PROBLEM POSING INQUIRY APPROACHES IN ENHANCING THE LEARNERS' SCIENTIFIC DISCOVERY PROCESS SKILLS

MELVIN G. HERNANDEZ[1], ELISA N. CHUA, PhD[2]
[1]https://orcid.org/0000-0001-6010-2269, [2]https://orcid.org/0000-0003-1358-9953
[1]melvin.hernandez@deped.gov.ph, [2]elisa.chua@lspu.edu.ph
[1]Col. Lauro D. Dizon Memorial National High School, Department of Education
[2]Laguna State Polytechnic University San Pablo City Campus

ABSTRACT

Learning science is a bit technical, scientific, as well as complex. Understanding scientific processes, through a certain teaching method was the central theme of this investigation. The purpose of this study was to examine the use of Problem Posing Approaches in teaching science and its effect to Science Discovery Process of Grade 10 learners at Col. Lauro D. Dizon Memorial National High School, San Pablo City during the Academic Year 2018-2019. The study utilized the pretest-posttest experimental design. Three heterogeneous groups of Grade 10 students were used; the first group was exposed to free-structured problem posing, the second to semi-structured problem posing and the third group to structured problem posing. Students in the experimental group were matched and paired in accordance to their second grading grades before the execution of the test. The research findings indicated that the pre-test scores of the students who were subjected to problem posing approaches had almost the same level of prior knowledge and proficiency skill in science at the start of the study. Meanwhile, the post test scores revealed that majority of the students improved their level of performance after the implementation of the said approach. In addition, since the posttest scores were higher than pre-test scores, high mean gain scores were also observed and noted. The difference between the mean pre-test scores of the students from the experimental groups was all marked as "Not Significant." Likewise, there was no significant difference in the mean posttest scores of the students in all components of scientific discovery process. However, the mean difference in the pre-test and posttest scores among the three experimental groups was found "significant".

Keywords: problem posing, inquiry approach, scientific discovery process, science education

INTRODUCTION

Science as a shared institution intends to yield more and more accurate natural explanations of how the natural world works, what its components are, and how the world got to be the way it is now. Science's main objective has been constructing knowledge and understanding, regardless of its potential applications. Scientific research is carried out with the explicit goal of solving a problem or developing a technology, and along the path to that goal; new knowledge and explanations are constructed (Caldwel, 2018).

In today's world, technology and the products of science are everywhere. There are public policies which directly affect every aspect of lives based in scientific evidence. The massively complex natural world that surrounds everyone demonstrates countless scientific concepts. As individuals grow up in an increasingly technologically and scientifically advanced world, they need to be scientifically literate to succeed (Meiners, 2017). Science offers ways of making sense of the world systematically. These includes developing student's scientific inquiry skills, values and attitudes, such as objectivity, curiosity, and honesty and habits of mind including critical thinking. Each of these is helpful to every student for his own personal development, future career, and life in general. These skills, values, attitudes, and dispositions are equally useful to the community that an individual student belongs to, and are further useful to the country that he lives in. The learning of science is also important for the nation's cultural development and preservation of its cultural identity. Science is most useful to a nation when it is utilized to solve its own problems and challenges, keeping a nation's cultural uniqueness and peculiarities intact (Brawner, 2011).

The Philippines' Grades 1-10 Science Curriculum envisions the development of scientifically, technologically, and environmentally literate and productive members of society. They must possess effective communication and interpersonal and lifelong learning skills as well as scientific values and attitudes. These skills will be acquired through a curriculum that focuses on knowledge relevant to real world and encompasses methods of inquiry. These will be implemented in a learning environment that promotes the construction of ideas and instills respect for others (DepEd Order No. 43, s. 2013).

According to the DepEd's K to 12 Science Curriculum Guide 2013, the aim of the science curriculum is to produce scientifically literate citizens who are informed and active participants of the society, responsible decision makers, and apply scientific knowledge that will significantly impact the society and the environment. Specifically, the science curriculum is designed to enhance three learning domains of the students. These are performing scientific processes and skills, understanding and applying scientific knowledge, and developing scientific attitudes and values.

In line with the above-mentioned statements, enhanced learning strategies from the teachers should be developed for the students to retain interest, cope up and adjust on the curriculum as Science requires broad understanding. With this, it can be inferred that learning can be processed, improved and retained, thus the use of problem posing approach was conceived to find out its effectiveness in the classroom setting.

OBJECTIVES OF THE STUDY

This study aimed to assess the use of Problem Posing Approaches in the teaching learning process and its effects in enhancing students' science discovery process. Specifically, the study attempted to obtain 1) the pre-test and posttest scores of the students who are subjected to problem posing approaches; 2) to analyze the mean gain scores of students who are exposed to the three types of problem posing approaches; 3) to find any significant difference in the mean pre-test and posttest scores of the students; and as well as 4) the significant difference in the mean pretest and posttest scores of the students who are exposed to the different problem posing approaches.

METHODOLOGY

The researcher employed experimental design using pretest and posttest. The experimental groups were taught using problem posing approach. One group for free structured problem posing (FSPP), the second group for semi-structured problem posing (SSPP) and the third group for structured problem posing (SPP). All groups were given the same set of lessons discussed and same set of pre-test and posttest. A teacher made test was the primary instrument for this study. The test was constructed based on student's scientific discovery process in terms of: problem solving *(conceptual understanding and procedural knowledge*) and scientific reasoning *(evaluate and drawing conclusion)*.

The study was conducted after seeking permission from the school authority, namely: division superintendent, school principal, head teacher of science department, and teacher-evaluators.

The study covered three phases namely: *Preliminary Stage,* (instrument validation, match pairing of respondents and submission of lesson plans to the expert teachers.); *Facilitating learning* (teaching and learning process using the method); and *Gathering data for statistical analysis.* The collected data were subjected to: descriptive statistics such as frequency, percentage, mean, and standard deviation was used to interpret the scores in the pre-test and the posttest. The t-test statistics was used to observe the possible presence of significant difference in the scores of the groups of students before and after the treatment. Finally, Analysis of Variance (ANOVA) was used to determine the possible presence of significant difference in the scores between groups prior to and after the implementation stage. Posited hypotheses were tested at 0.05 level of significance.

RESULTS AND DISCUSSION

1. The Pre-Test Scores of the Experimental Groups

1.1 Pre-test Scores in terms of Conceptual Understanding

Table 1
Pre-test Scores on Problem Solving Skills as to Conceptual Understanding

	Free -Structure Problem Posing		Semi Structured Problem Posing		Structured Problem Posing		
Interval	**F**	**%**	**F**	**%**	**F**	**%**	**Remarks**
9.0-10.0	-	-	-	-	-	-	Superior
7.0-8.0	8	20	4	10	4	10	Advanced
5.0-6.0	12	30	11	27.5	17	42.5	Developing
3.0-4.0	9	22.5	13	32.5	12	30	Basic
0.0-2.0	11	27.5	12	30	7	17.5	Below Basic
Total	40	100	40	100	40	100	

The data presented in the table showed the distribution of the pre-test scores of the experimental groups exposed to Problem Posing Approaches in terms of their problem-solving skills as to Conceptual Understanding. Students belonged to FSPP and SPP both obtained a score ranging from 5.0-6.0 with a percent distribution of 30.0 percent and 42.5 percent, respectively thus the majority of the students on these groups were at the “developing level.”

On the other hand, majority of students belonged to SSPP group attained a score ranging from 3.0-4.0 with a percent distribution of 32.5 percent which was part of the category “basic level”.

Meanwhile, there were eight students under the FSPP group who obtained a score ranging from 7.0-8.0 and four students under SSPP and SPP groups who earned the same score and was labeled as “advanced.” At this point the conceptual understanding of these students was far beyond the other respondents, thus they could highly recall concepts and ideas on the said topics.

1.2 Pre-test Scores in terms of Procedural Knowledge

Table 2
Pre-test Scores on Problem Solving Skills as to Procedural Knowledge

Score	Free -Structure Problem Posing		Semi Structured Problem Posing		Structured Problem Posing		Remarks
	F	%	F	%	F	%	
9.0-10.0	-	-	-	-	-	-	Superior
7.0-8.0	1	2.5	-	-	4	10	Advanced
5.0-6.0	7	17.5	9	22.5	9	22.5	Developing
3.0-4.0	15	37.5	14	35	9	22.5	Basic
0.0-2.0	17	42.5	17	42.5	18	45	Below Basic
Total	40	100	40	100	40	100	

The table above denotes that most of the students on each group obtained a score ranging from 0.0- 2.0 with a percentage distribution of 42.5 percent both for FSPP and SSPP groups and 45 percent for SPP group. The three groups acquired a description of "below basic level" for the procedural knowledge test. However, there were four students from the SPP group and one from the FSPP group who got a score ranging from 7.0-8.0 with a percent distribution of 10 percent and 2.5 percent respectively with a level of "advanced".

Each group of students who took the pre-test under this problem-solving skill manifested low level of procedural knowledge as depicted on their scores.

Generally, the pre-test scores indicate that students in groups have limited knowledge or idea on the topics since most scores were far below the passing score.

1.3 Pre-test Scores in terms of Evaluating

Table 3
Pre-test Scores on Scientific Reasoning Skills as to Evaluating

Interval	Free -Structure Problem Posing		Semi Structured Problem Posing		Structured Problem Posing		Remarks
	F	%	F	%	F	%	
9.0-10.0	-	-	-	-	-	-	Superior
7.0-8.0	4	10	5	12.5	5	12.5	Advanced
5.0-6.0	8	20	4	10	7	17.5	Developing
3.0-4.0	12	30	13	13	11	27.5	Basic
0.0-2.0	16	40	18	45	17	42.5	Below Basic
Total	40	100	40	100	40	100	

The data presented above were the scores of the students on Scientific Reasoning Skills as to Evaluating. It can be gleaned that the majority of students on each group was at the level of "below basic" with the following percentages: 40% (FSPP), 45% (SSPP) and 42.5% (SPP). This data showed that most of the students per group obtained a score ranging from 0.0- 2.0. Students find questions from the evaluating test difficult, such as the writing down of the traits of the organism using the amino acid sequence table. On the contrary, there were few students on each group that were categorized to have "advanced" level scoring between 7.0- 8.0 in the Evaluating part of the preliminary test as the data suggested.

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1.4 Pre-test Scores in terms of Drawing Conclusion

Table 4
Pre-test Scores on Scientific Reasoning Skills as to Drawing Conclusion

	Free -Structure Problem Posing		Semi Structured Problem Posing		Structured Problem Posing		
Interval	**F**	**%**	**F**	**%**	**F**	**%**	**Remarks**
9.0-10.0							Superior
7.0-8.0	1	2.5	5	12.5	2	5	Advanced
5.0-6.0	10	25	8	20	7	17.5	Developing
3.0-4.0	17	42.5	17	42.5	19	47.5	Basic
0.0-2.0	12	30	10	25	12	30	Below Basic
Total	40	100	40	100	40	100	

The above table presents the distribution of the pre-test scores of the respondents exposed to Problem Posing Approaches. The data reveal that most of the students' pre-test scores for each group in the drawing conclusion test were identified to be in "basic" level. The highest pretest scores with a frequency of five or 12.5 percent which was categorized as "advanced" level was achieved by the SSPP group. On the other hand, the lowest score on the preliminary test was gained both by the FSPP and SPP group with a frequency of 12 or 30 percent percentage distribution that falls under the "below basic" level.

2. The Posttest Scores of the Experimental Group

2.1 Posttest Scores in terms of Conceptual Understanding

Table 5
Posttest Scores on Problem Solving Skills as to Conceptual Understanding

	Free -Structure Problem Posing		Semi Structured Problem Posing		Structured Problem Posing		
Interval	**F**	**%**	**F**	**%**	**F**	**%**	**Remarks**
9.0-10.0	8	20	11	27.5	5	12.5	Superior
7.0-8.0	12	30	16	40	16	40	Advanced
5.0-6.0	13	32.5	9	22.5	14	35	Developing
3.0-4.0	7	17.5	3	7.5	3	7.5	Basic
0.0-2.0	-	-	1	2.5	2	5	Below Basic
Total	40	100	40	100	40	100	

Table 5 shows the data of the posttest of each group of students who were exposed to Problem Posing Approaches. Among the three groups of students, the score of 7.0-8.0 got the highest frequency of 16 for both SSPP and SPP groups were coined to be in the "advanced" level. The FSPP group gained a highest score at the scale of 5.0-6.0 with a frequency of 13 or 32.5 percent and falls under the category of "developing" level. It was noticeable that there were students who were in the "superior" level having a frequency of eight or 20 percent (FSPP), 11 or 27.5 percent (SSPP) and five or 12.5 percent (SPP). However, there were still few students that were categorized as “below basic” level having one or 2.5 percent in the SSPP group and two or five percent in the SPP group.

The data suggest that in terms of conceptual understanding the three groups had a higher improvement after the treatment of the problem posing approaches.

2.2 Posttest Scores in terms of Procedural Knowledge

Table 6
Posttest Scores on Problem Solving Skills as to Procedural Knowledge

Interval	Free -Structure Problem Posing F	%	Semi Structured Problem Posing F	%	Structured Problem Posing F	%	Remarks
9.0-10.0	-	-	1	2.5	1	2.5	Superior
7.0-8.0	5	12.5	4	10	6	15	Advanced
5.0-6.0	14	35	19	47.5	20	50	Developing
3.0-4.0	12	30	12	30	12	30	Basic
0.0-2.0	5	12.5	4	10	1	2.5	Below Basic
Total	36	90	40	100	40	100	

The data on the above table presents the posttest scores of the students in terms of their procedural knowledge. It was evident that the highest level achieved in groups SSPP and SPP was in the “superior” level with a frequency of one or 2.5 percent for both groups while only five or 12.5 percent from the score range of 7.0-8.0 was the highest score achieved by the FSPP group coined as “advanced”. However, examining more closely, there were still students from each group that were in the “below basic” level having a frequency of five or 12.5 percent (FSPP), four or 10 percent (SSPP) and one or 2.5 percent (SPP).

Overall, majority of the students exposed to the problem posing approaches were able to attain the “developing” level which was a high improvement result.

The procedural knowledge test included task that needed to be done in a step by step manner. One of this is to analyze and identify the correct arrangement of steps in RNA transcription which was the first part of protein synthesis. The used of problem posing approach in this topic helped students to understand the concepts of transcription.

2.3 Posttest Scores in terms of Evaluating

Table 7
Posttest Scores on Scientific Reasoning Skills as to Evaluating

Interval	Free -Structure Problem Posing F	%	Semi Structured Problem Posing F	%	Structured Problem Posing F	%	Remarks
9.0-10.0	26	65	23	57.5	29	72.5	Superior
7.0-8.0	5	12.5	9	22.5	5	12.5	Advanced
5.0-6.0	2	5	3	7.5	3	7.5	Developing
3.0-4.0	4	10	4	10	2	5	Basic
0.0-2.0	3	7.5	1	2.5	1	2.5	Below Basic
Total	40	100	40	100	40	100	

Table 7 presents the posttest scores of students exposed to Problem Posing Approach in terms of Scientific Reasoning as to Evaluating.

The highest frequency on the posttest scores for each group were as follows: FSPP was 26 or 65 percent, SSPP was 23 or 57.5 percent and SPP was 29 or 72.5 percent all falling under the scale of 9.0-10.0 and interpreted as superior.

The data revealed that majority of the students in each group understood well how a DNA strand was used in transcribing messenger RNA, used the codon to evaluate the correct anti-codon from tRNA and used the genetic code wheel and amino acid sequence table in order to produce certain amino acids. Meanwhile, the lowest posttest scores for each grou, was below basic in the scale of 0.0-2.0. The interpretation was based on the frequency of three (7.5%) for FSPP and one (2.5%) for both SSPP and SPP, respectively.

It is therefore revealed that after using Problem Posing Approaches the students' Scientific Reasoning Skills as to Evaluating were enhanced.

Evidently, the level of participation of the students during class increased enabling them to work cooperatively with each other. This made a lasting impact on their overall performance

2.4 Posttest Scores in terms of Drawing Conclusion

Table 8
Posttest Scores on Scientific Reasoning Skills as to Drawing Conclusion

	Free -Structure Problem Posing		Semi Structured Problem Posing		Structured Problem Posing		
Interval	**F**	**%**	**F**	**%**	**F**	**%**	**Remarks**
9.0-10.0	8	20	11	27.5	4	10	Superior
7.0-8.0	8	20	13	32.5	15	37.5	Advanced
5.0-6.0	15	37.5	9	22.5	14	35	Developing
3.0-4.0	7	17.5	7	17.5	3	7.5	Basic
0.0-2.0	2	5	0	0	4	10	Below Basic
Total	40	100	40	100	40	100	

The table above depicts the posttest scores of the students under the three types of Problem Posing Approaches. It was gleaned from the table that majority of the students under SSPP and SPP was under the score range of 7.0-8.0 with 13 (32.25%) and 15 (37.50%) respectively and got a level of "advanced."

On the other hand, there were 15 (37.5%) who obtained a score range of 5.0-6.0 for FSPP with matching interpretation of "developing" level. The table also shows that there were two (5%) and four (10%) in the score range of 0.0-2.02 obtained the verbal interpretation of "below basic" for SSPP and SPP respectively. It can be inferred from the outcomes of the study that students were able to enhance their Scientific Reasoning Skill as to Drawing Conclusion after being subjected to Problem Posing Approach.

3. Mean Gain Scores after the use of Problem Posing Approaches

As shown in the table it can be inferred that the problem posing approach had comparable results for each experimental group. All the groups achieved the highest mean gain score on the evaluating part of the test where they needed to transcribe and translated RNA to form proteins that corresponds to a certain trait of an organism. The SPP group attained the mean gain score of 4.80 which was the highest for the evaluate skill while SSPP got 4.50 and 2.98 for the FSPP group. Meanwhile, all the experimental groups had the lowest mean gain on the drawing conclusion part of the test with the following scores: FSPP (1.03), SSPP (1.35) and SPP (0.83).

Table 9
Students' Mean Gain Scores when Exposed to Problem Posing Approaches

Scientific Discovery Process Skills	Free-Structured Problem Posing		Semi Structured Problem Posing		Structured Problem Posing	
	Mean Gain	SD	Mean Gain	SD	Mean Gain	SD
Problem Solving Skills						
Conceptual Understanding	2.08	2.00	3.50	2.15	2.18	2.41
Procedural Knowledge	1.68	2.08	2.03	2.03	2.00	2.05
Scientific Reasoning						
Evaluate	2.98	4.07	4.50	3.62	4.80	3.93
Drawing Conclusion	1.03	2.90	1.35	2.95	0.83	2.18

These data suggest that the students have low development in this particular skill. It was expected that the FSPP has a better chance to improve problem solving skills in terms of conceptual understanding since the students were the ones who provided their own problems based on how they understood the lesson. The SSPP was anticipated to enhance the problem-solving skills and scientific reasoning since they were more exposed to visual representation in generating their own problems. The SPP has the potential to augment scientific reasoning skills where they can simply change the known and pose a new problem, or keep the data and change the required.

Test of Difference in the Pre-test and Posttest Scores

Table 10
Difference in the Pre-test Scores of the Students Exposed to Problem Posing Approaches

Scientific Discovery Process		Df	Mean Square	F	Sig.	Remarks
Conceptual Understanding	Between Groups	2	5.425	1.278	0.282	Not Significant
	Within Groups	117	4.243			
	Total	119				
Procedural Knowledge	Between Groups	2	1.075	.278	0.758	Not Significant
	Within Groups	117	3.865			
	Total	119				
Evaluating	Between Groups	2	17.908	1.639	0.199	Not Significant
	Within Groups	117	10.924			
	Total	119				
Drawing Conclusion	Between Groups	2	3.633	.442	0.644	Not Significant
	Within Groups	117	8.225			
	Total	119				

Presented in Table 10 was the test of difference between the experimental groups. It provided the data whether the mean scores for problem solving and scientific reasoning skills were significantly different or not from each other. It is exhibited that the p-value for all the skills were greater than 0.05 which means the means scores are not significantly different from each other. The result above also entails that most of the students in the groups had the same proficiency level during the pre-test. It can be reasoned out that students at this point have the same amount of prior knowledge on the lesson. However, there were still topics covered in the study that were new to them and therefore they have little knowledge on it. To sum up, the data imply that the respondents from the three groups were matched in terms of the prior knowledge on the topics covered in the study before the experiment was conducted.

Table 11
Difference in the Posttest Scores of the Students Exposed to Problem Posing Approaches

Scientific Discovery Process		Df	Mean Square	F	Sig.	Remarks
Conceptual Understanding	Between Groups	2	7.308	1.769	.175	Not Significant
	Within Groups	117	4.131			
	Total	119				
Procedural Knowledge	Between Groups	2	2.100	.656	.521	Not Significant
	Within Groups	117	3.203			
	Total	119				
Evaluating	Between Groups	2	8.775	1.445	.240	Not Significant
	Within Groups	117	6.072			
	Total	119				
Drawing Conclusion	Between Groups	2	10.825	2.145	.122	Not Significant
	Within Groups	117	5.047			
	Total	119				

The data on Table 11 present the result of the ANOVA comparing the posttest scores of the three groups of students using problem posing approach as to the different components of Science Discovery Process such as Problem Solving (conceptual understanding and procedural knowledge) wad Scientific Reasoning (evaluating and drawing Conclusion) at .05 level of significance.

Based on the data in the three-problem posing approaches the P-value that is greater than 0.05 which concluded that the mean posttest score of the experimental groups was not significant from each other. It broadens the versatility of the approach to use in teaching not only in the said topic but also in other field of Science.

It concludes that after the treatment all groups have almost the same level of science discovery process in terms of problem solving as to conceptual understanding and procedural knowledge and scientific reasoning skills as to evaluate and drawing conclusion.

It was mentioned in the study of Sengul (2012) that problem posing allows students to formulate their own problems, and to use their language skills and knowledge for the problem status. Therefore, it can be said that students in both groups have nearly the same extent of skills in terms of scientific discovery process as far as the use of problem posing approach is concerned.

4. The Test of Difference of the Mean Pre-test and Posttest Scores

Table 12
Difference in the Mean Pre-test and Posttest Scores of the students exposed to different Problem Posing Approaches

Groups	Scientific Discovery Process	Pretest		Posttest		Paired Differences		T	Sig. (2-tailed)	REMARKS
		M	SD	M	SD	M	SD			
Free- Structured Problem Posing	Conceptual Understanding	4.40	2.25	6.48	1.99	-2.08	2.00	-6.545	.000	76
	Procedural Knowledge	3.10	2.04	4.78	2.07	-1.68	2.08	-5.092	.000	S
	Evaluate	4.93	3.70	7.90	2.94	-2.98	4.07	-4.620	.000	S
	Drawing Conclusion	5.03	2.71	6.05	2.35	-1.03	2.90	-2.232	.031	S
Semi Structured Problem Posing	Conceptual Understanding	3.75	1.90	7.25	2.03	-3.50	2.15	-10.304	.000	S
	Procedural Knowledge	2.90	1.75	4.93	1.76	-2.03	2.03	-6.304	.000	S
	Evaluate	3.63	3.23	8.13	2.31	-4.50	3.62	-7.855	.000	S
	Drawing Conclusion	5.63	3.67	6.98	2.24	-1.35	2.95	-2.896	.006	S
Structured Problem Posing	Conceptual Understanding	4.38	2.01	6.55	2.07	-2.18	2.41	-5.717	.000	S
	Procedural Knowledge	3.23	2.09	5.23	1.49	-2.00	2.05	-6.168	.000	S
	Evaluate	4.00	2.94	8.80	2.05	-4.80	3.93	-7.724	.000	S
	Drawing Conclusion	5.28	1.96	6.10	2.15	-0.82	2.18	-2.391	.022	S

In Table 13, it was observed that the p-value for all the groups which were lower than 0.05 shows that there was a significant difference between the pre-test and posttest score. It concludes that any approaches utilized in the study lead to better performance of the students. This proves that the test of difference in the pre-test and posttest designs made a point that problem posing approaches were effective. Same results were gathered in the study of Akay et al. (2010) where they also found significant difference between the experimental groups in the use of problem posing approaches. On the study of Darbaz et al. (2010) where they looked on the effects of problem posing on understanding problem, it was also found out that the group of students were better in terms of understanding problem in all dimensions such as rephrasing, visualization and qualitative reasoning.

CONCLUSIONS

Based on the findings of the study, the following conclusions are drawn:

1. There is no significant difference in the mean pre-test scores of the experimental groups as to problem solving and scientific reasoning skills. Thus, the hypothesis posited in the study is sustained.
2. There is no significant difference in the mean posttest scores of the experimental groups in all scientific discovery processes such as problem solving and scientific reasoning skills. Therefore, the hypothesis posited in the study is sustained.
3. There is a significant difference in the pre-test and posttest scores of the experimental groups in all scientific discovery processes such as problem solving and scientific

reasoning skills. Thus, the posited hypothesis is not sustained.

RECOMMENDATIONS

Based on the conclusions of the study, the following are recommended:

1. Problem posing approach may be us 77 impart learning in science or even in disciplines. Through this, they may make teaching and learning process more interesting and dynamic.
2. School heads may organize seminar-workshops, in-service training, and other training programs on problem posing approaches. With this, they may consider the strategy in teaching other subjects and serve it as a tool in enhancing students' learning performance.
3. Future researcher may conduct the same study for a wider scope such as using other skills aside from what was used in this study (ex. Inquiry skills, higher order thinking skills, etc), in a longer span of time and in other learning areas of science such as Earth Science, Chemistry and Physics or other specialized fields or subjects.

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AUTHORS' PROFILE

Melvin G. Hernandez is a graduate of Master of Arts in Education major in Science and Technology at Laguna State Polytechnic University San Pablo City Campus, Laguna on 2019. He finished the degree Bachelor in Secondary Education major in Physical Science at Laguna State Polytechnic University, Philippines on 2011. He is a science teacher at Col. Lauro D. Dizon Memorial National High School. He has served as an active school representative of the San Pablo Association Science Mentors (SPASM) and has been a speaker and facilitators in various school activities.

Elisa N. Chua, PhD is an Associate Professor V at Laguna State Polytechnic University San Pablo City Campus, College of Teacher Education, Faculty of Graduate Studies and Applied Research. She earned her Doctor of Philosophy in Educational Management at Philippine Normal University, Manila. At present, she teaches science courses in undergraduate program, and major science subjects, methods of research, and thesis writing in the graduate program. She has served as the chairperson of the Research and Development on 2011-2016.

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