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Problem - Based Learning and Direct Teaching Strategies and Investigative Thinking Skills in a Blended Learning Modality of Grade 7 Students

Leianne Mae P. De Guzman[1], Elisa N. Chua PhD[2]

[1]Laguna State Polytechnic University, San Pablo City, Laguna, Philippines
lmpdgzmn[at]gmail.com

[2]Laguna State Polytechnic University, San Pablo City, Laguna, Philippines
elisa.chua[at]lspu.edu.ph

Abstract: ***The study aimed to determine the effectiveness of the blended learning approach and the investigative thinking skills of the grade 7 students of Dr. Maria D. Pastrana National High School for the school year 201-2022. It attempted to identify the pre-and post-performance scores of the learners as to their investigative thinking skills in science in terms of observation, communication, classification, inferences, predictions, and conclusions. Furthermore, it aims to determine if there is a significant difference between the pre-test and post-test scores of the two groups of students as exposed to Problem-based Learning and direct teaching strategies. The study utilized the descriptive quantitative specifically quasi-experimental design. Two groups of Grade 7 students served as the respondents of the study which were selected through purposive sampling using their third-quarter grade in science as a basis. The result indicated that there is a significant difference between the pre-post performance scores of the two groups of students exposed to Problem-based Learning and direct teaching. Since there is a significant difference between the pre and pre-performance scores except for classification, inferences, and conclusions. The null hypothesis is partially sustained. Likewise, there is a significant difference between the post and post-performance scores except for conclusions. The null hypothesis is partially sustained.***

Keywords: Problem-based learning, Direct Teaching, Strategies, Investigative Thinking Skills, and Blended Learning Modality

1. Introduction

Science education is one of the most essential subjects in school because of its significance to students' lives and the totally applicable problem-solving and critical thinking skills it uses and develops. These are lifelong skills that allow learners to produce ideas, weigh decisions intelligently and even understand the evidence behind public policymaking. Teaching technological literacy, critical thinking, and problem-solving through science education gives students the skills and knowledge they need to succeed in school and beyond (Arrieta, et. al., 2020). The Basic Education Learning Continuity Plan allows for the teaching and learning process to continue in the new normal. Despite the uncertainty of the circumstances, each public school is dedicated to achieving the aim of providing high-quality basic education.

Science has shaped the world by making sense of complex events and ideas about natural phenomena. It is a driving force in a country's ability to continue to innovate, lead, and create jobs for the future. Science knowledge is essential for comprehending current events, selecting, and employing technology, and making informed decisions about one's health care (National Research Council, 2013).

Our decision-makers, align curriculum, teaching, assessment, and learning in school and out-of-school settings to meet 'new normal' educational challenges, discover how other countries handle school re-openings and student learning recovery and explore strategies for reimagining the classroom to promote and sustain student-centered and creative pedagogies, master the strategies and skills required to promote hybrid curriculum delivery and learn how to empower students, teachers, and parents to deal with new challenges in the "new normal" of schooling.

Nonetheless, it is important to remember that many educational systems have already revamped their curricula after discovering that students were rarely able to adequately transfer the knowledge and skills acquired in school to everyday situations. Indeed, learning in school was rarely placed in the context of real-life situations, which contributed to the perception that school is boring and out of date.

Varied modes and innovative teaching approaches are adapted and practiced by the "new normal" Science educators. Lectures and discussions thru different online platforms, either synchronous or asynchronous, are of great help in reaching out to those students who find it hard to assimilate lessons and grasp Science theories rather by themselves. Simple experiments using indigenous, noncorrosive, nontoxic materials, like "kitchen experiments" where most of the materials needed for the experiment can be found in the kitchen or any part of the household is another strategy. Simplified activities can be done at home where instructions are provided thru a printed modular mode of delivery (Pamintuan, 2021).

DepEd is looking for ways to facilitate and innovate to provide quality education to Filipino students. With the massive shift in education this school year, DepEd developed various alternative modes of delivering learning to meet the needs of all learners, regardless of who or where they are. By the statements, teachers should develop an enhanced learning strategy to help students maintain interest, cope with, and adjust to the curriculum, as science necessitates a broad

understanding. As a result of this, it can be deduced that learning can be processed, improved, and retained, and thus the problem-based learning method was devised.

Rabino (2014), for a developing country like the Philippines to keep up with the rapid advancement of science and technology, it is critical to emphasize the quality of science education, specifically in the acquisition and enhancement of knowledge and skills to meet the demands of a highly competitive and scientifically inclined society. DepEd is constantly implementing scientific innovations to improve the quality of education in the country.

Although in most educational settings, traditional methodologies of teaching exist, educators are also able to use alternative techniques. It is important to consider techniques that include higher levels of thinking and problem-solving. In addition to the ability to communicate, analyze, research, and agree with others, a PBL is a strategy that helps students acquire problem resolution skills. This methodology enables students to become independent students and teachers to guide the process.

This research aims to determine whether the implementation of a problem-based learning model takes part in blended learning strategies in the investigative thinking skills of 7th grade towards science class. Also, to provide teachers with alternative educational strategies to use during the education process in the new normal setting. In the use of Problem based Learning method, the researcher expects students to become increasingly involved in science learning.

2. Literature Survey

Problem-Based Learning Model

Concerning the article in The Hun School of Princeton (2020), PBL (problem-based learning) is a teaching method that encourages students to take charge of their education. Problem-based learning encourages students to build problem-solving abilities and acquire concepts rather than memorizing facts by using difficult, real-world challenges as the classroom's subject matter. This can manifest itself in a variety of ways. Students submitting ideas and building their business plans to tackle a social need, for example, could be part of a problem-based learning initiative. Students could create, design, and launch their creative product in front of classmates and community leaders individually or in groups.

Kurt (2020), when using PBL, the instructor's role switches from the more traditional paradigm, in which the teacher gives relevant content, tells the class what needs to be done and offers details and information for students to apply their knowledge to a particular problem. The teacher serves as a facilitator in PBL, and the learning is student-driven to address the problem (note: the problem is established at the onset of learning as opposed to being presented last in the traditional model). Furthermore, the tasks range in length from a few weeks to a semester, with daily instructional time dedicated to group work. Furthermore, he mentioned that byworking with PBL, students will: Engage in open-ended scenarios that allow them to comprehend the working world; Participate in small groups to determine what is known and what is unknown, as well as the strategies for obtaining information to aid in the solution of the problem; Investigate a problem and come up with a list of unique solutions using critical thinking and problem solving: and Examine the scenario to see if the genuine issue has been articulated or if there are additional issues to be addressed.

Direct Teaching Strategies

(Renard, 2019), direct instruction is a method of teaching that is guided by the teacher. This means that the teacher stands in front of the class and delivers the material. Students are given precise, guided directions by the lecturers. It is one of the most effective teaching styles, according to research. Although it is frequently misinterpreted, pupils who are taught using the direct instruction method outperform those who are not.

Rohwer (2015), in using direct instruction, the teachers give daily lessons to a class and then individualize their instruction as needed. This type of method has numerous advantages and is very important to the academic success of the students. Further, direct instruction is important because it allows for more interaction. Students can ask more questions and request assistance. Problem-based learning has a wider and broader application. It originated from the educational management paradigm but was later used to apply in different disciplines and fields to test and verify its viability.

Barrows (2016), Problem-based learning (PBL) originated from a concept of small group learning for business education that was introduced during the 1920s. McMaster University in Canada modified this tutorial process in the 70s through research and development into a student-centered pedagogy in which students learn from problems, within small groups, and through discussions.

The literature that were reviewed explains that in a blended learning environment the used of Problem-based learning, direct teaching and other methodologies are important to guarantee in complex in science learning. Also, the literature evaluated for this study was primarily concerned with how using intervention and teaching strategies in education makes the instruction more efficient.

Many of the studies provided here examined the benefits of utilizing PBL instruction. Current technology breakthroughs were also investigated to find out how they may be integrated into teaching and learning. All of these are pertinent to this study because its goal is to evaluate how well using Problem-based learning and direct teaching in the science investigative thinking skills of the learners which were not explored in other research.

3. Methods/ Approach

The study utilized descriptive quantitative research. Bhandari (2020) defines quantitative research as the process of gathering and analyzing numerical data. In the quantitative research dimension, the test model based on a pretest and posttest with research-control groups was utilized. Quantitative experiments are an excellent way of finalizing results and proving or disproving a hypothesis and

are useful for testing the results gained by a series of qualitative experiments (Mobbing, 2019). Quasi-experimental research methods were used in this study. Thomas (2020), the quasi-experimental design aimed to establish a cause-and-effect relationship between an independent and dependent variable. However, unlike a true experiment, a quasi-experiment does not rely on random assignment. Instead, subjects are assigned to groups based on non-random criteria.

The participants of this study were the 120 from 790 grade 7 students of Dr. Maria D. Pastrana National High School, Mauban Quezon, the school year 2021-2022. The respondents of the study were selected by purposive sampling. Purposive sampling is also known as judgmental, selective, or subjective sampling where a sample is a non-probability sample that is selected based on the characteristics of a population and the objective of the study (Crossman, 2017). Since the study only involved the participation of 3 sections of grade 7 students who are attending blended learning modality under the supervision of the researcher. The only respondents of the study are under the conditions that they should be attending a blended learning modality which means they are given printed modular and attending online classes. The one hundred twenty (120) students were selected from the population of Grade 7 students of Dr. Maria D. Pastrana National High School.

The researcher conceptualized the topic by reviewing literature upon which research instruments were designed and validated. The researcher used purposive sampling in the selection of Grade 7 students from Dr. Maria D. Pastrana National High School who served as the respondents of the study. Two sets of lesson exemplars based on the learning competencies of Grade 7 Science reflected in the K to 12 curriculum guides were prepared by the researcher. One focused on Problem-based learning and the other focused on direct teaching. The lesson covered velocity and acceleration under the third grading period. The research instruments prepared by the researcher undergo both external and internal content validations. The comments and suggestions of the validators were incorporated into the final copy of the instrument.

The researcher sought permission from the Division office of Quezon and the principal of Dr. Maria D. Pastrana National High School to conduct the study during the month of March for the School Year 2021 – 2022. After approval, the chosen Grade 7 students were subjected to the study. A pre-test was used to assess the respondents' investigative thinking skills in terms of observation, communication, classification, inferences, predictions, and conclusions of science 7. The teacher-made lesson exemplar was executed using problem-based learning and direct teaching strategies. Problem-based learning was applied to Group A while direct teaching was used in Group B. Pre-Performance test was given prior to the conduct of the study. Two groups of students during the months of February-March. Pre-test and Post-test were administered to a control group of grade 7 students to measure and analyze their investigative thinking skills in Physics before and after the use of Problem Based Learning and direct teaching. The pre-test and post-test were distributed to the participants. Retrieval and data collection will follow. Statistical treatment will be used to measure and analyze the result.

After the execution of the lesson, students answered the post-test prepared by the researcher. Results were collected, tallied, tabulated, and submitted to CTE-GSAR Research and Statistics Center for statistical analysis. To measure the mean performance of Grade 7 students in Physics before and after using the PBL, the Mean Percentage Score (MPS) formula will be used.To measure the effectiveness of PBL as a basis for enhancing the investigative thinking skills of grade 7 students, a t-test for dependent samples will be calculated by the researcher and its result will be tested statistically at a 0.05 level of significance.

The table shows the pre-test performance of the students belonging to the problem-based group is high in terms of communication, average in inference, prediction, and conclusion, and low in terms of classification and observation. This implies that the students are proficient in terms of communication, beginning in terms of classification and observation and approaching proficient in terms of inference prediction and conclusion.

In the pre-performance test belonging to the direct teaching group, the students are developing in all the investigative thinking skills. This suggests that in the communication of a problem-based learning group, many of the learners could use descriptive words in the science concepts while students belonging in the direct teaching group, most of the students has still no prior knowledge in terms of investigative thinking skills because of this past year they do not have an actual lesson because of the pandemic. The students rely only in a modular learning modality and have no prior mastery. The table further showed that the results of both groups were low in overall investigative thinking skills. It can be perceived that learners who were under the problem-based learning got an overall mean of 16.02 (SD=3.985) while the learners under direct teaching strategies got a mean of 18.77 (SD=4.876). There was a mean difference of 2.75, and it showed that direct teaching had a higher mean during the pre-test. However, it also manifested that among the skills, communication in problem-based learning was able to get a high result which was 4.32 (SD=1.818).

Table 2 presented on the next page is the post-test mean scores of students in their investigative thinking skills using problem-based learning and direct teaching strategies.

4. Results / Discussiom

Table 1 presented the pretest mean scores of students in their investigative thinking skills using the problem-based learning and direct teaching strategies learning modality. The focused skills are observation, communication, classification, inference, prediction, and conclusion.

Table 1: Pretest Mean Scores of Students in Their Investigative Thinking Skills

Investigative Thinking Skills	Problem-Based			Direct Teaching		
	Mean	SD	DI	Mean	SD	DI
Observation	2.30	1.197	Low	3.22	1.209	Low
Communication	4.32	1.818	High	3.67	1.410	Low
Classification	3.07	1.517	Low	2.70	1.442	Low
Inference	3.48	1.372	Average	3.15	1.830	Low
Prediction	3.75	1.480	Average	3.08	1.169	Low
Conclusion	3.42	1.293	Average	2.95	1.672	Low
Overall Investigative Thinking Skills	16.02	3.985	Low	18.77	4.876	Low

Legend: DI-Descriptive Interpretation Very Low 2.5-3.9 (Beginning) Low. 2.6-4.0(Developing) Average 4.10 – 5.5(Approaching proficient) High. 5.6- 7.0(Proficient) Very High (Advanced); 1.00 Very Low (Beginning) 2.25 Low. (Developing) 3.50 Average (Approaching Proficient) 4.75 High(Proficient) 6.00 Very High (Advanced)

Table 2: Posttest Mean Scores of Students in Their Investigative Thinking Skills Using the Problem-Based Learning and Direct Teaching Strategies Learning Modality

Investigative Thinking Skills	Problem-Based			Direct Teaching		
	Mean	SD	DI	Mean	SD	DI
Observation	5.30	1.169	VH	4.92	1.279	H
Communication	6.10	1.160	VH	5.85	1.176	VH
Classification	5.40	.995	VH	5.13	1.049	VH
Inference	6.27	.972	VH	5.95	1.048	VH
Prediction	5.92	1.293	VH	5.67	1.244	VH
Conclusion	6.73	.756	VH	6.22	.976	VH
Overall Investigative Thinking Skills	35.72	3.805	Very High	33.73	3.799	Very High

Legend: DI-Descriptive Interpretation Very Low 2.5-3.9 (Beginning) Low. 2.6-4.0(Developing) Average 4.10 – 5.5(Approaching proficient) High. 5.6- 7.0(Proficient) Very High (Advanced); 1.00 Very Low (Beginning) 2.25 Low. (Developing) 3.50 Average (Approaching Proficient) 4.75 High (Proficient) 6.00 Very High (Advanced)

The table shows that the post-test performance of the students in their investigative thinking skills using problem-based learning and direct teaching shows that the performance in investigative thinking skills as to communication, classification, inference, prediction, and conclusion of two groups are very high showing there are already on the advanced stage except for observation in direct teaching which is high and in a proficient stage.

In the problem-based group was asked to perform to differentiate the science concepts through an e-learning videos and more on authentic assessment that showcase real-world scenarios than the direct teaching group which utilizes instruction as to the lesson exemplar, See Appendix G (lesson exemplar for Problem-based Learning) and H (lesson exemplar for direct teaching). In the problem-based group, the students had able to develop their investigative thinking skills. The researcher observed in the actual conduct of the study that the student's feedback positive interest in the subject. One student sent me a private message on my messenger account, "I really enjoyed our lesson because I can relate to the given problems, Ma'am! "(See Appendix L).

It was presented on the table that the overall mean scores of both groups had the descriptive interpretation of high, as it was shown that the group of students in problem-based learning got the mean score of 35.72 (SD=3.805) while the students in direct teaching strategies got the mean score of 33.73 (SD=3.799). Moreover, it was also shown that the investigative thinking skills which had the highest mean score were the conclusion in both groups.

The results affirmed to the statement of Skinner (2012) that in PBL, the process of learning is largely influenced by the contextual boundaries of structures and routines. For instance, the classroom is no longer used primarily as a "knowledge-filling" place and the teacher no longer assumes the content-giving role. Knowledge gathering now requires a larger context, which takes place outside the classroom. The teacher-student relationship also takes on a different dimension. As such, any changes in these boundaries are likely to impinge upon the rate and degree to which individuals learn. In the same way, the causes and effects of these boundary changes are likely to influence the way individuals behave and act. Of pertinence is the parallelism between the way individuals think (cognition) and act (behavior), and the stimulus-response theory of learning.

Table 3: Mean Gain Scores of Students in Their Investigative Thinking Skills Using the Problem-Based Learning and Direct Teaching Strategies Learning Modality

Investigative Thinking Skills	Problem-based Learning		Direct Teaching		Mean Gain Scores	
	Mean	SD	Mean	SD	Mean	SD
Observation	3	0.03	1.7	0.07	2.38	1.85
Communication	1.78	0.66	2.18	0.25	2.79	1.93
Classification	2.33	0.53	2.43	0.39	2.38	1.94
Inference	2.79	0.4	2.8	0.78	3.29	1.51
Prediction	2.17	0.19	2.59	0.07	2.35	1.79
Conclusion	3.31	0.53	3.27	0.69	3.99	1.65

The table shows that the total mean gain scores revealing that the students have an improved performance as to their pre and post assessment of the students in their investigative thinking skills using the problem-based learning and direct teaching strategies learning modality. The importance of gain scores is that it tells the difference between the two performances. A positive difference denotes a positive gain in performance whereas a negative score suggests a decline in performance. The mean in the post test is higher than the pre-test scores. Since the students were provided with learning strategies engaging with Problem-based learning and direct teaching that intended to improve learning.

It manifested in the results that the overall mean score was 21.6667 (SD=7.44) which had the interpretation of average. The skill with the highest mean score was the conclusion with 3.9917 (SD=1.65) while the lowest was prediction with a mean score of 2.3500 (SD=1.79). According to Walker et al., (2016) PBL is predicated upon the belief that learning is most effective when learners are actively involved and learn in a context where knowledge is to be used for a specific purpose. In other words, PBL is learning with relevance to prior objectives set – as opposed to conventional spoon-feeding and rote learning, evident in teacher-designed didactic settings.

Table 4: Test of Significant Difference between the Pretest and Posttest Performances as to Investigative Thinking Skills of Problem-Based Learning

Investigative Thinking Skills			Paired Differences				t	Sig. Two-Side dp
	Mean	SD	SEM	Std. Error Difference	95% Confidence Interval of the Difference			
					Lower	Upper		
Observation	3.00	.03	0	.210	-2.58	-3.42	14.29	<.001
Communication	1.78	.66	.08	.257	-1.27	-2.30	6.93	<.001
Classification	2.33	.53	.07	.250	-1.83	-2.83	9.33	<.001
Inference	2.79	.40	.05	.218	-2.35	-3.22	12.77	<.001
Prediction	2.17	.19	.02	.254	-1.66	-2.67	8.53	<.001
Conclusion	3.31	.53	.07	.172	-2.97	-3.66	19.26	<.001

The table shows that there is a significant difference between the pre-performance scores and the post-performance scores of the students exposed to blended learning modality using problem-based learning. Table 4 presented the group statistics of two groups of students in their pretest and post-test performance. It exposed the respondent's score in all investigative thinking skills. The students using the Problem-based learning modality performed better to the results of their scores from their pretest to post-test, most of the students in the problem-based group had experienced their grade 6 to have an online class once a week. The problem-based group was longer exposed to a blended learning approach than the direct teaching group.

Table 5: Test of Significant Difference between the Pretest and Posttest Performances as to Investigative Thinking Skills of Direct Teaching

Performance			Paired Differences				t	Sig. Two-Sidedp
	Mean	SD	SEM	Std. Error Difference	95% Confidence Interval of the Difference			
					Lower	Upper		
Observation	1.70	.07	.01	.225	-1.25	-2.15	7.57	<.001
Communication	2.18	.25	.03	.232	-1.72	-2.65	9.40	<.001
Classification	2.43	.39	.05	.228	-1.98	-2.89	10.65	<.001
Inference	2.80	.78	.10	.279	-2.24	-3.36	10.04	<.001
Prediction	2.59	.07	.01	.246	-2.09	-3.08	10.49	<.001
Conclusion	3.27	.69	.09	.216	-2.83	-3.70	15.10	<.001

The table shows that there is a significant difference between the pre-performance scores and the post-performance scores of the students exposed to blended learning modality using direct teaching strategies. Table 5 presented the group statistics of two groups of students in their pretest and post-test performance. It exposed the respondent's score in all investigative thinking skills.

This affirmed the statement of Kurt (2020), that when using PBL, the instructor's role switches from the more traditional paradigm, in which the teacher gives relevant content, tells the class what needs to be done, and offers details and information for students to apply their knowledge to a particular problem. The teacher serves as a facilitator in PBL, and the learning is student-driven to address the problem.

Table 6: Test of Significant Difference between the Pretest Performances of two groups of students

Investigative Skills		t-test for Equality of Means						
		t	Df	Significance	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
				Two-Sided p			Lower	Upper
Observation	Equal variances assumed	-4.17	118	<.001	-.917	.220	-1.35	-.482
	Equal variances not assumed	-4.17	117.990					
Communication	Equal variances assumed	2.188	118	.031	.650	.297	.062	1.238
	Equal variances not assumed	2.188	111.130					
Classification	Equal variances assumed	1.357	118	.177	.367	.270	-.168	.902
	Equal variances not assumed	1.357	117.696					

Inference	Equal variances assumed	1.129	118	.261	.333	.295	-.251	.918
	Equal variances not assumed	1.129	109.375					
Prediction	Equal variances assumed	2.738	118	.007	.667	.243	.185	1.149
	Equal variances not assumed	2.738	111.977					
Conclusion	Equal variances assumed	1.711	118	.090	.467	.273	-.074	1.007
	Equal variances not assumed	1.711	110.978					

The table shows the test of significant difference between the pretest performances of the two groups of students. Accordingly, it can be perceived that learners who were under the problem-based learning got the overall mean of 16.02 (SD=3.985) while the learners under direct teaching strategies got a mean of 18.77 (SD=4.876). There was a mean difference of 2.75, and it showed that direct teaching had the higher mean during the pre-test in Observation. Therefore, the results showed that there were significant differences observed between the pretest performance scores of the two groups of students in their investigative skills in studying the Science subject. The students of the groups of learning modalities had shown different mean scores.

This proved that the importance to PBL is the interactive dynamism among learners where the focus is on the process utilized by the learner rather than that directed by the teacher. In addition, PBL encourages focused learning based on relevance to the learner's identified objectives, ensuring that the process of knowledge acquisition is effective and efficient (Wee, 2014).

Table 7: Test of Significant Difference between the Posttest Performances of two group of students

Investigative Skills		t-test for Equality of Means						
		t	df	Significance	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
				Two-Sided p			Lower	Upper
Observation	Equal variances assumed	1.713	118	.089	.383	.224	-.060	.826
	Equal variances not assumed	1.713	117.048					
Communication	Equal variances assumed	1.172	118	.244	.250	.213	-.172	.672
	Equal variances not assumed	1.172	117.977					
Classification	Equal variances assumed	1.429	118	.156	.267	.187	-.103	.636
	Equal variances not assumed	1.429	117.670					
Inference	Equal variances assumed	1.716	118	.089	.317	.185	-.049	.682
	Equal variances not assumed	1.716	117.329					
Prediction	Equal variances assumed	1.079	118	.283	.250	.232	-.209	.709
	Equal variances not assumed	1.079	117.828					
Conclusion	Equal variances assumed	3.242	118	.002	.517	.159	.201	.832
	Equal variances not assumed	3.242	111.076					

As was shown above, the results revealed that there is a significant difference observed in the overall post-test performance between the two groups of students in their investigative skills relating to the conclusion in studying the Science Subject. The students using the PBL modality performed better in all investigative thinking skills.

This confirmed the study of Yang (2012) that when compared to traditional teaching where the teacher unilaterally instills knowledge, PBL places major emphasis on the student, with the teacher playing a catalytic role in cognitive coaching, guiding, and training students to actively explore knowledge, to acquire the know-how of effective lifelong learning, to gain collaborative problem-solving social skills. As a driving force for reforms in teaching concepts and teachers' self-renewal, PBL is a promising tool for transforming a teacher's career life.

Table 11: Test of Significant Difference between the Overall Posttest Performances of two groups of students

		t-test for Equality of Means						
		t	df	Significance	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
				Two-Sided p			Lower	Upper
Post Test	Equal variances assumed	2.857	118	.005	1.983	.694	.609	3.358
	Equal variances not assumed	2.857	118.0	.005	1.983	.694	.609	3.358

The results implied that there was a significant difference observed in the overall post-test performance between the two groups of students using the two learning modalities. Taking the overall post-test performance of the student the table reveals that there is a significant difference in the pre-performance of the students. This suggests that the problem-based learning group and direct teaching group had improved their scores during their post-performance scores.

The results agree with the statement of Yew & Goh (2016) that Problem-Based Learning (PBL) is an educational technique that allows students to learn while actively participating in real-world challenges. Through practice and reflection, students are provided opportunities to problem-solve in a collaborative context, construct mental models for learning, and form self-directed learning habits. Moreover, PBL supporters argue that it improves learning quality by fostering students' reflective, critical, and collaborative skills. When compared to students in a lecture-based learning environment, studies on the effectiveness of PBL appear to be varied, but they generally demonstrate that students who have experienced PBL acquire similar or fewer learning gains when it comes to short-term information acquisition.

5. Conclusion

Based on the findings of the study the following conclusion was drawn. There is a significant difference between the pre- and post-performance scores of the two groups of students exposed to Problem-based Learning and direct teaching. Since there is a significant difference between the pre and pre-performance scores except for classification, inferences, and conclusions. The null hypothesis is partially sustained.

Since there is a significant difference between the post and post-performance scores except for conclusions. The null hypothesis is partially sustained.

6. Future Scope

1) The study revealed that there was a significant improvement in the performance of the students. Therefore, it is recommended that teachers, as curriculum implementers, may consider using Problem-based Learning and direct teaching in devising a lesson exemplar that will meet the needs of the teaching and learning process, particularly in the context of distant learning. The intervention that should be prepared must fulfill the department's requirements and adhere to the department's guidelines, instructions, and memos.
2) Since investigative thinking skills of the students, when exposed to direct teaching, needs to be improved by incorporating learning tasks that will enhance their ability to perceive their senses and to recognize the subject's importance or significance.
3) A replication of the study can be conducted by exploring other learning strategies. the next researcher may also use the data gathered in conducting the study in other subjects and on bigger sample size.

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Author Profile

Leianne Mae P. De Guzman is a graduate student in Laguna State Polytechnic University taking Master of Arts in Education major in Science and Technology. She finished the degree Bachelor of Secondary Education major in Physical Science in Southern Luzon State University- Lucban, Quezon. She is a science teacher at Dr. Maria D. Pastrana National High School. She has served as an active member of the Philippine Association of Physics and Science Instructors.

Elisa N. Chua, PhD; Associate Professor 5 at Laguna State Polytechnic University San Pablo City Campus-College of Teacher Education, Faculty of Graduate Studies, and Applied Research. Former Chairperson of the Research and Development Office and presently the Program Coordinator of the College of Teacher Education of LSPU-San Pablo City. She earned her Masteral Degree at Ateneo De Manila University, Quezon City and Doctor of Philosophy in Educational Management at Philippine Normal University, Manila. She presented numerous research studies on national and international conferences and published this research in reputable journals. She teaches science courses and professional

subjects in the undergraduate program, and major science subjects, methods of research, and thesis writing in the graduate program. She has served as thesis adviser to graduate students major in science and technology and educational management.