies for helping students; encourage intellectual inquiry; embrace imagination; promote social change and transformation; and help people live in peace with one another. The teacher respondents observed personally the distinctive effects that the center-based approach had on children.

Students were encouraged to study the subject matter since the lessons in the processing level were made to branch out into a variety of possibilities depending on the students' interests and ability. The students put a lot of effort into each area to learn as much as they could till their curiosity was satiated. The students believed that the assignments were interesting and particular to them (Apat, 2004; Apat, 2007).

Table 3 presents the perceptions of science teachers on the center-based learning approach based on the proven effectiveness framework (PEF). Based on the findings, the mean score of the three (3) indicators out from the given criteria were higher, computer center (10), journal writing center (9.44), reading center (9.78), and manipulative center (9.56). This means that the perceptions of the junior high school science teachers in the said indicators were afflicted based on the criteria given. As per the science teachers, each center of the center-based learning method exhibited each of the characteristics and practices of an effective pedagogy. According to Apat (2004), the Center-Based Learning Approach promotes and improves opportunities for varied learning styles, intelligences, and teaching approaches in order to adapt to this rapidly changing world. In the classroom, there is a strong sense of being a community of learners involved in activity, conversation, and reflection. Students can develop practical skills like time management, teamwork, accountability, and adaptability in a supportive setting. Providing pupils with the freedom to think for themselves aids in their development as autonomous and competent thinkers (Saro et al., 2022).

Table 3. *Perceptions of Science Teachers on the Center-Based Learning Approach Based on the Proven Effectiveness Framework (PEF)*

Indicators	*Computer Center*	*Journal Writing Center*	*Reading Center*	*Manipulative Center*
Highly-Intellectual Tasks and Activities	10	9	9.6	9.3
Supportive Learning Environment and Learner Diversity	10	9.6	9.6	9.3
Connection To A Social Educational Context And Learning Experiences	10	9.6	10	10
Mean Score	10	9.4	9.7	9.5

Based on the summary in Table 4, the overall mean of the three indicators on the perceptions of the science teachers was (m = 4.63) with a standard deviation of 0.92, which means the descriptive equivalent is strongly agree. This concludes that the participants' participation in obtaining perceptions of the effectiveness of the center-based learning approach was very efficient, and the set items were beneficial to the study's participants. The center-based learning approach outperformed the conventional approach in producing better learning performance in teaching science subjects in junior high school levels, particularly in Grade 10. As a result, the center-based learning approach is an effective method for teaching Grade 10 science subjects. The teachers perceived that the CBLA was an effective approach for teaching science. The center-based learning approach possesses the characteristics that influence effective teaching and high learner performance. It is, therefore, an effective teaching approach.

Table 4. *The Summary of the Results based on the Proven Effectiveness Framework (PEF)*

Items	*Indicators*	*Weighted Mean*	*SD*	*Descriptive Equivalent*
1	Highly-Intellectual Tasks and Activities	4.65	0.96	Strongly Agree
2	Supportive Learning Environment and Learner Diversity	4.42	0.92	Strongly Agree
3	Connection To A Social Educational Context And Learning Experiences	4.81	0.87	Strongly Agree
	OVERALL	4.63	0.92	Strongly Agree

Conclusion

Both teaching and learning are interdependent. Teachers must constantly learn new things, especially with the concepts and data in various scientific fields

evolving rapidly. The center-based learning approach (CBLA), which is the foundation upon which a teacher can accomplish short-term or long-term academic goals, is essential in enhancing students' academic performance at school. The comparative performance of the Grade 10 students in science subjects after exposure to the learning approaches which are center-based learning approach and conventional learning approach. The findings shown that there is a large difference in the results of the experimental group when exposed to CBLA, the mean score is 47.10 with a standard deviation of 4.87 and a p-value of 0.000. Furthermore, after the assessment in the posttest, the control group has a mean score of 30.05, resulting in being highly significant, and mastery level of the students' academic performance after the test is 60.23. In this study, the mean score of the three (3) indicators out from the given criteria were higher for computer center (10) than journal writing (9.44) and reading (9.78) as compared to manipulative and social media (9.56 and journal writing respectively). This means that the perceptions of the junior high school science teachers in the said indicators were afflicted based on the criteria given. Overall, the overall mean of the three indicators on the perceptions of the science teachers was (m = 4.63) with a standard deviation of 0.92, which means the descriptive equivalent is "strongly agree." The center-based learning approach outperformed the conventional approach in producing better learning performance in teaching science subjects in junior high school levels, particularly in Grade 10. The teachers perceived that the CBLA was an effective approach for teaching science. It possesses the characteristics that influence effective teaching and high learner performance.

To address the findings of the study, the researchers offer the initiatives and ideas listed below: The center-based learning approach embodies the traits of a fruitful and successful pedagogy. As a result, its use and application are advised. The center-based learning approach should be used by DEPED teachers if they want to raise student performance. Teachers should apply the productive pedagogy reflection criteria provided by the researcher when choosing the approach, method, strategy, or technique they will use in their lessons.

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