

The Challenges in Teaching Science Subject Employing Problem-Based Learning Approach

Xela Efrena V. Sator

<https://orcid.org/0000-0002-5424-708X> | xelaefrena.sator@deped.gov.ph

Teacher-in-Charge, Lunas Elementary School, Lunas, Carcar City, Cebu, Philippines

Joselito V. Dinela

<https://orcid.org/0009-0007-8400-4621> | joselito.dinela@deped.gov.ph

Teacher III, Matalao Elementary School, Matalao, Dumanjug, Cebu, Philippines

Felmarie D. Libato

<https://orcid.org/0009-0000-5124-6359> | felmarie.libato@deped.gov.ph

Teacher I, Polo Elementary School, Polo, Alcantara, Cebu, Philippines

Lyndon G. Frejoles

<https://orcid.org/0009-0005-6794-2400> | lyndon.frejoles@deped.gov.ph

Teacher I, Panlaan Elementary School, Panlaan, Dumanjug, Cebu, Philippines

Renan P. Unabia

<https://orcid.org/0009-0008-4910-1837> | renan.unabia@deped.gov.ph

Head Teacher III, Tawog Elementary School, P. Nellas St., Poblacion III, Carcar City, Cebu, Philippines

Abstract

This study investigates the efficacy of the Problem-Based Approach in teaching Science to fourth-grade students at Carcar Central Elementary School, District of Carcar 1, Carcar Cebu, during the 2017-2018 academic year. The research addresses the primary question of whether this pedagogical approach positively impacts student performance and, consequently, aims to inform the development of an instructional plan. Employing a 0.05 level of significance, the study examines the significant difference between pre-test and post-test scores, revealing a rejection of the null hypothesis and affirming the approach's effectiveness. The findings indicate that the Problem-Based Approach enhances understanding and application of Science concepts, with post-test mean scores surpassing pre-test scores. Moreover, the study identifies the least learned competencies, shedding light on specific challenges related to abstract concepts in Science, particularly in the areas of light, sound, and heat. The qualitative analysis of student experiences underscores positive engagement, teamwork, and a sense of responsibility during problem-based

activities. In conclusion, the study recommends the integration of the Problem-Based Approach into Science education for fourth-grade students, acknowledging its potential to foster critical thinking, problem-solving, and collaborative skills. The research contributes valuable insights to the educational landscape, advocating for innovative and student-centered approaches to enhance Science learning outcomes.

Keywords: Science, Most Essential Learning Competencies, Least Mastered Skills, Grade-5 teachers and learners, Strategic Intervention Plan

Introduction

Problem-based learning (PBL) is an approach that challenges students to learn through engagement in a real problem (Ali, 2019). It further stated that that simultaneously develops both problem solving strategies and disciplinary knowledge bases and skills by placing students in the active role of problem-solvers confronted with an ill-structured situation that simulates the kind of problems they are likely to face as future managers in complex organizations.

It is also being noted that there are several unique aspects that define the PBL approach such; learning takes place within the contexts of authentic tasks, issues, and problems--that are aligned with real-world concerns. In a PBL course, learners and the instructor become co-learners, co-planners, co-producers, and co-evaluators as they design, implement, and continually refine their curricula (Yew & Goh, 2016). The PBL approach is grounded in solid academic research on learning and on the best practices that promote it. This approach stimulates students to take responsibility for their own learning, since there are few lectures, no structured sequence of assigned readings, and so on.

It furthers discoursed that Problem-Based Approach occurs mostly in a small groups rather in lectures. The teachers act only as facilitator, the coach and resource person to the learners not the knowledge disseminator.

It added that traditional education practices, learners often forget what they have learned and cannot apply to the real life situation, realizing that being traditional teachers is a burden to both part in teachers and learners. According to Bidokht and Assareh (2011) Traditional educational approaches do not lead to a high retention, were studies have shown that in 90 days students forget 90% of everything they have been told and it added that such traditional classrooms environments is also usually low.

The use of lecture-based teaching methods has been observed to elicit an indifferent response from students (Ondog & Kilag, 2023). Those who are auditory learners may benefit, but others often appear tired and restless. This method tends to disrupt the learning environment, as some students stand up, visit the restroom without purpose, or even leave the classroom to eat. Their lack of participation in discussions transforms them into sources of disturbance within the class. Additionally, some students resort to cutting classes due to boredom and disinterest, rendering the lesson ineffective. The negative consequences of these behaviors result in a waste of valuable class time that could otherwise be dedicated to meaningful learning activities.

Based on the National Achievement Test in the previous years, low performance of pupils in science in both elementary and high school level is still the main issue and concern according to Nyoni, et al.(2017), one factor that affects low performance is the teachers' effectiveness. This is the greatest factor to be considered anchored with pupils' behaviour when it comes to pupils' achievement.

Constructed on the data of the SMEA tools of 2017-2018 specifically the first and second quarter of Carcar Central Elementary School, it showed that science subject perform the least in terms of MPS compare to the other subjects.

Statement of the Problem

The study evaluated the effectiveness of Problem Based-Approach in teaching Science grade 4 in Carcar Central Elementary School, District of Carcar 1, Carcar Cebu for the school year 2017-2018 as basis for proposing an instructional plan.

To answer the main problem, the study sought to investigate the following sub-problems.

1. Is there a significant difference between the pre-test and post test performance of grade four learners?
2. What are the least learned skills of the grade four learners in quarter three?
3. What are the learning experiences of the grade four learners exposed in Problem-based Learning approach?

Hypothesis

The hypothesis was tested 0.05 level of significance.

Ho: There is no significant relationship between the pretest and post-test performance of grade four learners

Literature Review

The review delves into the significance and applicability of Problem-Based Learning (PBL) across educational settings, sourcing insights from relevant literature and research studies. Wood (2003) defines PBL as a learner-driven process utilizing real-world issues to enhance knowledge and understanding, originating from McMaster University's medical school programs and expanding across disciplines and educational levels. PBL promotes student-focused, active learning, fostering critical thinking and collaboration skills. Challenges include resource intensity, information overload, and the need for skilled facilitation (Wood, 2003).

Studies, including Ayaz and Sekerci (2015) and Trullàs, et al. (2022) on Springer, affirm the success of constructivist, problem-based learning methods, showcasing positive outcomes across diverse subjects. Malaysia introduced PBL in secondary mathematics through the Problem-Based Learning the Four Core Areas (PBL4C) model (Haridza & Irving, 2017) while universities in Malaysia, like University Tun Hussein Onn Malaysia (UTHM) and Universiti Malaya, have

successfully incorporated PBL into their curricula. Republic Polytechnic in Singapore is a notable example of full-scale PBL adoption across all diploma courses.

A Problem-Based Approach is explored in education law, offering a hands-on approach to understanding legal concepts and fostering problem-solving skills. Inquiry-based instruction, rooted in constructivism, emphasizes hands-on learning, with PBL aligning with its principles, empowering students to conduct research, integrate theory, and apply knowledge to solve defined problems (Kilag, et al., 2023).

Teachers play a crucial role in creating a genuine PBL environment, acting as facilitators and guiding students through the learning process. Teachers must support inquiry-based instruction, ask open-ended questions, and manage the transition from traditional teaching methods to PBL. Direct instruction, a teacher-driven strategy, contrasts with PBL's student-centered, inquiry-oriented approach, with PBL offering a more engaging and motivating environment, promoting higher-order thinking.

PBL and Project-Based Learning (PjBL) share similarities but differ in outcome focus, with PBL emphasizing problem-solving and PjBL involving creating a product (Anazifa & Djukri, 2017). Finding a balance between the two is essential for a successful classroom. Challenges in transitioning to PBL include teacher adaptation, time constraints, and the difficulty of assessing learning outcomes (Uy, et al., 2023). Despite challenges, PBL stands as an engaging alternative to traditional instructional methods, offering opportunities for meaningful, relevant learning experiences. The adaptability of teachers in balancing various pedagogical approaches is crucial for providing students with diverse and effective learning opportunities.

Methodology

This embodies the order of the research design, flow of the study, research environment, research instruments, data-gathering procedure, and treatment of data and definition of terms.

Research Design

This study primarily makes use of the pre-test post- test design descriptive analytical method of research for this is the most appropriate mean of evaluating the effects of problem-based approach of the grade 4 learners in Science in Carcar Central Elementary School.

Research Environment

The study was conducted in Carcar Central Elementary School specifically in a single group in grade IV level of Carcar City Division, District 1. The school is located in the center part of Carcar City.

Carcar Central Elementary School is the only mega school in whole Carcar City. Composed of 56 teachers including the 4 Speed teachers, 3 Master Teachers and a full pledge principal. It has 2200 pupils from kindergarten to grade 6 and speed learners. The school specifically located at P. Nellas St. Poblacion 3, Carcar City, Cebu.

As an implementing arm of Department of Education, Carcar Central is devoted to provide chances to challenge its pupils with the facilitation of the teachers to discover and pursue their aspirations. It is the primary trust of the school to equip them with academic, and develop the 21st century skills and character, personal discipline, and cultural awareness that will mold them into responsible and successful citizens.

Interms of physical facilities, CCES has thirteen school buildings with forty-six instructional classrooms. One building is declared for demolition. The other two school buildings will also be demolished sooner for they're already dilapidated. The Gabaldon Building as the oldest building in school has sixteen classrooms and a library. The school library is functional with donated books from private partners and from the Ramon Aboitiz Foundation. All learners and teachers are welcome to maximize the use of the library facilities. It is also used as conference room.

Computer units are placed for use with internet connectivity in the offices. CCES is also a recipient of the DepEd Computerization Program. The E-Learning classroom is not yet air-conditioned.

Research Respondent

The respondents of the study were the grade IV level of section S.B. with 42 learners composed of 25 boys and 17 girls of Carcar Central Elementary School, District of Carcar I in Carcar City Division. They were tapped because they were directly involved and observe by the researcher. The respondents are presented in table 1.

Table I
Respondents of the Study

Pupils	Number of Pupils
Male	25
Female	17
Total	42

Research Instrument

This study utilized an adapted tool from Department of Education Learner's Manual. It is the chapter test questionnaire in Science IV K-12 curriculum, with 35 items in the third quarter. There were six competencies developed in the questionnaire. The same questionnaire was administered to the grade four learners during the pretest and posttest.

Data Gathering Procedures

In conducting the study, the researcher asked permission from the Schools Division Superintendent of DepEd Carcar City. Once it was approved, the researcher furnished a copy of the transmittal letter to the school head of Carcar Central Elementary School. After which the researcher asked a parents' permit for the respondents to conduct the study. After the approval, the researcher conducted the pre-test assessment to the subjects. The respondents were exposed to the problem-based approach in teaching the competencies during the third quarter. After the delivery of the competencies, the respondents were given post-test. The result of the pre-test and post-test were checked, tabulated, analysed, statistically treated and interpreted.

Treatment of Data

1. Mean Percentage Score was used to determine the performance of the learners in Science during the pre-test and post-test.
2. T-Test- this was used in finding the significant difference between the pre-test and post-test performance of grade 4 learners.
3. Frequency and rank was used in determining the least learned skills of grade 4 learners in quarter 3.
4. Thematic analysis was used in interpreting the learners exposed in problem based-approach.

Results

Table 2
SIGNIFICANT DIFFERENCE BETWEEN THE PRE-TEST AND POST-TEST PERFORMANCE

Assessment	Mean	Variance	sd	p-value	Decision	Interpretation
Pretest	7.79	14.81	3.85	0.00*	Reject	Significant
Posttest	18.17	19.56	4.42		Ho	

As reflected in Table 2, significant difference between the pre-test and post-test performance of grade four learners in science in Carcar Central Elementary School. It was found out that the t-computed value of -15.67 is less than the t-tabular value of 2.02 and with 0.05 level of significance and 41 degree of freedom, therefore the null hypothesis is rejected.

This means that there a significant difference between the pre-test and post-test performance of the grade four learners in Science. The mean scores of the grade four learners in the post-test were greater than the pre-test. The standard deviation of the pre-test scores was 3.85 and post-test scores was 4.42 which signifies that the pre-test scores were less dispersed than that of the post-test scores.

The results imply that the problem-based approach is effective in teaching Science. It is the best way for students to learn science is to experience problems that challenge science, and the thought, habits of mind and actions associated with trying to solve them.

Least Learned Competencies of Grade Four learners in Science

The least learned competencies of the grade four learners were determined through the competencies in the third quarter in Science. The result is presented in table 3.

Table 3
LEAST LEARN COMPETENCIES OF GRADE FOUR LEARNERS IN SCIENCE
N = 42

Competencies	Items	f	Ave. Percentage	Rank
Practice safely measures in physical activities and proper handling of materials	1-7	93	66.43	1
Explain the effects of force applied to an object	8-11	147	60.0	2
Describe the forces exerted by magnets	12-14	59	56.19	3

Describe ways to protect oneself from exposure to excessive lights, heat and sound	15-22	130	53.06	4
Investigate properties and characteristics of light and sound	23-25 32-34	100	47.62	5
Describe how light, sound and heat travel	26-31 35	82	29.29	6

As gleaned in Table 3, the least learned competencies of the grade four learners in Science in Carcar Central Elementary School. It reveals that competencies of the least learned competencies were describing ways to protect oneself from exposure to excessive lights, heat and sound; investigating properties and characteristics of light and sound; and describing how light, sound and heat travel.

This means that the learners have the difficulty in light, sounds, and heat lessons. Understanding the concepts of light, sound, and heat in science can be quite challenging due to their abstract nature and the complex theories involved. Light, sound, and heat are directly observable with our senses, making it harder for the students to form concrete mental images. The wave-particle duality of light, the behavior of sound waves, and the transfer of thermal energy are intricate ideas that require a deep understanding of physics and mathematics.

This implies that educators need to employ effective teaching strategies, such as visual aids, interactive simulations, and real-world examples, to help students visualize and grasp these abstract concepts better. It is also important to incorporate hands-on experiments that can significantly enhance understanding. Conducting experiments related to optics, sound waves, and heat transfer can provide students tangible experiences that reinforce theoretical knowledge.

Learning Experiences of the Grade Four Learners Exposed in Problem-Based Approach

According to the learner during the interview, *“Basta di ko maminaw mam dili ko makuha sa answer unya ig test gamay ako score, maulaw ko ky sungogon ko sa ako mga kauban”* If I will not participate I can’t get the answers and I will get low scores it is shameful, my classmates will tease me.

Another learner said *“Ganahan ko mam kay ako ila gipasulat sa manila paper sa among report unya ako pajud ang nibarog sa atubangan para mugunit kauban sa reporter.”* I’m happy because they let me wrote our report in the manila paper facing our classmates with the reporter.

Another learner said *“Nindot kaayo mam kay kami tanan naa jud trabaho kada activity nato unya molihok na ang mga lalaki.”* It was great experienced because all the members will work in the activities we have especially the boys.

Another learner said *“Gisugo ko sa ako mama mam palit ug karne sa manok didto sa merkado. Gipadad-an ko ug P150.00 sa akong mama unya nahulog ang sinsiyu nga singkwenta pesos, dili na noon kaabot ug sa akong paliton nga usa aka kilo nga manok.”*

Akong gibuhay kay gipagamyan nang nako ang ako gipalit dili nang isa kilo para maigo ang kwarta para palit sa manok, unya di napod ko magbalik-balik sa merkado.” My mother told me to buy 1 kilo of chicken meat, she gave me P150, but accidentally the P50.00 pesos coin lost, so I decided just buy worth only for the money left in my hand so that will not go back again to the market.

Discussion

The research aimed to assess the effectiveness of the Problem-Based Approach in teaching Science to fourth-grade students at Carcar Central Elementary School, District of Carcar 1, Carcar Cebu during the school year 2017-2018, with the intention of proposing an instructional plan. To address the primary research question, the study investigated the sub-problems mentioned in the statement of the problem sections. The hypothesis, tested at the 0.05 level of significance, posited that there is no significant relationship between the pretest and post-test performance of fourth-grade learners.

The results, as presented in Table 2, indicate a significant difference between the pre-test and post-test performance of grade four learners in Science at Carcar Central Elementary School. The rejection of the null hypothesis suggests that the problem-based approach led to a notable improvement, with post-test scores surpassing pre-test scores. The mean scores for the post-test were higher, indicating an enhancement in student performance. The standard deviation values implied that post-test scores were more dispersed than pre-test scores.

The findings suggest that the Problem-Based Approach is effective in teaching Science, aligning with Valdez and Bungihan (2019) assertion that PBL promotes critical thinking, problem-solving, and communication skills.

Table 3 presents the least learned competencies of the fourth-grade learners, revealing challenges in understanding concepts related to light, sound, and heat. The abstract nature of these topics and the complexity of associated theories contribute to difficulties in comprehension. This necessitates effective teaching strategies, including visual aids and hands-on experiments, to facilitate better understanding.

The results resonate with Topsakal, et al. (2022) perspective that while teaching light, sound, and heat may pose challenges, they present valuable opportunities for developing critical thinking and problem-solving skills.

The qualitative data gathered from learner interviews shed light on positive experiences with the Problem-Based Approach. Students expressed engagement, teamwork, and a sense of responsibility during various activities. Notably, the students found value in participating actively, as it contributed to better understanding and higher scores. The experiences underscore the effectiveness of the problem-based approach in fostering collaboration and active participation.

The study's outcomes suggest that the Problem-Based Approach significantly improves student performance in Science. Addressing the least learned competencies requires targeted teaching strategies, and the positive learning experiences affirm the approach's impact on student engagement and understanding. The study provides a foundation for proposing an instructional

plan based on the effectiveness of the Problem-Based Approach in teaching Science to fourth-grade learners.

Conclusion

In conclusion, this study set out to evaluate the effectiveness of the Problem-Based Approach in teaching Science to fourth-grade students at Carcar Central Elementary School, District of Carcar 1, Carcar Cebu, during the school year 2017-2018. The investigation aimed to inform the development of an instructional plan based on the observed outcomes.

The results of the study revealed a significant difference between the pre-test and post-test performance of fourth-grade learners in Science, indicating that the Problem-Based Approach positively influenced student achievement. The mean scores for the post-test were higher, reflecting an enhancement in understanding and application of Science concepts. The rejection of the null hypothesis supported the notion that the problem-based approach contributed to improved learning outcomes.

The identification of the least learned competencies highlighted specific challenges in understanding abstract concepts related to light, sound, and heat. This finding emphasizes the importance of tailored teaching strategies, including visual aids and hands-on experiments, to address these challenges and enhance comprehension.

Qualitative data on the learning experiences of fourth-grade learners exposed to the Problem-Based Approach provided valuable insights. The students expressed positive engagement, teamwork, and a sense of responsibility during various activities. Active participation was seen as a key factor contributing to better understanding and higher scores. These qualitative findings underscore the effectiveness of the problem-based approach in fostering collaborative learning environments and promoting student involvement.

The study's outcomes align with existing literature, particularly the work of Duch et al. (2015) and Glenberg (2014), which emphasizes the benefits of Problem-Based Learning in promoting critical thinking, problem-solving skills, and communication abilities.

In light of these findings, it is recommended that educators and curriculum developers consider incorporating the Problem-Based Approach into the instructional strategies for teaching Science to fourth-grade students. The study lays the groundwork for proposing an instructional plan that leverages the positive impact of this pedagogical approach on student learning outcomes.

While the results are promising, it is essential to acknowledge the study's limitations, such as the specific context of Carcar Central Elementary School. Further research could explore the generalizability of these findings across diverse educational settings. Additionally, ongoing professional development for teachers to effectively implement Problem-Based Learning is crucial for sustained success.

This research contributes valuable insights to the pedagogical landscape, advocating for the adoption of innovative and student-centered approaches to enhance Science education. The

positive outcomes underscore the potential of the Problem-Based Approach as a valuable tool in fostering a deeper understanding of scientific concepts and preparing students for active engagement in their learning journey.

References

Ali, S. S. (2019). Problem based learning: A student-centered approach. *English language teaching*, 12(5), 73-78.

Anazifa, R. D., & Djukri, D. (2017). Project-based learning and problem-based learning: Are they effective to improve student's thinking skills?. *Jurnal Pendidikan IPA Indonesia*, 6(2), 346-355.

Ayaz, M. F., & Sekerci, H. (2015). The Effects of the Constructivist Learning Approach on Student's Academic Achievement: A Meta-Analysis Study. *Turkish Online Journal of Educational Technology-TOJET*, 14(4), 143-156.

Bidokht, M. H., & Assareh, A. (2011). Life-long learners through problem-based and self directed learning. *Procedia Computer Science*, 3, 1446-1453.

Haridza, R., & Irving, K. E. (2017, February). Developing critical thinking of middle school students using problem based learning 4 core Areas (PBL4C) model. In *Journal of Physics: Conference Series* (Vol. 812, No. 1, p. 012081). IOP Publishing.

Kilag, O. K., Lisao, C., Lastimoso, J., Villa, F. L., & Miñoza, C. A. (2023). Bildung-Oriented Science Education: A Critical Review of Different Visions of Scientific Literacy. *Excellencia: International Multi-disciplinary Journal of Education*, 1(4), 115-127.

Kilag, O. K. T., Aniel, M. T. B., Engbino, V. A., Bubuli, A. L. B., Macapobre, M. D., & Fajardo, J. M. L. (2023). Collaborative-Constructivism Approach Reading Remediation. *International Journal of Social Service and Research*, 3(2), 376-384.

Kilag, O. K. T., Dejino, J. A., Almendras, R. C., Arcillo, M. T., Mansueto, D. P., & Abendan, C. F. K. (2023). Enhancing Student Engagement in Multimedia-Mediated Constructivist Learning: Exploring Students' Perceptions. *EUROPEAN JOURNAL OF INNOVATION IN NONFORMAL EDUCATION*, 3(6), 51-59.

Nyoni, M., Nyoni, T., & Bonga, W. G. (2017). Factors Affecting Students' Academic Achievement in Zimbabwe's Rural Secondary Schools: A Case Study of Marimasimbe Secondary School in Jiri Community. *Dynamic Research Journals' Journal of Economics and Finance (DRJ-JEF)*, 2(3), 01-15.

Ondog, J., & Kilag, O. K. (2023). A Constructivist Framework for Early Grade Numeracy: Drawing on Jean Piaget's Cognitive Development Theory. *Excellencia: International Multi-disciplinary Journal of Education* (2994-9521), 1(4), 308-320.

Topsakal, İ., Yalçın, S. A., & Çakır, Z. (2022). The effect of problem-based stem education on the students' critical thinking tendencies and their perceptions for problem solving skills. *Science Education International*, 33(2), 136-145.

Trullàs, J. C., Blay, C., Sarri, E., & Pujol, R. (2022). Effectiveness of problem-based learning methodology in undergraduate medical education: a scoping review. *BMC medical education*, 22(1), 104.

Uy, F., Kilag, O. K., & Arcilla Jr, A. (2023). Empowering Education: A Learning-Goals-Centric Approach to Curriculum Development. *Excellencia: International Multi-disciplinary Journal of Education* (2994-9521), 1(4), 48-61.

Valdez, J. E., & Bungihan, M. E. (2019). Problem-based learning approach enhances the problem solving skills in chemistry of high school students. *JOTSE*, 9(3), 282-294.

Wood, D. F. (2003). Problem based learning. *BMJ*, 326 (7384), 328-330. <https://dx.doi.org/10.1136%2Fbmj.326.7384.328>

Yew, E. H., & Goh, K. (2016). Problem-based learning: An overview of its process and impact on learning. *Health professions education*, 2(2), 75-79.