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Predict-Observe-Explain (PED): Effects on Students' Achievementand Attitudes Towards Science

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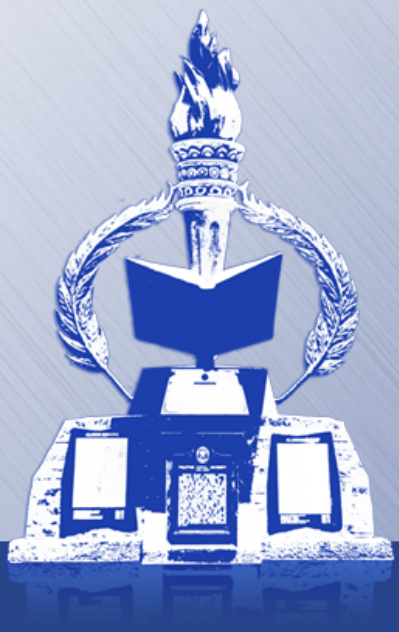

PREDICT-OBSERVE-EXPLAIN (POE): EFFECTS ON STUDENTS' ACHIEVEMENTAND ATTITUDES TOWARDS SCIENCE

A thesis
Presented to the Graduate Faculty of the
Department of Physical Sciences
College of Science

In Partial Fulfillment
Of the Requirements for the Degree
Master of Arts in Science Education
With Specialization in General Science

Janel P. Gernale

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DEDICATION

To the heavenly Father,
Creator of all things, true source of
light and wisdom.
May this humble work be
pleasing to your sight.

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ABSTRACT

Title: Predict-Observe-Explain (POE): Effects on Students' Achievement and Attitudes Towards Science

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Degree: Master of Arts in Science Education

Specialization: General Science

Key Concepts: Predict-Observe-Explain Approach, students' achievement, students' attitudes

Advisers: Prof. Fidela Q. Arañes and Dr. Virgil Duad

The main purpose of this study is to determine the effectiveness of Predict-Observe-Explain (POE) Approach in enhancing the achievement and attitudes of grade five students over the traditional method of instruction. This study was conducted in G. Gatchalian Elementary School-Las Piňas City during the third grading period of the school year 2012-2013. This study employed the Repeated Measures Two Factors Design also known as Quasi-Experimental Design. The subjects are two intact sections of grade five comprising the experimental group exposed to POE Approach and the control group which was subjected to traditional method of instruction.The instruments employed in the study include the Lesson Plans, POE Tasks, Achievement Test, Learning Science Attitude Inventory (LSAI), and other additional parameters in the study such as student's profile, rubric in evaluating the POE activities, and observation checklist. The dependent t-test was used to find the significant differences and changes between the two groups or within each group in terms of achievement and attitude towards science at 0.05 level of significance. The result of the study revealed that both groups differ significantly in the

pretest and posttest. However, the gain score in the achievement test and change of scores in the attitude inventory indicated that the experimental group performed better than the control group. It was also supported by the result of class observations. The students enjoyed and showed enthusiasm in doing the activities using the POE Approach than the traditional approach.

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THE PROBLEM AND ITS BACKGROUND

Introduction

In the horizon of a fast changing world, science education has experienced substantial growth over the past several years. The development in science education records various attempts in measuring achievement and determining the attitudes, learning styles and performance of students towards science. This development requires science teachers to be more innovative and creative for the students to achieve higher in science and develop favorable attitudes towards it at the same time.

Science education program undergoes vertical ladder, developing science experiences from one level to those preceding ones. Hence, the elementary education contributes a greater opportunity as an imperative craft in learning science as the students move on to their level of education. It is the time when the students start to explore and discover something out of their curiosity. For children, science is fraught with interesting facts and exciting experimental activities. Consequently, science teachers are being faced with both a challenge and a responsibility.

Many elementary students fear this subject due to a lot of reasons. One of these is the inappropriate and teachers teach the subject in not so encouraging way since they are using the same teaching strategies throughout the year. Teller and Stinner (2007) stated that students often do not demonstrate understanding of the underlying concepts in

Science nor they find their classes interesting because they relied upon memorization of facts. Science requires memorization of mostly difficult terminologies and understanding of theories and equations. This reality creates lots of burden on the part of educators in enhancing the achievement of students in science and in developing positive attitudes among them.

The study of Allen (2006) explained that many elementary school teachers face a trio of issues when it comes to teaching science: they do not like science, they do not feel confident in their knowledge of science, and they do not know how to teach science effectively. Allen's idea was supported by Ginns (2000). He stated that many elementary teachers express a lack of confidence in their ability to teach science.

According to Sihera (2002), attitudes associated with science appear to affect students' participation in science as a subject and impact performance in science. Teachers should consider that to attain higher achievement in science, they should also need to set proper attitudes towards the subject.

Indeed, there is a need to develop students' intellectual skills and a heightened sense of motivation. The improvements in science education and educator's willingness to embrace change will depend on how the science teachers motivate the students. In traditional method of teaching, majority of the time is spent on lecture and little emphasis is given on laboratory activities. This creates a teacher-centered way of learning. The students may develop motor skills but not critical and analytical sides. As a result, the quality of science education has not reached its fullest percentage.

It is observed that students learn in many ways, can perform better on achievement test, and attain good attitude towards science, if they are exposed to hands-

on activities and student-centered approach. For this reason, the researcher decided to adopt an effective teaching approach known as Predict-Observe-Explain Approach. The POE approach was developed by White and Gunstone (1992) to uncover individual students' predictions, and their reasons for making these, about a specific event. It requires the students to predict, observe and look for evidence and finally to construct conclusion through explanation. Haury and Rillero (2004) stated that teachers who embrace hands-on learning like POE in science seem to recognize certain desirable outcomes and endorse student-centered instructional approaches. Since science is more on discovery approach, using hands-on activities like POE is effective as proven by the studies done by Hernandez (2002), Mosca (2001), Kearney (2001), Liew (2004), and Mthembu (1998). Based on their studies, the POE Approach improves the students' achievement and they tend to develop favorable attitudes about the subject.

Thus, the researcher was prompted to conduct this study to confirm the use of POE Approach as an effective way in enhancing students' achievement and attitudes towards science that suites the modern way of teaching and learning in the new generation.

Background of the Study

In the Philippines, the development in science education is a great challenge. Based on history, Philippines had enjoyed the fame of being top among Asian countries 50 years back. Today, statistics shows that we are second from the bottom, thus, we are thankful to Bangladesh for that. Example is the TIMSS (Trends in International Mathematics and Science Study) result in which long before we ranked second from the

top but now it is a total up-side-down picture. This fact shows the deterioration of the Philippine education. It reveals the big difference of the performance of the country's education from being on top and now found at the bottom. The enrolment in the sciences and related fields is also very small for the Philippines and this correlates with the poor performance of Philippine students in the TIMSS. (Arora, 2012)

In the National Achievement Test (NAT) in Science, a mean of 55.15 was obtained in grade III for the year 2011-2012. On the average, the Grade 3 children in public schools obtained an MPS of 56.98 in the 2012 NAT. This finding is retrogression in relation to the previous years' performance. Regions II and III are the most improved regions in the NAT Grade 3. However, in grade VI, the mean is 60.11. Over the years, they performed best in Filipino in contrast with the remaining subjects: Math, Science, HeKaSi and English 3. Region VIII and CARAGA showed high performance in the NAT. In the recent NAT, the examinees showed marked increase in Science; while slightly improved performance in English. But this slight increase is not enough to meet the target percentage of passers in the NAT which if 75%. (Sanyal, 2012)

Article XIV, Section 10 of the 1987 Philippine Constitution mandates, among others, that Science and Technology education is essential for development, invention, innovation, training, and services. Science should be presented according to the needs of an individual and society.

In the current situation of the Philippine Educational System, there are shortages in classrooms and other instructional materials. Moreover, funds are not enough to cater all those needs including materials that are use in every science classroom. The primary goal of teaching according to Dy (2011) is to provide appropriate and effective

instructions to students. Science teacher therefore, is responsible to device and provide the necessary materials for use in science classes and use effective teaching approaches to bridge the difficulties of students in science.

One effective approach in science teaching as proven by Liew and Treagust (1995 & 2004), Kearney (2001), Hernandez (2002) and Mosca (2007) is the Predict-Observe-Explain Approach (POE). It is an approach that lets the students explore concepts and generate investigation. This idea of POE in science was supported by the Dale's Cone of Experience. According to him, students may generally remember information through:*10% of what they read*, *20% of what they hear*, *30% of what they see*, *50% of what they hear and see*, *70% of what they say and write,* and *90% of what they do.* It states that the more the students are exposed to hands-on activities, the higher is their ability to remember information and apply those learning in real-life situations.

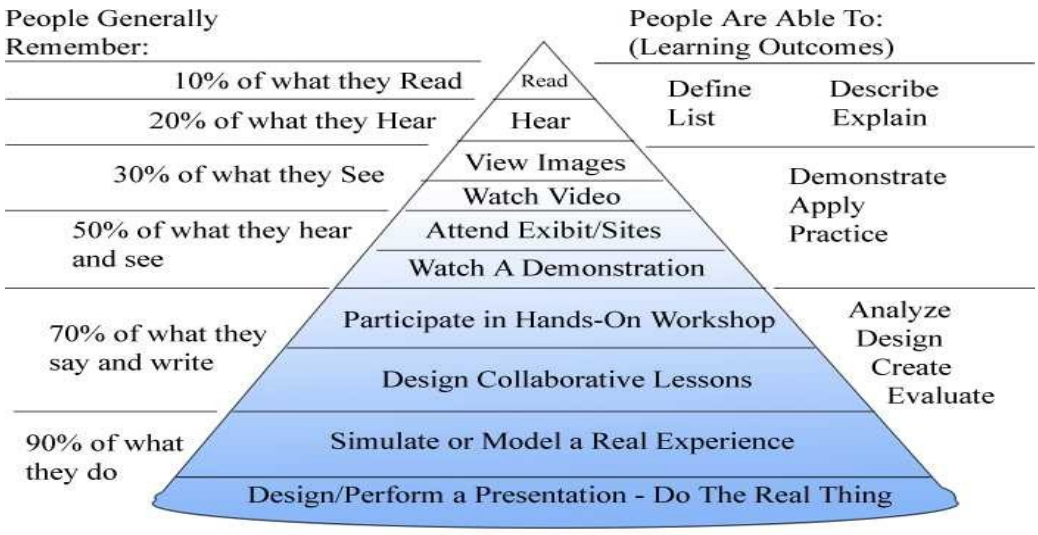


Figure 1. Dale's Cone of Experience

The cone presented by Edgar Dale shows the relationships between ways on how students acquire knowledge and its application on their learning process. It states how various educational experiences affect their ability to remember information. The ability of the student to use a variety of several senses like the sense of sight, smell, hear, touch and movement is considered in the cone. When the students experience what they are studying, they tend to remember the information rather than just listening or observing things.

Dale's Cone of Experience supports the idea of Predict-Observe-Explain (POE) Approach. In this approach, the students are given the chance to express their schema and experience the science ideas behind the activity to satisfy their curiosity.

The different problems in the educational system are now being addressed by the government by adopting the K-12 program. The G. Gatchalian Elementary School adopted the K-12 program being implemented by the government which extends the basic education curriculum from 10 to 12 years. Both the POE Approach and the K-12 as the new curriculum in education have something in common. Both of them have the purpose in bringing up the deeper thoughts of students and indulge them into a more student-centered setting. The quest for a student-centered approach triggered the interest

of the researcher to pursue the study on the effects of POE on students' achievement and attitude towards science.

Theoretical Bases

The concept of POE Approach is anchored on the three theories of learning, namely: behaviorism, constructivism, and humanistic learning theory. These are created with basic underlying assumptions on how each theory influences the behavior and development of the students.

Behaviorism

In this study, positive reinforcement was used to motivate the students to participate and give relevant predictions, observations and explanations that resulted to favorable attitudes towards science after using the POE Approach.

The proper attitude in dealing with science may affect their response to the POE activities. It is important that the teachers should also set favorable attitudes and motivate the students to express their ideas.

Reinforcement was explained in behaviorism theory. This theory was introduced by Ivan Pavlov as cited by Killoran (2003) that focuses on the use of reinforcement. The two types of reinforcement are positive or negative. Behaviors can be measured, trained, and changed. According to this theory, behavior can be studied in a systematic and observable manner with no consideration of internal mental states. This school of thought suggests that only observable behaviors should be studied, since internal states such as cognitions, emotions and moods are too subjective.

Humanistic Learning Theory

The traditional educators often do not separate the cognitive and affective domains because the students relied on memorization and note taking/lecturing. Carl Rogers (1993) introduced Humanistic Learning Theory that suites the more student-centered way of teaching. According to this theory, humanistic teachers believe that both feelings and knowledge are important in the learning process of the students.

Rogers quoted, "The tutor or lecturer tends to be more supportive than critical, more understanding than judgmental, more genuine than playing a role." Humanistic teachers believe it is important for students to be motivated and engaged in the material they are learning, and this will happen when the topic is something the students need and want to know. The feelings (attitude) and knowledge (achievement) were both taken into consideration to attain the main objectives of this study. As the students predict, observe and explain, students indulge in an engaging environment that promotes meaningful learning towards science.

Social Constructivism

In this study, the students exposed to the POE Approach learned by stating their ideas and coming up with acceptable answers through the ideas of their classmates. The students learned best through stating own ideas and other's ideas as what is stated in the Social Constructivism Theory. It was strongly influenced by Lev Vygotsky (1978) cited by Eggan and Kauchak (2004). It encourages the learner to arrive at his or her version of the truth, influenced by his or her background, culture or embedded worldview. Knowledge is first constructed in a social context and is then taken up by individuals. According to social constructivists, the process of sharing each person's point of view—

called collaborative elaboration (Meter & Stevens, 2000)--results in learners building understanding together that would not be possible alone (Greeno et al., 1996).

The teacher acts as a facilitator that leads the students to be independent learners and learn through cooperation.

Conceptual Framework

Predict-Observe-Explain (POE) was first introduced by White and Gunstone (1992). The students use their science process skills such as prediction, observation and explanation in learning science

In this study, the method of instruction varies in both groups. The experimental group used the POE Approach and the control group used the traditional approach of teaching. This study is guided by the following conceptual framework:

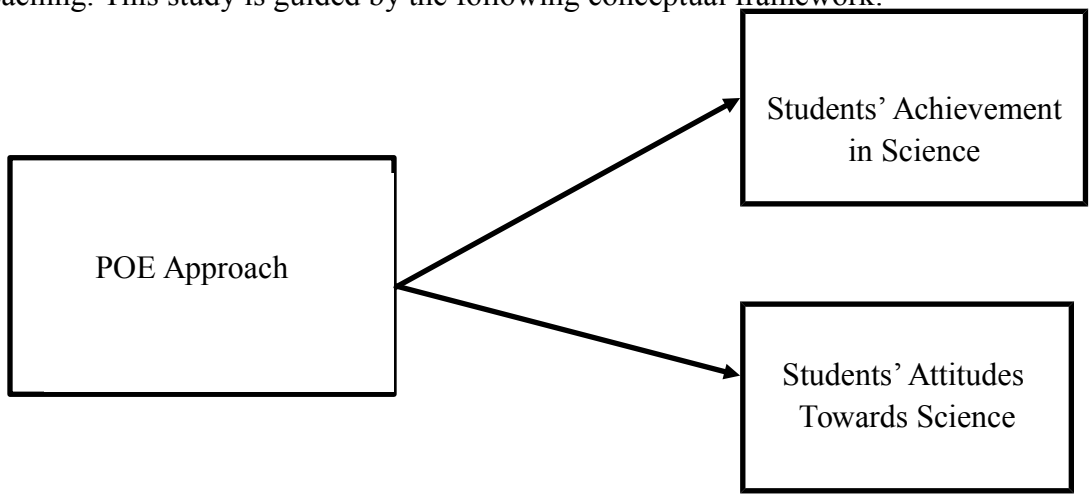


Figure 1. The Conceptual Framework

The students generate ideas as a combination of their background knowledge and those that are shared by their classmates in the class discussion (Social Constructivism

Theory). It was supported by the Humanistic Learning Theory which stated that the students' knowledge and feelings are both important in the learning process of the students. When the teachers let their students engaged in the lesson (learning by doing) using POE Approach and with a positive reinforcement, the students' achievement will enhance and the students will develop favorable attitude towards science.

It is observed nowadays that the students learn best if they indulge in hand-on activities. Predict-Observe-Explain Approach is a powerful instructional approach that guides and motivates learners to express their own ideas about a certain topic based on their experiences and background knowledge. The students are given a chance to learn independently at first and sooner come up with ideas agreed upon by the class. The use of POE Approach may affect the students' achievement and attitudes towards science.

It has been deemed important that the POE Approach was given to the experimental group and the traditional method of instruction to the control group. In order to achieve the expected outcomes of the study, the pretest and posttest result within and between the two groups of subjects were obtained and analyzed.

Statement of the Problem

The main purpose of this study was to determine the effects of using the POE Approach in enhancing the achievements and attitudes towards science of Grade five students at G. Gatchalian Elementary School during the school year 2012-2013.

Specifically, the study seeks to answer the following questions:

1. Is there a difference in the achievement of the students in science in the experimental group before and after they were exposed to POE Approach?

2. Is there a difference in the achievement of the students in science in the control group (non POE) in science before and after they were exposed to the traditional method of instruction?

3. Is there a difference in the gain scores of POE and non POE group in terms of achievement?

4. Is there a change in the attitude before and after the actual instruction?

a) experimental group

b) control group

5. Is there a change in the attitude between the experimental group and control group?

Research Hypotheses

At 0.05 level of significance, the following research hypotheses were tested:

H_1 H_1 : There is a significant difference on the achievement of students in science in the

experimental group before and after they were exposed to POE Approach.

H_2 : There is a significant difference on the achievement of students in science in the control group before and after they were exposed to POE Approach.

H_3 : There is a significant difference on the gain scores of POE and non POE group in terms of achievement.

H_4 : a) There is a significant change in the attitude before and after the actual instruction in the experimental group.

b) There is a significant change in the attitude before and after the actual instruction in the experimental group.

H_5 : There is a significant change in the attitude of experimental group and control group.

Assumptions

This research was anchored on the following basic assumptions:

1. The subjects answered the instruments as honestly and accurately as possible.
2. The subjects expressed their predictions, observations, and explanations confidently and are acceptable as the actual instruction goes by.

Significance of the Study

The POE Approach is commonly used for high school students but using the basic words and ideas about Mixtures and Solutions could be an important foundation in preparing the students' transition from elementary to high school. Therefore, this study was conducted to determine if POE Approach can enhance achievement in science and develop favorable attitudes of elementary students towards Science. It also accompanies the following significances:

For the students, who could improve their achievement in science and develop science process skills such as prediction, observation and explanation skills. The study would provide information on the significant role of POE among the students in learning science concepts. The use of POE Approach could promote students' favorable attitude towards science. It could also promote independent learning that leads to the discovery of

science concepts through their own ideas and of their classmates. It is hoped that the students could engage in discovery learning so they may be able to understand and apply the concepts learned in real-life situations.

For Science teachers, who could be more focused and effective science teachers. Secondly, the POE activities could be one of the best tools to evaluate students' ideas about science topics particularly mixtures and solutions. Third, the POE Approach could be a helpful way to improve students' achievement and may have a positive effect on their attitude towards science. Finally, this study could challenge and motivate teachers and school administrators to work together in improving students' achievement in science.

For Science Division Supervisors, who could use this study in improving science education and students' achievement towards science.

For future researchers, who could use either high school or elementary students as their subjects and explore how POE Approach is effective in science teaching and learning.

Scope and Delimitations of the Study

This study was concerned primarily on the use of Predict-Observe-Explain (POE) Approach to determine the students' achievements and attitudes towards Science. The study was conducted at G. Gatchalian Elementary School Las Piňas City in the 3rd Grading Period of school year 2012-2013.

The study used Repeated Measures Two-Factor Design with two sections randomly selected from Grade V classes in G. Gatchalian Elementary School. The experimental group used the POE Approach while the control group was subjected to the

traditional method of teaching. The lesson plan used in the experimental group can be found in Appendix I.1 on page 93. Additional activities were employed in the control group that served as their remedial activities to unlock their difficulties in mixtures and solutions. The Lesson Plan used in the control group can be found in Appendix I.3 on page 126.Both classes were handled by the researcher. To avoid disruption of classes of other subjects, the study was done during science time.

The Learning Science Attitude Inventory was used to determine the student's attitude towards Science. A 40-item pretest and posttest involving concepts in Mixtures and Solutions were administered to the students before instruction and after all POE Tasks and lessons have been taken. Mixtures and Solutions are the area of study because these topics are the least mastered skills according to the achievement of students from the previous year and it requires hands-on activities which describe how the POE Approach was used.

Definition of Terms

To provide a clearer view and understanding of this study, the following important terms are defined operationally:

Predict-Observe-Explain (POE) Approach refers to the method of instruction that was used by the experimental group. At first, a certain situation is shown to the class and they are asked to predict what will happen when some changes are made. After that, the students will observe and explain what happens in the activity.

Traditional Method of Teaching refers to the deductive method of teaching (from general to specific) employed in the control group (non POE) wherein the teacher gives introductory lesson at first, then the students performed the science activities and answer the questions on the activity sheets given to them

Predict-Observe-Explain (POE) Activity Sheets refer to the activity sheets that were accomplished by the students in each lesson. It involves different activities about Mixtures and Solutions which the students were asked to predict, observe and explain. It was graded through rubrics.

Students' Achievement refers to the result of pretest and posttest composed of 40-item multiple choice type of test which was administered before and after the actual instruction for both groups of subjects .

Students' Attitude refers to the learning behaviors of the students during Science time. In this study, it was measured using the adapted Learning Science Attitude Inventory that contains statements about students' attitudes towards Science

Learning Science Attitude Inventory (LSAI) refers to the adapted 10-item test from Luseco (2011) that was administered before and after instruction. This instrument was used to identify the attitudes of students towards science. The students rated themselves from 4 (Strongly Agree), 3 (Agree), 2 (Disagree), and 1 (Strongly Disagree)

Chapter II

REVIEW OF RELATED LITERATURE

In order to provide a background about the present study, a review of related literature and studies which are related to the topic were gathered from various sources.

On The Achievement of Students in Science

Capistrano (2000) believed that results in the achievement test serve as an accurate measure of how much a student has learned, what the student can and cannot do. Achievement test helps in identifying students' mastered skills and least mastered skills in a certain area or field of study. It is a useful tool in keeping track of the learners' progress under the curriculum prescribed.

Spencer (1999) explained the New Traditions Project whose vision is to facilitate a paradigm shift from faculty-centered teaching to a student-centered learning such that students obtain a deeper learning of new situations, enhance their critical thinking and experimental skills and increase their enthusiasm for science and learning. The students exposed in practical situations and hands-on activities achieve higher than on lecture method of teaching.

The students construct their own knowledge derived from what they already know. According to the Stanford Achievement Test, the results of their study indicate that the longer students are enrolled in research-based science programs, the better they perform in Science.

Using the right instructional strategies and programs can make the learning process an exciting time of discovery, empowering students to be scientifically literate individuals. Many curriculum-based interventions, programs, and strategies are designed to improve science achievement.

On the Attitude of Students in Science

The critical role of attitude is well recognized in advancing science education, in particular designing curriculum and choosing powerful pedagogies and nurturing

students. (Saleh & Khine, 2009).The attitude towards teaching sciences used to be that the memorization of facts and high exam scores were more important to students than whether or not they actually liked science. Fortunately, that view is changing. Research has shown that despite the important role that knowledge plays in science, an appreciation of and affinity for the subject as a whole is much more important for students to learn while in school.

Yucel (2007) believed that the positive attitude of students toward Science affects achievement to a significant extent. It was observed that the achievement rates of students with a proper attitude toward Science tend to increase in proportion to their positive attitude in Science. He stated that positive attitudes of students can result to a higher achievement in science.

Yucel's idea was supported by Berg (2005), he explained that the students' attitude towards learning and motivation and the design of learning situations are the key factors in the attainment of desirable higher educational goals such as the ability to judge, use and develop knowledge. The teacher needs to develop higher achievement of students accompanied by positive attitudes of students towards science.

One of the problems that science teachers are facing is that more than half of elementary school dropouts claimed that their primary reason for dropping out was "classes were not interesting" or "spent time with people who are not interested in school". Bridgeland, et al. (2006).The learning behaviors of the students are sometimes the reason why they find science not interesting and relevant subject. Because of this, it is a great responsibility for science teachers on how to motivate their students to appreciate Science and relate themselves in real-life situations.

Sihera (2002) confirmed that attitudes associated with science appear to affect students' participation in science as a subject and impact performance in science. Her idea suggests the importance of teaching the students the proper attitudes towards science so that they will become well-motivated learners to a higher achievement.

It has been determined that the performance of students in science decreases due to the negative perception of students in science as a subject**.** The science teachers should consider that using interesting activities make the students develop positive attitudes that will let them achieve higher in science.

On the POE Approach

The POE approach was developed by White and Gunstone (1992) to uncover individual students' predictions, and their reasons for making these, about a specific event.

Soliven (2000) stated that *Predicting* is an exercise of identifying a possible outcome for a future event. One can look at it from different view point as "finding out stuff", "trying out experiments," "guessing," "saying something that you do not really know if it is true or not," and "trying to tell something is going to do based on a study of what it's really done." The students are motivated to express their own ideas that help them develop self-confidence.

In her latest article entitled: Literature-Based Teaching in Science: What's in the Sky?, Carol Cox (2012) stated that when students practice *Observing* in science, they use their senses to collect information about objects and events related to a question, topic, or problem to solve in science. Also, to learn some strategies to help students organize and

analyze their data through presentations, sharing, and discussion. The National Science Education Standards (NSTA, 1996) identified "making observations" as a key component of inquiry-based, discovery-focused learning in science instruction. This means that students engage with an inquiry question, topic, concept, or problem in science through direct observation of the natural world and develop the skills to record the data from their observations, analyze and interpret it, and infer explanations and draw conclusions from what they have observed (Hanuscin, 2008).

Teachers can effectively scaffold student understanding through careful questioning as students share their observations of the natural world. Webster (1992) stated that *Explaining* is giving reasons to what accounts for a phenomenon. This process is considered as a fundamental skill in concept learning.

According to Turner (as cited by Ganaden, 2000), practical work or laboratory work is a powerful motivating factor in the science classes. The students are naturally curious about things around them. If properly planned, practical work should find all the students doing their respective roles either as record keeper, in-charge of setting up the apparatus, observing or keeping time and other roles which may be required by a particular activity. Experiments can make abstract concepts less abstract thereby making science more interesting.

Related to POE Approach, Tien, Rickey and Stacy (1999) developed the Model-Observe-Reflect-Explain (MORE) Thinking Frame to promote metacognition in a guided discovery environment, which encourages students to explore science concepts through scientific inquiry. This requires students to reflect on their ideas about various aspects of the chemical system rather than on the isolated experimental outcome.

According to the standards, a scientifically literate individual can "ask, find, or determine answers to questions derived from curiosity about everyday experiences"; explain natural phenomena; and understand science news in the popular media. (NRC, 1996). Curiosity is a fundamental skill in learning. It is important that science teachers focus their approach in discovering because it will let the students consider science as relevant and interesting subject for what POE offers.

Corpuz (2006) stated that knowledge of scientific facts, concepts and generalizations must be applied in real-life. The teaching and learning process would be much effective if the students are able to relate their topics in their lives.

In the article, "Teachers" Manila Bulletin (2005), it states that teachers could draw out from their students the understanding and appreciation of the lesson through activities that engage them actively in the learning process. This statement supported the learning by doing approach. The students make use of concrete materials or discover the science concepts through experience.

Related Studies

On the POE Approach

The POE Approach had been employed by various studies stated as follows:

In the study of Kearney (2001), the use of multimedia supported by POE Approach among elementary students had been an effective way in probing understanding in science topics. Findings of the study revealed that the students and teachers' perceptions towards the use of multimedia had positively improved.

Hernandez (2002) attempted to determine the effect of Predict-Observe-Explain (POE) Approach on the performance of the students on selected topics in General Chemistry Laboratory. Specifically it attempted to determine if there is a significant difference in the achievement of the experimental group and the control group before and after they were exposed to POE Approach and non POE Approach. The respondents were tertiary level first year medical technology students enrolled in General Chemistry. The quasi-experimental research design was used. Results of the study showed that there is a significant difference in the pretest and posttest means in both the experimental group and control group before and after they were exposed to POE and non POE Approach.

Capistrano (2000) conducted a study about Force and Motion in Physics using improvised apparatus and presented his lesson through POE Approach. He used the single group research design. The respondents were fourth year high school students taking up Physics. In his study, he evaluated not only the effectiveness of the POE Approach but also the POE Activity as a method of instruction. Results of the study revealed that the students after exposure to the POE Approach scored higher in the posttest than in the pretest.

King George V (1998) revealed from his study that as the students predict outcomes, perform experimentation and observations, the students' explanation skills are explored.

Mthembu (1998) introduced chemical reactions to his class using the POE Technique. His class had undergone experiments using POE. Findings of the study studied that the students better understand chemical reactions using the POE Technique as proven by the achievement high test score.

In the study done by Kala et al. (2012), the POE tasks also revealed that some of the students had misconceptions regarding pH and pOH. The students believed that pH was a measurement of the acidity, while pOH was a measurement of the bases.

In a study in Houston (2001), science teachers used lesson plan with POE Approach in presenting their lesson about Separating Mixtures. The students are given Activity Sheets which includes four steps: Step 1: Preparing the materials needed in the activity. Step 2: Predicting what will happen before the start of the activity. Step 3: Recording what happens based on students' observation, and Step 4: Answering the questions which explain students' findings and conclusions about the activity. As a result, the students gained more knowledge and confidence on the ideas of separating mixtures. Through the activity sheets, the students are comfortable to state their ideas in the topic. Results of the study implied that the students' performance in the class improved after using activity sheets with POE Approach.

Liew (2004) revealed that the POE tasks can be used by teachers to insightfully design learning activities and strategies that start from the students' viewpoint rather than that of the teacher or the scientist. Findings in this research have implications for curriculum development and learning strategies, teacher development, and the promotion and assessment of students' understanding and level of achievement. The students tend to understand more science concepts and improved their level of achievement.

Mosca (2007) studied the effectiveness of POE in high school science teaching. His findings revealed that POE is an effective approach wherein the students achieve

higher in science in terms of achievement and motivated them to explore the concepts and generate investigation in science.

The findings of Liew's research (2010) revealed that POEs were effective in capturing a range of possible student observations and prediction outcomes when worded in an open-ended format. Quality information on students' understanding and on the way they responded to contradictory data was obtained when POEs were administered.

On the Achievement and Attitude of Students in Science

Luseco (2011) studied the use of vignette of scientists on the performance and attitude of freshman high school students in Cavite State University. She found that using a Learning Science Attitude Inventory will determine the attitudes of students manifested during Science time and it would be a great help in enhancing the students' achievement towards science.

Johnson (2006) compared performance based and traditional teaching method in science in his study. His findings showed that all classes disliked the traditional method and favored the performance based method of teaching.

Caliskan and Kaptan (2007) stated in their study, "Effects of Performance Based Assessment on Elementary Students' Science Process Skills", that using performance-based activities and criteria during measurement and evaluation process will provide permanent learning in science. They also used Science Attitude Scale to evaluate how the performance-based assessment develops the students' science process skills. Results of the study showed that students achieve higher and developed science process skills through performance-based assessment.

However, the study of Tabago (2005) stated that the students' achievement and attitude towards science can be intensified when they work cooperatively as they learn; providing them with more opportunities to apply their own skills and make their own decisions; and taking into consideration as well as overcoming their misconceptions on the subject.

In a study conducted by Fanega (2001), the achievement and attitude of students towards science can be best determined through achievement test and students' perception inventory. He stated that the performance of students in science is influenced by the students' attitudes.

Synthesis

According to Spencer, learning should focus on student-centered rather than teacher-centered activities. Through student-centered learning activities like POE Tasks, students develop their critical thinking skills, keen observation and ability to reason.

Results of the study done by Kearney, Liew, Mthembu, Mosca, and Johnson implied that the POE Approach had been an effective approach in science teaching.

It was supported by the study of Hernandez which revealed that both the experimental group and the control group have significant difference in terms of achievement. However, there is a slight difference on the achievement of the experimental group and the control group.

In contrast, the study of Fanega found that the traditional method in teaching gave introduction and increase students' achievement in science.

The attitudes of students affect their performance in Science. Yucel stated that students with proper behaviors perform better in Science as supported by Beng and Sihera. Further, Luseco, Hernandez and Johnson concluded that the POE Approach had significant change in the students' attitude towards science.

If the teaching strategy of the teacher is skill-oriented, effective teaching and learning may take into action. Through POE Approach, students may be able to plan, collect and organize data. This will ensure independent learning among the learners.

Using POE Approach in teaching Science has proven to be effective in science teaching and learning as supported by Capistrano, Kearney, Liew, Mthembu, Mosca, Johnson, Yucel and Luseco . The students enjoy the learning process because most of their scientific skills and attitudes are being used and developed. They can be able to relate themselves through stating their prior knowledge and observations. However, it was contradictory to the study done by Fanega and Hernandez in the sense that both the experimental group and the control group obtained significant difference.

These related studies revealed that the POE Approach had been effective in science teaching. There were some studies that utilized high school students as their subjects. Though in this study the subjects are elementary grade five students, the effectiveness of the POE Approach was the main focus in introducing Mixtures and Solutions which can be substantial introduction and preparation as they move on their high school life. Therefore, the researcher used terms and approach in a way that elementary students can follow and understand.

Chapter III

THE RESEARCH METHODOLOGY

This chapter deals with the methods and procedures employed in the study. It includes the following: Research Design, The Subjects, Research Instruments, Data Gathering Procedures and Statistical Treatment of Data.

RESEARCH DESIGN

This study employed the Repeated Measures Two Factors Design also known as Quasi-Experimental Design. One of the most common and powerful types of mixed design which was used in this study is the pre-post control design. All subjects in this study were given a pretest and a posttest, and these two tests served as a within-subject factor (test).

The subjects in this study were also divided into two groups. One group was the focus of the experiment (experimental group) and one group was a base line (control group). They were matched in terms of age and general average in science in which matched group was done. The achievement and attitude mean pretest and posttest scores of these groups were computed and analyzed. A repeated measures design was used because there are multiple independent variables or measures that exist in the data set, but all participants have been measured on each variable and results were analyzed group to group.

The control group was subjected to traditional method of teaching. The students were given activity sheets to be answered after the lecture. Post-consent was done to the parents of the subjects in the control group and they were properly oriented regarding the study and ways to improve their child's performance in science. However, the

experimental group was employed POE Approach and accomplished three activity sheets, namely; prediction sheet, observation sheet, and explanation sheet.

This design is suited to the researcher's main thrust which is to determine if there is significant difference between pretest and posttest scores of Grade five students in terms of achievement and attitude.

The design of the study is shown below:

$$O_1 \quad X_1 \quad O_2$$

$$O_1 \quad O_2$$

where: O_1 - pretest

O_2 - posttest

X_1 - POE Approach

The students in the experimental group took the pretest (Achievement Test and Learning Science attitude Inventory) then exposed to POE Approach (X_1) and took the posttest (O_2) after all the POE activities have been accomplished. However, in the control group, the students took the same pretest (O_1) but was subjected to lecture method and posttest. The topics for both groups of subjects were the same.

THE SUBJECTS

The subjects of this study are Grade Five students studying at G. Gatchalian Elementary School located in Gatchalian Subd. Manuyo Dos Las Piñas City for the school year 2012-2013.

The five sections in grade five are shown in the table below:

Table 1
Number of Students per Class in Grade V (S.Y. 2012-2013)

SECTION	MALE	FEMALE	TOTAL
V-Einstein	26	29	55
V-Newton	21	36	57
V-Edison	28	32	60
V-Darwin	33	30	63
V-Galilei	29	31	60

The grade five students in GGES are heterogeneously divided into five sections. Among the five sections of grade five, the two sections which are of almost the same class size were chosen. By tossing a coin, one class was assigned as the experimental group (Grade V-Einstein) and the other one as the control group (Grade V-Newton).

To ensure the consistency of the performance of subjects in the study, those students who regularly attended their classes were included. As a result, the total of grade V-Einstein was reduced from 55 students to 49 students and grade V-Newton originally from 57 students was reduced to 50 students. The experimental group was composed of 49 students, 26 female and 23 male. The control group was composed of 50 students, 33 female and 17 male. Both classes were handled by the researcher. This study lasted for two weeks.

The following factors were considered in choosing the two groups: (a) Both groups have the same classroom condition, (b) the researcher was their science teacher (c) both of them are grade v students which follow the same curriculum, and (d) to avoid disruption of classes in other subject areas, this study was done during their science time.

To achieve equivalence among the two groups, matching of groups was implemented. They were matched in terms of age, sex (gender), learning style, and general average. The distribution by sex and learning styles are shown below:

Table 2
Distribution of Subjects by Sex

Variable	Level	Experimental Group		Control Group	
		N	%	N	%
Sex	Female	26	53.1%	33	66.0%
	Male	23	46.9%	17	34.0%
Total	**Both Sexes**	**49**	**100.0**	**50**	**100.0**

Table 2 shows the frequency of females and males for each group. There were 49 subjects in the experimental group, 53.1 % are females and 46.9% are males. The control group was dominated by females which had 66.0% while males comprised 34.0%. This table reveals that sex (gender) cannot be used in matching the two groups.

Table 3 presents the learning styles of subjects for both groups.

Table 3
Distribution of Subjects by Learning Style

Variable	Level	Experimental Group		Control Group	
		N	%	N	%

Learning Style	Visual	8	16.3%	11	22.0%
	Auditory	10	20.4%	9	18.0%
	Kinesthetic	31	63.3%	30	60.0%
Total	**All levels**	**49**	**100.0**	**50**	**100.0**

Table 3 shows the frequency of subjects in relation to the three types of learning style. In the experimental group, there were 8 visual learners (16.3%), 10 auditory learners (20.4%), and 31 kinesthetic learners which compromise the biggest percentage of 63.3%. Meanwhile in the control group, most of the subjects are also kinesthetic which has 60.0%. There are 11 (22.0%) visual learners and 9 auditory learners (18.0%). These data reveal that most of the subjects for both groups are kinesthetic. However, the sex and learning style were not used as variables in matching the two groups since they are qualitative in nature and most importantly, it was interpreted using a statistical tool which revealed that both sex and learning style are not significant. The statistical analysis is presented in table 4.

To find the significant differences between and within groups, the following statistical tests and interpretation were employed:

Table 4
Differences between Control Group and Experimental Group

Variable	**Statistic**		**df**	***p-level***	**Remark**
	Test	**Value**			
Sex	X^2	1.761	1	0.184	Not Significant
Learning Styles	X^2	0.655	2	0.414	Not Significant
Age	t_{sep}	-0.015	96.9	0.988	Not Significant

General Average	t_{sep}	0.643	96.6	0.522	Not Significant
Achievement Pretest	t_{sep}	3.577	92.8	0.001	Significant
Attitude Pretest	t_{sep}	2.014	97.0	0.047	Significant

This study employed the repeated measures two factors design. The subjects were matched group to group. The above table shows the summary of the profile of students and pretest results in matching the experimental group and the control group. The profile includes sex, learning style, age, and general average in science. In interpreting the sex and learning style of the students for both groups, the chi-square test (X^2 was used. The chi-square test is used to determine whether there is a significant difference between the expected frequencies and the observed frequencies in one or more categories. The result in the sex and learning style of the students indicates that these variables are not significant in matching the two groups, sex: chi-square value is 1.761, df=1, p=0.184 and learning style: chi-square value is 0.655, df=2, p=0.414, respectively.

If sex and learning style are not significant in matching the two groups, the other variables were analyzed using separated t-test (t_{sep}). The separated t-test was used to determine if the two groups of subjects are equal in terms of age, general average and pretest result in the achievement and attitude test. The t-value of age is -0.015, df is 96, and p-level=0.988 which means that age is not significant for both groups. In gaining the general average, the students' grade for the first and second grading in science was obtained. The t-value is 0.643, df of 96.6 and p-value= 0.522. These data reveal that general average is still not significant.

The achievement and attitude pretest were administered to the students before the actual instructions. In the achievement pretest, the value of t-test was 3.577, and p-value calculated is 0.001 which proves that the result in the achievement pretest for both groups is significant. The same finding was drawn in the pre-attitude test, t-value= 2.014, df = 97.0 and p=0.047.

These data denote that the students before the actual instruction are matched in terms of four relevant variables, namely; sex, learning style, age, and general average. The achievement pretest and pre-attitude test are significant in this study; therefore, it can be used as variables in comparing the test results between and within the two groups of subjects.

RESEARCH INSTRUMENTS

Four research instruments were used to attain the objectives of this study: the Achievement Test (Appendix F on page 85), Learning Science Attitude Inventory-LSAI (Appendix H on page 91), Lesson Plans (Appendix I.1 on page 94-107 and I.3 on page 127-137), and Predict-Observe-Explain (POE) Activity Sheets (Appendix I.2 on page 108-126). Other additional instruments were used as additional parameters of the study, namely: Learning Style Quiz (Appendix J on page 143), Observation's Checklist (Appendix L on page 155-159) and rubric in grading the POE Activities (Appendix N on page 161). All these instruments were checked by the thesis mentors and were distributed to the experts to rate its content and validity. They evaluated the instruments using the validation checklist modified by the researcher.

Table 5
Interpretation of Validation Checklist

Range	Remark
3.50-4.00	Outstanding
2.50-3.49	High Satisfactory
1.50-2.49	Satisfactory
0.00-1.49	Needs Improvement

The instruments in this study were validated by four experts by rating the instrument in the four-point rating scale. The mean ratings were interpreted as follows: 3.01-4.00 (outstanding), 2.01-3.00 (high satisfactory), 1.01-2.00 (satisfactory), and 0.00-1.00 (needs improvement).

Table 6 shows the profile of the four experts.

Table 6
Expert's Profile

Validator	Qualifications	School	Current Position	Yrs. in Service
A	B.S. Med Tech Best Teacher 2nd place: SIM National Level	Univ. of Perpetual Help Rizal	Teacher III Elem. Science teacher Science Coordinator	17
B	MA in Biology	Univ. of Perpetual Help Rizal	Div. Science Supervisor Las Piñas City	14
C	MA Sci Ed	UP Diliman PNU	Science Professor	7
D	MA Ed.	Saint Francis of Assisi College	Master Teacher I Science Coordinator	18

Legend: SIM-Strategic Intervention Material

The experts who validated the instruments used in this study were chosen according to these criteria: qualifications, years in teaching, position and achievement concerning science.

Achievement Test

The researcher-made test originally consisted of 50 multiple-choice items covering the three specific topics in Mixtures and Solutions (a) Mixing Materials, (b) Common Conditions that affect how Materials are Mixed, and (c) Separating Mixtures. The Table of Specifications (TOS) (Appendix G on page 90) was first prepared based on the competencies stated in the Basic Education Curriculum (BEC) that can be found in Appendix O on page 161. The Bloom's taxonomy was used in preparing the TOS.

The pilot test was given to 48 grade six students who took the same topics in science last school year. After the try out, the final test was reduced from 50 items to 40 items. The final test is shown in Appendix F on page 85. The researcher developed the test using science books and laboratory manuals. The instrument was presented to science experts and thesis mentors.

Table 7 presents the experts' validation of the achievement test. The detailed experts' rating on the achievement test is found in Appendix K on page 144-152.

Table 7
Experts' Validation of the Achievement Test

Domain	Mean	Remark
I. Format	3.80	Outstanding
II. Language and Style	3.65	Outstanding
III. Content	3.47	High Satisfactory
Composite	3.64	Outstanding

To determine the reliability and acceptability of the achievement test, the researcher used mean rating. Based on the results of experts' validation using rating mean

above, the achievement test attained an overall of 3.64 (marked outstanding) hence, it specifically met the criteria.

Learning Science Attitude Inventory (LSAI)

An adapted 10-item attitude inventory in learning science from the study of Luseco (2011) was translated to Filipino so that the elementary students can understand the statements and can choose whatever language they are comfortable with (English or Filipino). This instrument was composed of eight positive statements and two negative statements. The responses of the students were computed this way: for positive items, strongly agree (SA) is 4, agree (A) is 3, disagree (D) is 2, and for strongly disagree (SD) is 1. For the negative items, strongly agree (SA) is 1, agree is 2, disagree (D) is 3 and for strongly agree (SD) is 4. It was given before and after the instruction (POE and traditional approach). The students with mean scores less than 2.50 were classified as having negative attitude while those with mean scores greater than or equal to 2.50 as having positive attitude.

Table 8
Experts' Validation of the Learning Science Attitude Inventory (LSAI)

Domain	Mean	Remark
I. Format	3.75	Outstanding
II. Language and Style	3.70	Outstanding
III. Content	3.67	Outstanding
Composite	3.71	Outstanding

The above table presents the rating of experts in the validation of LSAI. This instrument was adapted from Luseco (2011) and with Filipino translation done by a Filipino Coordinator. The mean in each domain reveals that the adapted LSAI is acceptable and met the criteria.

Lesson Plan

Eighteen semi-detailed lesson plans were prepared by the researcher for each POE activity. The objectives were aligned with the Basic Education Curriculum-Philippine Elementary Learning Competencies (BEC-PELC 2010). Nine lesson plans were developed for the experimental group (Appendix I.1 on page 94-107) and nine lesson plans for the control group. (Appendix I.3 on page 127-137)The lesson plans for each group of subjects were different from the other group; the developed lesson plans for the experimental group employ the POE Approach and the control group was subjected to lecture method.

The teacher used different science references and surfed on the Internet to gather pertinent data about Mixtures and Solutions. A general science professor and science teachers validated this instrument and the experts' ratings are shown in table 9.

Table 9
Experts Validation of the Lesson Plan

Domain	Mean	Remark
I. Overall	3.70	Outstanding
II. Objective	3.75	Outstanding
III. Lesson Introduction	3.63	Outstanding
IV. Lesson Presentation	3.58	Outstanding
V. Content	3.63	Outstanding
VI. Closure	3.88	Outstanding

VII. Assessment	3.50	Outstanding
Composite	3.67	Outstanding

An overall mean of 3.67 was obtained from the validation rating which means that the Lesson Plans constructed by the researcher were reliable and acceptable to utilize in the study.

Predict- Observe-Explain Activities

Nine researcher-made activities were constructed for the study which covers Mixtures and Solutions. The POE Approach was used because it was suited for the topics. Mixtures and Solutions were chosen because these topics require hands-on activities and considered as the least mastered topics last year. These tasks were taken from the Basic Education Curriculum and integrated in each lesson. The instrument was validated by a Chemistry, General Science teacher and elementary science teachers. This instrument included the following sheets: (a) *Prediction Sheet*- The teacher asked the prior knowledge of the students of the topics in each given task. (b) *Observation Sheet*- The students wrote their observations while the teacher demonstrated the activity and, (c) *Explanation Sheet*- The students wrote their comparison between their predictions and observations.

Table 10 presents the experts' rating on the validation of the POE activities.

Table 10
Experts' Validation of the Predict-Observe-Explain (POE) Activities

Domain	Mean	Remark
I. Format	3.95	Outstanding
II. Language and Style	3.75	Outstanding
III. Content	3.42	High Satisfactory

Composite	3.71	Outstanding

To determine the validity of the POE Activities that were used during the actual instruction in the experimental group, the above table was considered. There was an overall mean of 3.71 which reveals that this instrument is reliable to use for the experimental group.

The summary of the experts' rating of the instruments validated is presented below:

Table 11
Summary of Experts' Ratings

Instrument	Mean	Remark
I. Achievement Test	3.64	Outstanding
II. Lesson Plan	3.67	Outstanding
III. POE Activities	3.71	Outstanding
IV. LSAI	3.71	Outstanding

Table 11 reveals that all the instruments validated are outstanding. Therefore, these instruments are considered reliable and acceptable to use in this study. The detailed validation result in each instrument is shown in Appendix K.5 on page 153.

DATA GATHERING PROCEDURES

The study followed four phases in gathering data. The summary of data gathering procedures is presented in figure 3.

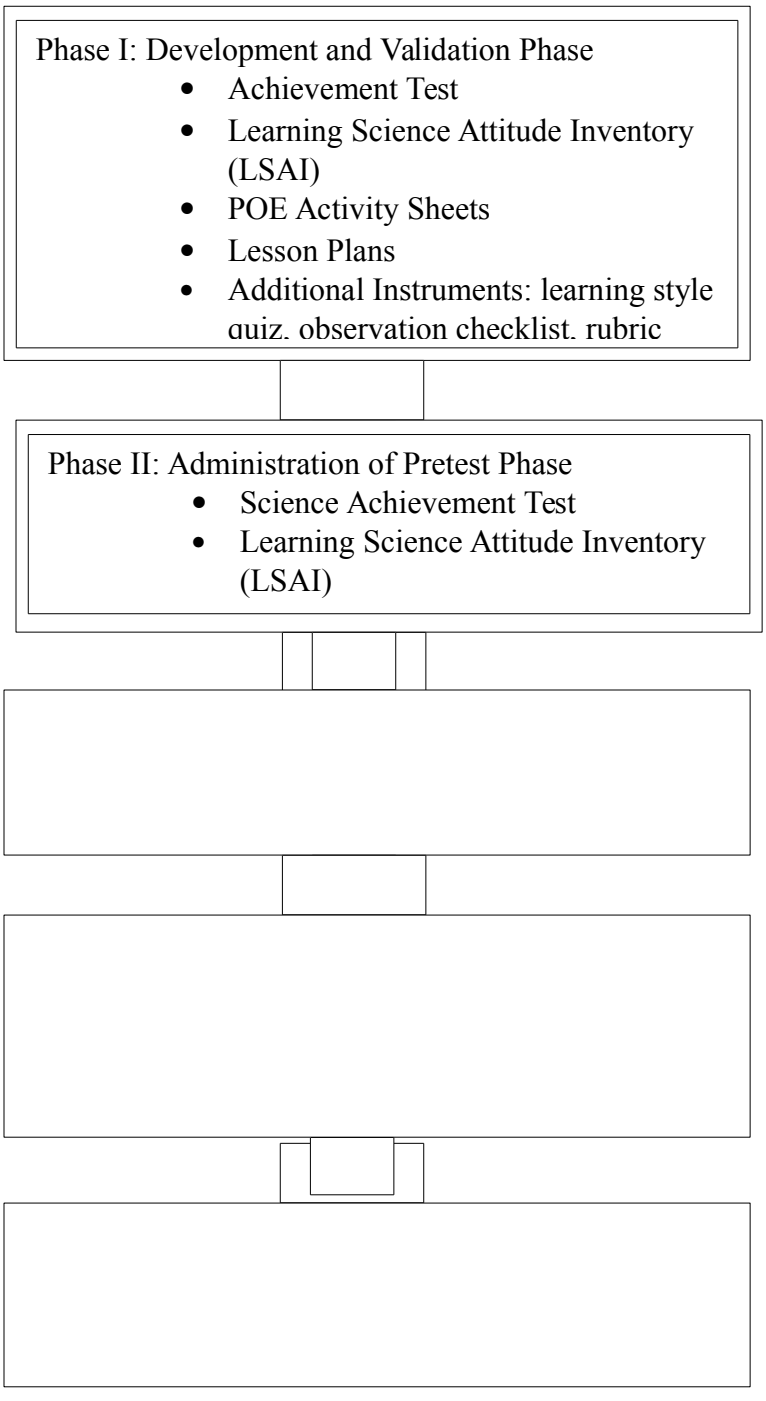


Figure 3. **Data Gathering Procedures**

Phase I: Development and Validation Phase

Phase I involved the development and validation of research instruments. The Basic Education Curriculum-Philippine Elementary Learning Competencies (BEC-PELC) was used as the basis in the preparation of the Lesson Plans. Simultaneously, the POE activities and the 50-item achievement test were prepared. The Learning Science Attitude Inventory (LSAI) was adapted from Luseco (2011) and was translated to Filipino. The researcher prepared and searched for other instruments that gave additional parameters in the study such as learning styles, student's profile, rubric and observation checklist.

Before the conduct of the study, the pilot test was administered to the 48 grade six students. The Achievement Test was composed originally of 50 items. After the test, item analysis using the Classical test theory statistics was used in determining the items that need to be rejected. As a result, the test which was composed of originally 50 items was reduced to 40 items. The item analysis result is shown in Appendix C on page 80.

Phase II: Administration of Pretest

Phase II involved the administration of the pretest for achievement test and Learning Science Attitude Inventory. A permit to conduct the study was requested from the school principal and schools division superintendent division of Las Piñas City. After the permit to conduct a study has been approved, the researcher prepared the needed instruments and planned the schedule that will be covered in the study.

The student's profile was filled-up by the students as additional background and served as variables in matching the two groups of the subjects.

The 40-item Achievement pretest and Pre-attitude test were administered to the students, a day before the actual discussion of the lessons. The adapted LSAI was composed of 10 items; there are 8 positive statements and 2 negative statements.

The profile of pupils and pretest results were interpreted using the following qualitative descriptions:

Table 12
Interpretation of Grade/Scores

Variable	Range	Level
General Average	89-95	High
	82-88	Average
	75-81	Low
Achievement	28-40	High
	13-27	Average
	0-12	Low
Attitude	31-40	High
	20-30	Average
	10-19	Low

Table 12 provides the interpretation for the general average in science, achievement test, and attitude inventory. In interpreting the general average, the grade which ranges from 89-95 belongs to high level, 82-88 is average, and 75-81 is low. In interpreting the test scores in the achievement test, the score which ranges from 28-40 has high level, 13-27 is average, and 0-12 is low. Lastly, in interpreting the attitude inventory,

the score which ranges from 31-40 belongs to high level, 2-30 is average, and 10-19 is low.

The profile of the students and result in their pretest is shown in table 13.

Table 13
Profile of Pupils

Variable	Level	Control Group		Experimental Group	
		f	*%*	*f*	*%*
Age	13	1	2.0	1	2.0
	12	6	12.0	6	12.2
	11	30	60.0	29	59.2
	10	13	26.0	13	26.5
General Average	High	2	4.0	3	6.1
	Average	14	28.0	17	34.7
	Low	34	68.0	29	59.1
Achievement Pretest	Average	31	62.0	44	89.8
	Low	19	38.0	5	10.2
Attitude Pretest	High	46	92.0	46	93.9
	Average	4	8.0	3	6.1

Table 13 presents the variables used to confirm the reliability of matching the two groups of subjects. It includes the profile of the students and pretest result. In the control group, 60.0% of the students are 11 years old which has very close percentage in the experimental group, 59.2%.

The students' science grades in the first and second grading (since this study was done during the third grading) were obtained to get the general average. The frequency of 34 which has the greatest percentage (68.0%) with respect to general average in the

control group belongs to low level. The same level has the highest percentage in the general average of the experimental group wherein the frequency is 29 and comprises 59.1%.

In the achievement pretest, most of the students in both groups were in the average level result while in the pre-attitude test, both groups achieved the high level result.

The data given in table 13 shows that the achievement pretest and pre-attitude test have close frequency for both groups. Therefore, it proves that the two groups are matched before the start of the actual instruction.

Phase III: Actual Instruction

Phase III involved the conduct of actual instruction using the POE Approach in the experimental group and the traditional method of teaching in the control group. It lasted for two weeks. The students were given three sheets to record their prediction, observation and explanation. At the end of the lesson, the students were given a 5-item formative assessment and assignment to provide extension of their learning.

Table 14 presents the parallel activities of the POE and non-POE group.

Table 14
Parallel Procedures of the Experimental Group and the Control Group in the Actual Instructions

Activity	Experimental Group	E)
1	• students are given situation and they will predict what will happen (prediction) • the class arrive at acceptable prediction/s	• Presents the lesson • discuss the lesson, give examples
2	• perform the POE activ (observation)	• science activities
3	• compare the observations with the predictions (explanation)	• the teacher discuss the correct answers
4	• discuss the result	• discuss the science concepts

In the experimental group (POE), the students were given a situation at first and then stated their predictions. The class arrived at acceptable answer/s to the questions raised in the activity. After predicting, the students observed what happens while performing the activity. Finally, they compared their prediction with their observations by explaining what happened. At the end, the students generalized the science concepts behind the activity. The teacher served as a facilitator and directed the science facts for a particular topic.

The control group (non POE) which followed the traditional approach started the science activity using deductive approach. The teacher presented the lesson at first then the students performed the science activities while answering the laboratory questions in the activity sheets given to them. There was a discussion and generalization after the science activity.

Table 15
Parallel Activities of the Experimental Group and the Control Group in each Topic

Activity	Topic	Experimental Group (POE)	Control Group (non POE)
1	Separa fron	• perfor	• discuss the lesson and perform science activity 1
2	Separ fro	• perform POE Act. 2	perform science activity 2
3	Separa fr	• perform POE Act. 3	perform science activity 3
4	Types of Mixtures	• perform POE Act. 4	• perform science activity 4
5	Effec on	• perform POE Act. 5	perform science activity 5
6	Effec M	• perfor	• perform science activity 6
7	Effec	• perfor	• perform science activity 7
8	Identi an	• perfor	• perform science activity 8
9	Natur an	• perfor	• perform science activity 9

POE group- Perform POE activities

non POE group- Perform science activity/experiment

Both groups were taught same concepts. (Mixtures and Solutions)

To further determine the effect of POE Approach in science teaching and learning, class observations were done for both groups of subjects and there were interpreted using the following interpretations:

Table 16
Interpretation of Result in the Class Observation

Range	Remark
4.49-5.00	Advanced
3.50-4.49	Proficient
2.50-3.49	Approaching Proficiency
1.50-2.49	Developing
1.00-1.49	Beginning

The researcher adopted the interpretation found in the observation checklist. The mean score of observations were interpreted using these ranges: 4.49-5.00-Advanced; 2.50-3.49-Approaching Proficiency; 1.50-2.49- Developing and 1.00-1.49-Beginning.

Phase IV: Administration of Posttest

Phase IV involved the administration of the posttest of the achievement test and adapted Learning Science Attitude Inventory (LSAI). It was done after the actual instructions and all the instruments have been administered.

Phase V: Analysis Phase

Phase V involved the analysis of data and results gained in the study. At first, the variables in matching the two groups of subjects such as the students' profile were analyzed. Then, to test if there is any significant difference in the pretest and posttest scores in both groups as well as the difference in the experimental group and control group in terms of achievement and attitude, dependent t-test were used and results was analyzed. Finally, the results were interpreted to answer the problems raised in the study.

STATISTICAL TREATMENT OF DATA

To ensure systematic presentation and objective analysis of research data, the following statistical tools and techniques were applied: (1) The frequency and percentage distribution were used in summarizing the student's profile and to determine if both groups are matched. (2) arithmetic mean and standard deviation were used in quantifying the test scores in the pretest and pre-attitude test. The descriptive statistical measures were used in interpreting the results of the pretest and posttest of the achievement test and LSAI. (3) In interpreting the sex and learning styles of subjects for both groups, the chi-square of homogeneity was used. The chi-square of homogeneity was applied to a single categorical variable from two different groups of subjects. It was used to determine whether frequency counts are distributed identically across different populations and best used when there is a random sampling. To determine if the sex and learning style preferences of each group of subjects are significantly matched the chi-square of homogeneity was utilized. (4) The t-test for separate variance approach and correlated t-test employing the single group and matched groups design were used. It was used to

determine the significant difference of the pretest and posttest result within and between the two groups of subjects in terms of achievement and attitude.

The p-value was used to measure the probability that the hypothesis is actually correct. It was interpreted as follows:

Table 17
Interpretation of p-level

Range	Remark
$p \geq 0.050$	Not Significant
$0.010 \leq p < 0.050$	Significant
$0.001 \leq p < 0.010$	Highly Significant
$p < 0.001$	Extremely Significant

If the p-value is greater than 0.050, the t-value associated with the test statistic is said to be not significant. On the other hand, if the p-value is greater than 0.010 but does not exceed 0.050, it is significant and highly significant if the p-value is greater than 0.001 but not more than 0.010. Lastly, if the p-value is less than 0.001, the computed t-value associated with the t-test is extremely significant.

Chapter IV

PRESENTATION, ANALYSIS, AND INTERPRETATION OF DATA

This chapter presents the data gathered in the study. These data have been analyzed and interpreted to provide answers to the problems raised in the study.

STUDENTS' ACHIEVEMENT

The achievement test developed by the researcher was used as the pretest and posttest. The Achievement test is shown in Appendix F on page 85-89. The experimental group was composed of 49 students and 50 students in the control group.

Problem No. 1: Is there a difference in the achievement of the students in science in the experimental group before and after they were exposed to POE Approach?

Table 18
Pretest, Posttest, and Gain Score in the Achievement Test: Experimental Group (n=49)

Variable	Highest Score		Lowest Score		Pretest	Posttest	Gain Score
	Pre	Post	Pre	Post	Mean	Mean	
Achievement	23	34	9	16	15.90	27.86	11.96

Table 18 presents the basic summary of the pretest and posttest achievement in the experimental group. The highest score in the pretest is 23 while in the posttest is 34. It

shows that there is a difference between the highest score in the pretest and posttest. Same conclusion was drawn in the lowest scores; the pretest is 9 while the posttest is 16. The calculated mean in the pretest is 15.90 and 27.86 in the posttest. There is a gain score of 11.96 which means that the students performed better in the posttest than in the pretest.

To test if there is a significant difference in the students' achievement before and after they were exposed to the POE Approach, t-test for independent sample was used.

Table 19 summarizes the dependent t-test result between the pretest and posttest in the experimental group in terms of achievement.

Table 19

Dependent t-test between Posttest and Pretest Mean Scores in the Achievement Test:Experimental Group (n=49)

Variable	Pretest			Posttest			Diff.*	*t-value*	df	*p-level*	Remark
	Mean	SD	Int.	Mean	SD	Int.					
Ach.	15.90	3.337	Ave.	27.86	4.016	High	11.96	19.355	48	0.000	Extremely Significant

*Posttest-Pretest
Legend: Ach.-Achievement
Ave.-Average

The above table shows the difference between the pretest and posttest of the experimental group in terms of achievement. In the achievement pretest, the students obtained a mean score of 15.9 and standard deviation of 3.337 which has the average level interpretation. However, in the posttest, a high level interpretation was obtained with a mean score of 27.86 and standard deviation of 4.016. The mean difference between the posttest and pretest is 11.96. The computed t-value is 19.355 and p-value is

0.000. The computed p-value is less than the level of significance set in the study ($p<0.010$) which indicates that there is a significant difference between the pretest and posttest scores of the students.

This study also confirms the study done by Hernandez (2002) and Mosca (2001). Mosca stated that POE is an effective teaching strategy in science which was proven in the posttest result of the students. Mosca's findings were supported by the study of Hernandez. The students achieved higher when they were exposed to the POE Approach.

This could mean that the experimental group showed improvement in their achievement test when exposed to the POE Approach.

Problem No. 2: Is there a difference in the achievement of the students in the control group (non POE) in science before and after they were exposed to the traditional method of instruction?

Table 20
Pretest, Posttest, and Gain Score in the Achievement Test: Control Group (n=50)

Variable	Highest Score		Lowest Score		Pretest	Posttest	Gain Score
	Pre	Post	Pre	Post	Mean	Mean	
Achievement	23	25	7	12	13.70	18.22	4.52

Table 20 indicates that the highest score in the achievement in the control group is 23 while in the posttest is 25, while the lowest score in the pretest is 7 and in the posttest is 12. This reveals that there is a slight difference between the highest and lowest score in the pretest and posttest. The pretest mean is 13.70 while 18.22 in the posttest. The gain score of 4.52 confirms that there is a slight difference in the achievement pretest and

posttest in the control group after exposing the students to the traditional method of instruction.

To test if there is a significant difference in the students' achievement before and after they were exposed to the traditional method of instruction, t-test for independent sample was used.

Table 21
Dependent t-test between Pretest and Posttest Mean Scores in the Achievement Test: Control Group (n=50)

Variable	Pretest			Posttest			Diff.*	*t-value*	*df*	*p-level*	Remark
	Mean	SD	Int.	Mean	SD	Int.					
Ach.	13.70	2.742	Ave.	18.22	3.119	Ave.	4.52	9.467	49	0.000	Highly Significant

*Posttest-Pretest
Legend: Ach.- Achievement

As revealed in table 21, there is a slightly difference of 4.52 between the pretest and posttest mean with a standard deviation of 2.742 in the pretest while 3.119 in the posttest. These data mean that both the pretest and posttest obtained are in the average level. It means that the posttest and pretest in the control group after exposing the students to the traditional method of instruction is highly significant; t-value calculated=9.467, df=49 and p=0.000.

This finding supports the findings of Fanega (2001) in her study. She stated that traditional method may give introduction and increase students' achievement in science.

It also with concurs with the study of Hernandez (2002). Both groups (experimental and control) obtained the same significant result.

Result of this study implies that traditional approach in teaching is somehow effective in enhancing students' achievement with slight difference.

Problem No.3: Is there a difference in the gain scores of POE and non POE group in terms of achievement?

To find out if there is a difference in the gain score between the control group and the experimental group in terms of the achievement test, the following table is presented below:

Table 22
Gain Score Mean in the Achievement Test

Control			Experimental			Diff. *	*t-value*	*df*	*p-level*	Remark
N	**Mean**	**SD**	**N**	**Mean**	**SD**					
50	4.52	3.376	49	11.96	4.325	7.44	9.502	97	0.000	Significant

*Experimental-Control

Table 22 provides the gain score mean of the control group and the experimental group in terms of achievement. There is a difference of 7.44 between the mean score of the control group and the experimental group. The standard deviation in the control group, 3.376 is smaller than the standard deviation of 4.325 in the experimental group. The computed t-value is 9.502 and p-value of 0.000 which means that the achievement in the experimental group significantly differs from the control group.

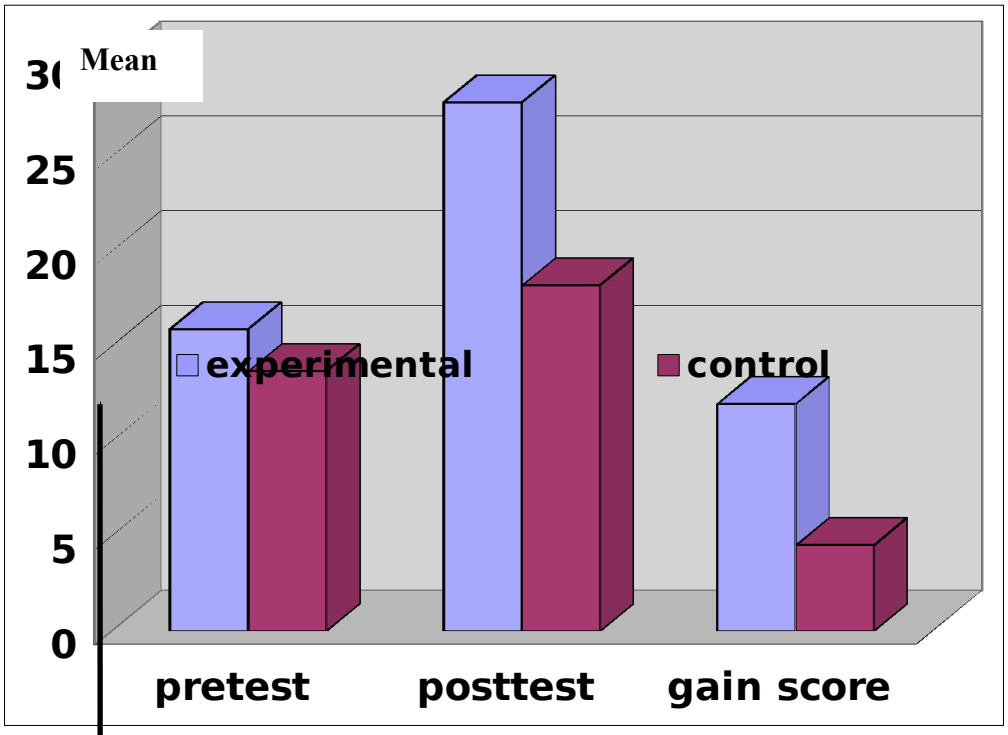
This finding conforms with the study done by Hernandez (2002). The achievement of the experimental group and the control group was significantly different.

In a study in Houston (2001), the POE Approach had been proven effective in introducing mixtures and the students achieved higher after exposure to this approach.

The result above reveals that there is a significant difference in the gain scores of the experimental group after exposing them to the POE Approach as compared to the control group exposed to the traditional method of instruction. The students in the experimental group (POE) performed better in the achievement test compared to the control group (non POE).

The findings in the achievement between the experimental group and the control group are summarized in the following figure:

Figure 4. Graphic Representation of Pretest, Posttest, and Gain Score between the Experimental and the Control Group: Achievement



Achievement Test

Figure 4 shows the comparison of the experimental group and the control group in terms of achievement test. It reveals that there is a slight difference between the two groups in the pretest while in the posttest, the experimental group had higher mean score than the control group. The blue shaded bar represents the experimental group using the POE approach and the violet shaded bar represents the control group using the traditional approach. The gain score shows that there is a difference between the pretest and posttest mean in the experimental group compared to the control group. It indicates that the POE Approach had a great effect in enhancing the students' achievement in science.

STUDENTS' ATTITUDE

The students' attitude towards science was determined using the adapted Learning Science Attitude Inventory (LSAI) from Luseco (2011) found in Appendix H on page 91-92. It consisted of 10 items and utilized a four-point rating scale with corresponding

qualitative interpretation, 4 (Strongly Agree), 3 (Agree), 2 (Disagree), and 1 (Strongly Disagree).

Problem No. 4: (a) Is there a change in the attitude before and after the actual instruction in the experimental group?

The following table shows the summary of results in the attitude inventory in the experimental group:

Table 23
Pretest, Posttest and Gain Score in the Attitude Inventory: Experimental Group (n=49)

Variable	Highest Score		Lowest Score		Pretest	Posttest	Gain Score
	Pre	Post	Pre	Post	Mean	Mean	
Attiitude	38	40	26	35	34.35	37.98	3.63

The highest score in the pre-attitude test is 38 and in the posttest is 40 while considering the lowest score, the pretest is 26 and the posttest is 35. There was a positive gain in the mean attitude of the experimental group from the pretest and posttest. The pretest mean is 34.35 while the posttest mean is 37.98. There is a difference of 3.63 which means that there is a difference between the pretest and the posttest in the experimental group in terms of attitude.

To test if there is a significant change in the attitude of the students in the experimental group before and after exposing the students to the POE Approach, t-test for independent sample was used and result is presented in the following table:

Table 24
Dependent-test between Pretest and Posttest Mean Scores in the

Attitude Inventory: Experimental Group (n=49)

Variable	Pretest			Posttest			Diff.*	*t-value*	*df*	*p-level*	Remark
	Mean	SD	Int.	Mean	SD	Int.					
Attitude	34.35	2.437	High	37.98	1.266	High	3.63	11.293	48	0.000	Extremely Significant

*Posttest-Pretest

By adhering to the results of the dependent t-test above, the change from the pretest to the posttest attitude mean scores of the experimental group is extremely significant, mean difference=3.63*, t-value* calculated is 11.293, *df*=48 and *p*=0.000.

This finding confirms the study done by Luseco (2011) . This is also supported by Liew and Teagust (1998). According to them, POE is an effective tool in understanding science and developing positive attitudes towards science.

This study implied that there is an improvement in the attitude of the experimental group after exposing the students to the POE approach. They tend to develop favorable attitudes towards science.

Problem No. 4: (b) Is there a change in the attitude before and after the actual instruction in the control group?

Table 25
Pretest, Posttest and Gain Score in the Attitude Inventory: Control Group (n=50)

Variable	Highest Score		Lowest Score		Pretest	Posttest	Gain Score
	Pre	Post	Pre	Post	Mean	Mean	
Attitude	38	39	24	30	33.36	35.58	2.22

The control group was exposed to the traditional method of instruction. Table 25 presents the summary of the pretest and posttest result in the control group in terms of attitude. A difference of 1 existed between the highest score in the posttest and the pretest. With respect to the lowest score, the pretest is 24 while the posttest is 30. There is a slight difference of 2.22 in the gain score between the pretest and posttest (35.58-33.36).

To find out if there is a change before and after exposure to the traditional method of instruction in the control group, table 26 is presented:

Table 26
Dependent t-test between Pretest and Posttest Mean Scores in the Attitude Inventory: Control Group (n=50)

Variable	Pretest			Posttest			Diff.*	*t-value*	*df*	*p-level*	Remark
	Mean	SD	Int.	Mean	SD	Int.					
Attitude	33.36	2.439	High	35.58	2.071	High	2.22	9.076	49	0.000	Highly Significant

*Posttest-Pretest

As what is shown in the table above, in the pre-attitude inventory, the students obtained a mean score of 33.36 and standard deviation of 2.439 falls in the high level interpretation. However in the posttest, it also falls in the high level interpretation with mean score of 35.58 and standard deviation of 2.071. The mean difference between the pretest and posttest is 2.22. The computed *t-value* is 9.076, *df* is 49 and *p-value* is 0.000

which shows that there is a highly significant difference between the pretest and posttest scores of students in the control group in terms of attitude.

This finding conforms with the study done by Fanega (2001). The traditional method of instruction tends to increase students' achievement in science and they tend to develop proper attitudes towards science.

This result is contradictory to the study of Johnson (2006) where he compared the students' attitude on performance-based instruction and traditional teaching method. At the end of the study, all classes disliked the traditional method which is the lecture method and favored the performance-based instruction.

The data presented indicates that the use of traditional method significantly changes the attitude of the students belonging to the control group in terms of attitude.

Problem No. 5: Is there a change in the attitude between the experimental group and control group?

To test if there is a significant change in the attitude between the experimental group and the control group, the following table is shown**:**

Table 27
Change in the Attitude Inventory

Control			Experimental			Diff. *	*t-value*	df	*p-level*	Remark
N	Mean	SD	N	Mean	SD					
50	2.22	1.730	49	3.63	2.251	1.41	3.501	97	0.001	Highly Significant

*Experimental-Control

Table 27 gives the summary of the changes in the mean scores of the experimental group and the control group in terms of attitude. The attitude inventory posted a gain

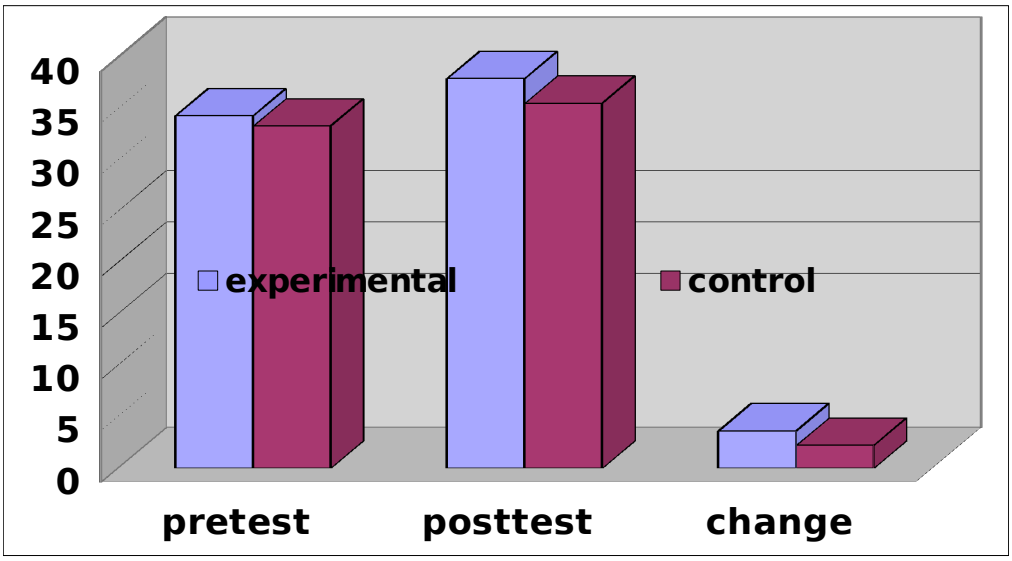
score of 1.41. This gain score is considered highly significant based on t-test results. The computed *t-value* and *p-value* are 97 and 0.001, respectively. This result concurs with the study done by Yucel (2007). He believed that the positive attitude of students toward Science affects achievement to a significant extent. It was also supported by Luseco (2011). According to the findings of her study, the Attitude Inventory revealed the improvement of students' attitude towards science after using a particular strategy.

In as much as the POE Approach was used by the experimental group, it could be speculated that the instruction had established a learning atmosphere suited to the learning approach of the students

Figure 5 shows the comparison between the experimental group and control group in terms of attitude.

Figure 5

Graphic Representation of Pretest, Posttest, and Gain Score between the Experimental Group and the Control Group: Attitude



Attitude Inventory

As what is shown in the figure above, there is a slight difference in the pretest and posttest mean between the experimental group and the control group in terms of attitude. This implies that the use of POE has helped the pupils improve their attitudes towards science.

Class Observations

The researcher triangulated the use of observation checklist to substantiate the result of the study. The following table shows the date of observations with its corresponding topic.

Table 28
Date of Observation and Corresponding Topics

Observer	Date	Topic
1	03/13/13	Separating Solids from Solids
2	03/14/13	Separating Liquids from Liquids
3	03/15/13	Separating Liquids from Solids
4	03/16/13	Types of Mixtures
5	03/19/13	Effect of Temperature on Solutions
6	03/20/13	Effect of Pressure on Mixtures
7	03/21/13	Effect of Density on Mixtures
8	03/22/13	Identifying Solute and Solvent
9	03/25/13	Nature of Solute and Solvent

Same topics in each day were taught in the two groups of subjects.

To confirm the differences between the experimental group and the control group in terms of class observations, table 29 is presented:

Table 29
Difference of POE and non POE Group in the Class Observations

Area	POE			non POE			Diff.*	*t-value*	*df*	*p-level*	Remark
	Mean	SD	Int.	Mean	SD	Int.					
I. Classroom Management	4.94	0.110	A	4.92	0.125	A	0.02	0.555	8	0.594	Not Significant
II. Teaching-Learning Process	4.94	0.108	A	4.52	0.408	A	0.42	2.945	8	0.019	Highly Significant
III. Student-Learning Process	5.00	0.000	A	3.56	0.464	P	1.44	9.339	8	0.000	Extremely Significant
IV. Learning Objective	5.00	0.000	A	3.78	0.441	P	1.22	8.315	8	0.000	Extremely Significant
Composite	4.97	0.043	A	4.20	0.216	A	0.77	11.466	8	0.000	Extremely Significant

**POE-non POE*
Legend: A- Advanced
P- Proficient

The class observation was focused on four areas, namely: Classroom Management, Teaching-Learning Process, Student-Learning Process, and Learning Objective. In the experimental group, a mean score of 4.97 was obtained and a standard deviation of 0.043 which gives "Advanced" interpretation. Meanwhile, in the control group, the mean is 4.20, standard deviation is 0.216 which also gives "Advanced" interpretation. It can be seen that the POE and non POE group were observed to be extremely significantly different in terms of student-learning process and learning objective which support the main purpose of this study which is to determine the effectiveness of the POE Approach in science. The difference between means is 0.77, the computed *t-value* is 11.466, *df* is 8 and *p-value* calculated is 0.000 which implies that the experimental group (POE) has an extremely significant difference between the control

group (non POE) in terms of class observations. The detailed result of class observations can be seen in Appendix M on page 159.

The following are some comments and suggestions of the observers in both the experimental group (POE) and the control group (non POE).

Table 30
Observers' Comments and Suggestions on the Actual Instruction in the Experimental Group (POE) and the Control Group (non POE)

POE	non POE
"The teacher gave experiment to make lesson more challenging and interesting."	*"The class will be more interesting if the students indulge into more activities."*
"The lesson was presented in the way which captured the interest of the learners"	*"The students' interest may be developed if they were exposed to hands-on activities."*
"The students enjoyed the lesson. The approach used in teaching caught students' participation"	*"There is a need to use more effective approach in teaching because the topics are difficult for the students."*
"The students cooperate in the activities and able to generalize ideas using POE Approach"	*"The flow of discussion was well-followed. However, it is suggested to use more applicable activities."*
"The students can relate themselves in the topics presented through prediction, observation and explanation"	*"Let all the students participated in class discussion"*

The observers' comments in the experimental group revealed positive feedback on the use of POE Approach in the class. They did the interview after the discussion and based their rate and comments on their own observations as well as the feedback of students in the interview. The students enjoyed, got interested, challenged and involved themselves in class discussion. On the other hand, the traditional approach in teaching in the control group was also done in a good way. However, there were many suggestions

given to better improve the achievement and attitude of students towards the lesson, one of these is to expose the students into a more student-centered approach in teaching. These class observation results confirmed that the POE Approach enhanced the achievement and attitude of students towards science than the traditional approach in teaching.

Chapter 5

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This chapter presents the summary of findings, the conclusions drawn based on the analysis and interpretation of the data gathered, and the corresponding recommendations.

Summary of Findings

Based on the statistical treatment of data, the following are the significant findings of the study:

1. In the achievement test, there is an increase in the mean pretest and posttest in the experimental group (pre=15.90,post=27.86). The 11.96 gain score implies that there is a significant difference in the achievement of the experimental group before and after expose to the Predict-Observe-Explain (POE) Approach.
2. In the control group, there is a slight increase of 4.52 from the pretest to the posttest in terms of achievement. This reveals that there is a slight difference in the achievement of the control group before and after the traditional method of instruction.
3. The gain score of 7.44 between the experimental group (11.96) and the control group (4.52) indicates that POE has a great effect on the achievement of students in the POE group compared to the non POE group.
4. The mean attitude score of the experimental group in the pretest (34.35) is higher by 0.99 than the control group (33.36). Higher mean scores in the pretest attitude favor the experimental group over the control group, however, these scores for both

groups initially reflect an initial difference and a need to improve their attitude.

5. The change score of attitude test in the experimental group (3.63) is slightly higher than the control group (2.22). This implies that there was positive gain in the mean score in the experimental group and that the POE Approach is more effective than the traditional method of instruction.

From the results of the study, it can be seen that both the experimental group and the control group have significant p-values. However, it means that the students in the experimental group who were exposed to the POE Approach performed better than the control group. The more the students indulge into hands-on activities like POE, the greater is the improvement of the students in terms of achievement and attitude towards science. Considering that this is the first time the students were exposed to this kind of approach, it gives positive feedback as what is shown in the given data. This finding was supported by the result of the class observations done by the science teachers, science coordinator, and school principal. Result revealed that the experimental group exposed to the POE Approach has significant difference with the non POE Approach.

Conclusions

Considering the findings of the study, the following conclusions were drawn.

1. The achievement of students in the experimental group was improved after exposing them to the POE Approach.
2. The achievement of students in the control group slightly increased after exposing

them to the traditional method of teaching.

3. The students in the experimental group (POE) performed better than the control group (non POE) in terms of achievement. It implies that the POE approach tends to enhance the achievement of students in science.
4. The change from the posttest to pretest mean scores in attitudes of the control group is highly significant while there was an extremely significant difference between the experimental group. Therefore, the students' attitudes in both groups were enhanced after exposing them to the POE Approach and traditional approach in teaching.
5. The change in the students' attitude in the experimental group was significantly higher than the control group.

Recommendations

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

1. The traditional method of instruction (the use of ready-made laboratory activities) is somehow effective in science teaching. However, it is strongly recommended to use the POE Approach for students to better understand science concepts particularly mixtures and solutions. It could promote independent learning among the students and make science learning an interactive and exciting one.
2. To further verify the result of the study, interview and survey among the students and

teachers can be conducted. Through interview and survey, the instruments used could be improved and different needs and necessary revisions can be done.

3. Proper utilization of the POE Approach should be employed to attain the objectives of the lesson. However, the procedures can be improved by the teacher as long as the use of prediction, observation and explanation task can still be followed.
4. Further study may be undertaken using a bigger sample to generalize the results of this study.
5. A similar study using the POE Approach on the students' achievement and attitudes may be conducted. Furthermore, it is also recommended that this study be replicated in other schools to obtain comparative results.

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Appendices

Communication Letters

Appendix F

G. Gatchalian Elementary School
ACHIEVEMENT TEST IN SCIENCE V
Third Grading

Name:_____Date: _____
Gr. & Section: _____ Teacher: _____

Instructions:

1. Read and understand each question carefully.
2. Use black or blue pen only.
3. Avoid erasures.

Multiple Choice: Encircle the letter of the correct answer.

1. What happens when sand is mixed with bits of salt?
   A. The salt changes in form.
   B. The sand changes in form.
   C. Sand and salt mixed and lost their original characteristics.
   D. Sand and salt mixed and retained their own properties.

2. Which of these are methods of separating a liquid from a solid?
   A. decanting and dissolving
   B. decanting, filtering and dissolving
   C. decanting, filtering and evaporating
   D. decanting, evaporating and use of magnet

3. What type of solution is carbonated soft drinks?
   A. solid solution
   B. liquid solution
   C. solid and liquid solution
   D. liquid and gas solution

4. Which of the following chemical systems are NOT homogenous?
   A. salt and water
   B. flour and starch
   C. alcohol and water
   D. oil and water

5. What factor makes naphthalene (moth ball/alkampor) insoluble when added to water?
   A. nature of solute
   B. nature of solvent
   C. pressure
   D. temperature

6. What elements cause the carbonated soft drinks to bubble?

A. carbon dioxide B. hydrogen C. oxygen D. sugar

7. Homogenous mixture has the same phase throughout the system. Which of the following is a homogenous mixture?

A. fog
B. gasoline
C. muddy water
D. iron filings on the sand

8. Which of the following liquids is the least dense?

A. cooking oil
B. corn syrup
C. honey syrup
D. water

9. Which of the following methods can be used to separate iron from the mixture of copper and aluminum?

A. distillation B. magnetic attraction C. filtration D. sieving

10. Which of the following methods can be used to remove gasoline from water if there is an oil spill?

A. decantation
B. use of vacuum truck
C. evaporation
D. filtration

11. Which of the following can be dissolved on cold water easily?

A. coffee powder
B. flour powder
C. milk
D. sugar

12. What will happen when salt is added to water?

A. The salt evaporates.
B. The salt condenses.
C. The salt solidifies.
D. The salt dissolves.

13. What is the method of separating iron filings from sand?

A. sieving B. use of magnet C. decantation D. filtering

14. Which of the following methods can be used in separating water from the sand?

A. decantation
B. evaporation
C. picking
D. use of magnet

15. What process is involved in separating mixtures?

A. physical change
B. chemical change
C. mechanical change
D. both chemical & mechanical change

16. What do sugar, salt and milk powder have in common?

I. solute
II. solids
III. solvent
IV.suspended materials

A. I & II B. III & Iv C. II & III D. I & IV

17. Which of the following descriptions is TRUE about solutions?
    A. homogenous
    B. definite
    C. heterogeneous
    D. balanced

18. Which of the following factors affect the behavior of oil when placed in water?
    A. density
    B. pressure
    C. nature of solute
    D. concentration

19. The table below shows the classification of some substances as solution, suspension, and colloid. Which classification is correct?

A	B	C
Solution	**Suspension**	**Colloid**
sugar & water	pebbles & water	milk powder & water
salt & water	sand & water	dust particles on air
sand & water	munggo seeds & water	salt and water

    A. column A
    B. column C
    C. column B
    D. column A and B

20. Which of the following is an example of a solution?
    A. sugar and water
    B. sand and water
    C. milk powder
    D. mayonnaise

21. Which of the following statements is **TRUE** about filtration?
    A. it separates a liquid from a solution
    B. it separates a liquid from another liquid
    C. it separates a soluble solid from a liquid
    D. it separates an insoluble solid from a liquid

22. Which of the following should have more amounts to form solution?
    A. solute
    B. solvent
    C. insoluble substances
    D. both solute and solvent

23. What phase change does evaporation process undergo?
    A. solid-liquid B. liquid-gas D. liquid-liquid D. solid-solid

24. What factors affect the concentration of a solution?
    A. solubility
    B. temperature
    C. pressure
    D. all of the above

25. What classification of mixture is involved when there is a mixture of two or more substances and looks the same throughout the container?
A. suspension B. solution C. colloid D. compound

26. What method is used to separate the solid particles that have been dissolved in water?
A. by decantation C. by evaporating
B. by sieving D. by filtering it

27. If you want to separate alcohol from water in a wine, which method is the most applicable to use?
A. crystallization C. filtration
B. distillation D. sieving

28. Which of the following methods results to the formation of pure solid particles of a substance from a solution?
A. filtration C. crystallization
B. evaporation D. condensation

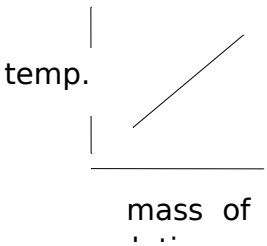
29. Which method is used in separating sand and water?
A. crystallization C. filtration
B. evaporation D. picking

30. What are the two processes involved in distillation?
A. dissolving and evaporation C. freezing and melting
B. solidification and melting D. evaporation and condensation

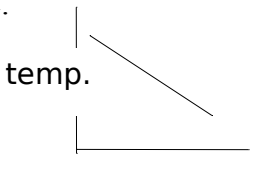
31. Which characteristics of water are the oxygen and carbon dioxide more soluble?
A. warm and moving C. cool and moving
B. cool and stationary D. warm and stationary

For numbers 32-34, refer to the following graphs shown below.

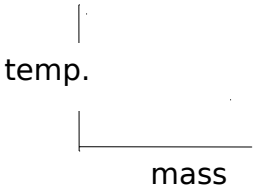
A.



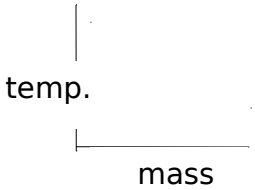
C.



B.



D.



32. Which of the given graphs represents this conclusion: "As the temperature

increases, more solute dissolves.”?

A. graph B B. graph C C. graph A D. graph D

33. Which is a dependent variable in the graph shown above in letter A?

A. temperature C. both a and b

B. mass D. none

34. According to graph A being shown, what is the relationship between temperature and mass?

A. inverse B. direct C. equal D. no relationship

35. At what temperature do salt and sugar dissolve faster?

A. hot water C. iced water

B. cold water D. a slight warm water

36. Which of the following can help dissolve salt faster?

A. The use of cold water. C. Stirring

B. The use of stainless container D. The kind of salt used

37. What method is used to separate the salt that has been dissolved in water?

A. by decantation C. by evaporation

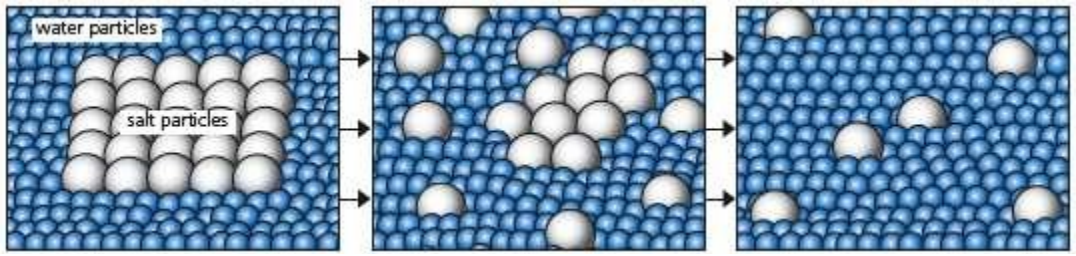
B. by dissolving D. by sieving

38. What is the best way to separate oil from water?

A. freezing B. evaporating C. filtrating D. decantation

The following illustration shows what happens when salt is added to water.

A B C



39. What happens to the salt particles in illustration C?

A. The salt disappears.

B. The salt undergoes dissolving.

C. The salt particles increase in number.

D. The salt particles retain their shape.

40. Which substance should have more amount to make dissolving process faster?

A. solute B. solvent

C. solute and solvent D. suspended materials

Appendix H

LEARNING SCIENCE ATTITUDE INVENTORY (LSAI)

Pagsusuri sa mga Pananaw sa Pagkatuto ng Agham

Instructions: For each numbered item, please put a check ( ) mark on the space which corresponds to your answer.

Panuto: *Lagyan ng tsek (√ ang kolumn ng iyong sagot sa bawat aytem.*

Legend:

Sanggunian:

4*- Strongly Agree (*Lubos na Sumasang-ayon)** ***2*-Disagree (*Di-Sumasang-ayon)

3*- Agree (*Sumasang-ayon) ***1*-Strongly Disagree (*Lubos na Di Sumasang-ayon)***

Items ***Mga Pananaw***	**4 Strongly Agree** ***Lubos na Sumasang-ayon***	**3 Agree** ***Sumasang-ayon***	**2 Disagree** ***Di-Sumasang-ayon***	**1 Strongly Disagree** ***Lubos na Di-Sumasang-ayon***
1. Learning Science serves as a motivation for me in analyzing problems. *Ang pagkatuto ko sa Agham ay naggaganyak sa akin upang suriin ang mga suliranin*				
2. Learning Science inspires me to know what is happening in the surroundings. *Ang pagkatuto ko sa Agham ang nagbibigay-inspirasyon sa akin upang alamin ang mga nangyayari sa aking paligid.*				
3. Learning Science excites me because I learn new information about the environment. *Ang pagkatuto ko sa Agham ang nagbibigay-sigla sa akin dahil natututo ako ng mga bagong*				

kaalaman tungkol sa kapaligiran.				
4. I am willing to search for ways on how I can learn best in Science. *Ako ay interesado sa pagtuklas ng mga bagong kaalaman sa pamamagitan ng Agham.*				
Items ***Mga Pananaw***	**4** **Strongly Agree** ***Lubos na Sumasang-ayon***	**3** **Agree** ***Sumasang-ayon***	**2** **Disagree** ***Di-Sumasang-ayon***	**1** **Strongly Disagree** ***Lubos na Di-Sumasang-ayon***
5. Learning Science makes me feel uncomfortable, irritable and impatient. *Iritable at wala akong tiyagang pag-aralan ang Agham.*				
6. Learning topics in Science is enjoyable. *Ang mga liksyon sa Agham ay kawili-wili.*				
7. I am interested in discovering new things through learning Science. *Nais kong gumawa pa ng mga pagsasaliksik upang lubos kong matutunan ang Agham.*				
8. Learning Science encourages me to be more creative. *Ang pagkatuto ko sa Agham ang nagtutulak sa akin upang lalong maging malikhain.*				
9. Learning Science gives me lots of confusion. *Ang pagkatuto ko sa Agham ay nagbibigay sa akin ng pag-aalinlangan.*				
10. Learning Science makes me look at this world differently. *Nag-iba ang aking pananaw sa buhay/mundo dahil sa pagkatuto ko sa Agham.*				

Adapted and translated from a thesis entitled: "The Use of Vignettes of Scientists on the Performance and Attitude of Students in Cavite State University" by Marilou P. Luseco , 2011, TUP Manila

Appendix I. Lesson Plan and Activities

Appendix I.1

A Semi-Detailed Lesson Plan in Science Grade V
Lesson 1: POE Group

I. Objective

Describe what happens when solids are mixed with other solids.

II. Subject Matter

Topic: Mixing Solids-to-Solids

References: BEC-PELC 1.2 (2010)

Science for Active Learning, Science and Health

Science Concept: A mixture is a combination of two or more substances that are not chemically united and do not exist in fixed proportions to each other.

Solids are the materials having definite volume and shape.

Science Process Skills: predicting, observing, describing, drawing conclusion

Materials: iron filings, sawdust, magnet

Time Frame: 60 minutes (as required by the DEPEd)

Values: Careful handling of materials.

III. Procedures

A. Preliminary Activities

1. Personal Hygiene Reporting
2. Science Trivia
3. Drill

What are the five states of matter? Identify what state of matter does the following belong: sun, rocks, light bulb, carbon dioxide, juice, stars

4. Review

Say something about the following: (written on the flashcards)

mixtures

pure

solutio

5. Checking of Assignment

B. Developmental Activities

1. Motivation

Bring out some solid materials you have inside your bag.

2. Presentation

How will you separate these materials?

3. Activity Proper

A. Picking

Show concrete example of stone and pieces of crumpled papers. Ask: How will you separate the stone from the crumpled papers?

B. Using a magnet

Refer to the attached copy of Task 1: "Separating Solids from Solids"

4. Discussion

Perform the POE Task 1: "***If you have a mixture of iron filings and sawdust, how will you separate this mixture?"***

What happens when solids are mixed with other solids?

Prediction	Observation	Explanation

5. Concept Formation

How will you separate solids from other solids? How can you separate metals and irons easily from other solids?

6. Application

What is the use of a magnet in a refrigerator? Are all solids attracted to magnet? Why or why not?

IV. Evaluation

Identify what will happen when solids are mixed with other solids. Write COMBINE or SEPARATE.

_____ 1. paper and sand
_____ 2. salt and colored chalk powder
_____ 3. sugar and milk powder
_____ 4. round pepper and rock salt
_____ 5. loam soil and sand

V. Assignment

Write 1-3 other ways of separating solids to solids

A Semi-Detailed Lesson Plan in Science Grade V

Lesson 5: POE Group

I. Objective

Describe the effect of temperature on materials that are mixed.

II. Subject Matter

Topic: Common Conditions Affecting How Materials are Mixed (solid & liquid)

References: BEC-PELC 2010

Science for Active Learning, Science and Health

Science Concept: Liquids and solids solidify and melt at different temperatures. Temperature is one of the factors affecting the behavior of materials that are mixed.

Science Process Skills: predicting, observing, describing, drawing conclusion

Materials: 2 tablespoons of milk powder, 1 glass of hot water,
1 glass of cold water

Time Frame: 60 minutes (as required by the DEPEd)

Values: Careful handling of materials when doing an experiment.

III. Procedures

A. Preliminary Activities

1. Personal Hygiene Reporting
2. Science Trivia
3. Word Drill

Pronounce and spell the following words correctly. Try to give your prior knowledge/definition about these scientific words:

temperature
density

4. Review

What are the two types of mixtures? How do they differ?

B. Developmental Activities

1. Motivation

Show pictures of solid and liquid substances.

2. Presentation

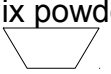
What state of matter is in column A? How about column B? How does the temperature affect the state of matter?

.

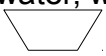
3. Activity Proper

Perform POE Task 5:Hot or Cold?

1. If you mix powdered milk on hot water, what do you observe?



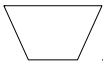
powdered milk



hot water

2. How about if you mix powdered milk in cold water, what do you observe?

powdered milk



cold water

3. Which situation will milk dissolve faster? Why?

4. Discussion

Discuss the POE Task 5

How does the temperature affect the materials that are mixed?

Prediction	Observation	Explanation

5. Concept Formation

What is temperature? How does it affect the materials that are mixed? (Write the generalizations drawn from the students on the board)

6. Application

It's late at night when you want to drink cold milk. As you mix the milk powder on the glass of cold water, you notice that the powder just floats instead of dissolving it. Why does this happen?

IV. Evaluation

Fiil-in the blanks with the correct answer. Choose your answer from the choices given.

*solidifying	* hot water	*cold water
*temperature	* melting	

1. The _____ is the physical property of matter that quantitatively expresses the common notions of hot and cold.
2. A solute dissolves faster on _____.
3. A solid can be transformed to liquid through the process of _____.
4. A coffee powder when placed in _____ dissolves slower.
5. In_____ the liquid, it is important to have a cold temperature.

V. Assignment

Are dissolving and melting the same process? If not, in what way do they differ?

A Semi-Detailed Lesson Plan in Science Grade V
Lesson 7: POE Group

I. Objective

Describe the effect of viscosity of liquid materials when mixed.

II. Subject Matter

Topic: Mixing Liquids-to-Liquids

References: BEC-PELC 2010

Science for Active Learning, Science and Health

Science Concept: Liquids are state of matter that have indefinite shape and a definite volume. Some liquids are denser than other liquids. This is because of what we call as viscosity.

Viscosity is the property of a fluid that describes its ability to flow. To roughly determine the viscosity of one fluid to another, one can simply pour each fluid from a pitcher, and qualitatively observe the ease with which each fluid exits.

Science Process Skills: predicting, observing, describing, drawing conclusion

Materials: 5.0 mL water, 5.0 mL cooking oil

Time Frame: 60 minutes (as required by the DEPEd)

Values: Realize that curiosity is next to learning.

III. Procedures

A. Preliminary Activities

1. Personal Hygiene Reporting
2. Science Trivia
3. Drill

What are the two classifications of mixtures?

4. Review

How does the temperature affect the materials that are mixed? In what temperature of liquid does a certain solute dissolve faster?

B. Developmental Activities

1. Motivation

a. Has anyone ever mixed 2 liquids? Maybe you've mixed milk and chocolate syrup. What happens after mixing milk and chocolate syrup?

b. Name some liquids that can be mixed which are found at home.

2. Presentation

Today, we will discover the properties of different kinds of liquids and their reactions when mixing together.

3. Activity Proper

Describe each sample liquid. Say: This time we are going to mix liquids with different properties. Let's see what happens. (Refer to POE Task 7)

4. Discussion

Perform the POE Task 7.

1. If you mix 5.0 mL of water and 5.0 mL of oil, what do you observe?

2. What physical property of liquids is involved in this case?

3. Which is more dense? less dense? Why?

What happens when liquids are mixed with other liquids? What property of liquids affect its behavior when mixed with other liquids?

Prediction	Observation	Explanation

5. Concept Formation

What is viscosity? density? Why do some liquids cannot be mixed easily? (Write the generalizations drawn from the students on the board)

6. Application

Suppose there are two boys sitting on the table holding 2 cups; one holds soda and one holds honey. If a careless person passes by that lets 2 cups fall down, which cup will become empty first? Why?

IV. Evaluation

Fill-in the blanks with the correct answer. Choose your answer from the given choices.

1. A more viscous fluid such as honey has _____ (stronger, weaker) intermolecular forces compared to a less viscous fluid like water.

2. One way to decrease the viscosity of a liquid is to _____(heat, cool) the fluid.
3. Adding corn starch to water _____ (increases, decreases) the overall viscosity.
4. _____ (honey, water, corn starch) has the highest viscosity.
5. More viscous fluids tend to have a _____ (slow, fast) pipe flow.

V. Assignment

Define the following scientific terms in 1-2 sentences:

1. sieving 2. filtration 3. decantation 4. evaporation

A Semi-Detailed Lesson Plan in Science Grade V

Lesson 8: POE Group

I. Objective

Identify the solute and solvent in a given mixture.

II. Subject Matter

Topic: Identifying the Solute and Solvent in a Given Mixture

References: BEC-PELC 2010

Science for Active Learning, Science and Health

Science Concept: Solutions are types of mixtures where in one substance undergoes dissolving. Solute is the constituent of a solution that acts as a dissolving agent and solvent does the dissolving process. It is constituent that is present in larger quantity is considered the solvent.

Science Process Skills: predicting, observing, describing, drawing conclusion

Materials: 1 cup of seawater 1 cup of Gin
1 cup of rubbing alcohol 1 cup of water
3 tbsp of white sugar

Time Frame: 60 minutes (as required by the DEPEd)

Values: Carefulness.

III. Procedures

A. Preliminary Activities

1. Personal Hygiene Reporting
2. Science Daily Facts
3. Word Drill

Pronounce and spell the following words correctly:

decanting	mixtures
sieving	solute
homogeneous	solvent
heterogeneous	solution

4. Review

What are the common conditions that affect how materials are mixed?

B. Developmental Activities

1. Motivation

Classify the following according to their state of matter.

chalk powder	honey syrup
soft drinks	chocolate bar
water	refined sugar

2. Presentation

What states of matter do the substances belongs to? What is the difference between these states of matter?

3. Activity Proper

Perform POE Task 8: Identifying Solute and Solvent

Identifv the solute and solvent in each solution.

Solution	**Component**	**Solute**	**Solvent**	**Explanation**
1.seawater	salt & water			
2.Gin	Alcohol & water			
3.Rubbing Alcohol	Alcohol 40% & water			
4.Sugar and water	Sugar and water			

4. Discussion

Discuss the POE Task 8.

Prediction	Observation	Explanation

What is a solution? solute? solvent? Give examples.

5. Concept Formation

What is a solute and solvent?

6. Application

What can you do to dissolve the solute faster?

IV. Evaluation

Write the letter of the correct answer.

___ 1. Which of the following solute dissolves faster on water?

A. dark chocolate bar

B. iodized salt
C. juice powder

___ 2. What process is involved in a solution?
A. mixing substances
B. separating substances
C. removing substances

___ 3. Which of the following mixtures is a solution?
A. sand and water
B. calamansi bits and water
C. salt and water

___ 4. What will happen to the solute when mixed with a solvent?
A. solute disappears
B. solute dissolves on water
C. solvent becomes solute

___ 5. Which of the following classification of mixtures undergoes dissolving?
A. solution
B. suspension
C. colloid

V. Assignment- Give two examples of solution found at home. Identify what is the solute and solvent.

A Semi-Detailed Lesson Plan in Science Grade V
Lesson 9: POE Group

I. Objective

Identify the nature of solute and solvent.

II. Subject Matter

Topic: Identifying the Nature of Solute and Solvent

References: BEC-PELC 2010

Science for Active Learning, Science and Health

Science Concept: Solubility of a solute in a solvent purely depends on the nature of both solute and solvent. A polar solute dissolved in polar solvent. Solubility of a non-polar solute in a solvent is large. A polar solute has low solubility or insoluble in a non-polar solvent.

Polarity refers to a separation of electric charge leading to a molecule or its chemical groups having an electric dipole or multipole moment. Polar solutes are usually soluble in polar solutes. Example: H_2O is an example of a polar solvent. Salts are examples of polar solutes (NaCl). Nonpolar solutes are usually soluble in nonpolar solvents. Example: CCl_4 is an example of a nonpolar solvent. Hydrocarbons are examples of nonpolar solutes (CH_4).

Science Process Skills: predicting, observing, describing, drawing conclusion

Materials: salt, coffee powder, naphthalene powder

Time Frame: 60 minutes (as required by the DEPEd)

Values: Carefulness

III. Procedures

A. Preliminary Activities

1. Personal Hygiene Reporting
2. Science Daily Facts
3. Drill

Identify what type of mixtures are the following:

sand & water
iodized salt & warm water
milk powder & warm water

4. Review

What are solutes? solvents?

B. Developmental Activities

1. Motivation

Present a practical situation: Why do you think bath soap is better to use in removing blood stain on clothes rather than detergent bar?

2. Presentation

What do you think are the chemical components of bath soap that differs in a detergent soap?

3. Activity Proper

Perform POE Task 9: Nature of Solute and Solvent

A. If you place a pinch of the given solute in a 5mL of solvent, predict and observe what happens?

Solute	Water (Polar Solvent)	Kerosene (Non Polar Solvent)
1. salt		
2. coffee powder		
3. naphthalene powder		

B. Put a check ( ) mark if the above solutes are soluble in water and in kerosene and cross (X) if insoluble.

1. Will salt dissolve in water?
2. Will coffee powder dissolve in water?
3. Will napthalene powder dissolve in water?
4. Will salt dissolve in kerosene?
5. Will coffee powder dissolve in kerosene?
6. Will naphthalene powder dissolve in kerosene?
7. Is water polar or nonpolar?Why?
8. Is kerosene polar or non polar? Why?

4. Discussion

Discuss the POE Task 9.

Prediction	Observation	Explanation

5. Concept Formation

What is a polar solute and solvent? non polar?

6. Application

Explain this statement: “Like dissolves like.”

IV. Evaluation

Write **True** if the statement is correct. If **False**, change the underlined word to make it correct.

_____ 1. Like dissolves <u>unlike</u>.

_____ 2. Alcohol is a polar <u>solvent</u>.

_____ 3. <u>Solute</u> acts as a dissolving agent.

_____ 4. Solvent is present in a <u>larger</u> quantity.

_____ 5. Water is a polar <u>solvent</u>.

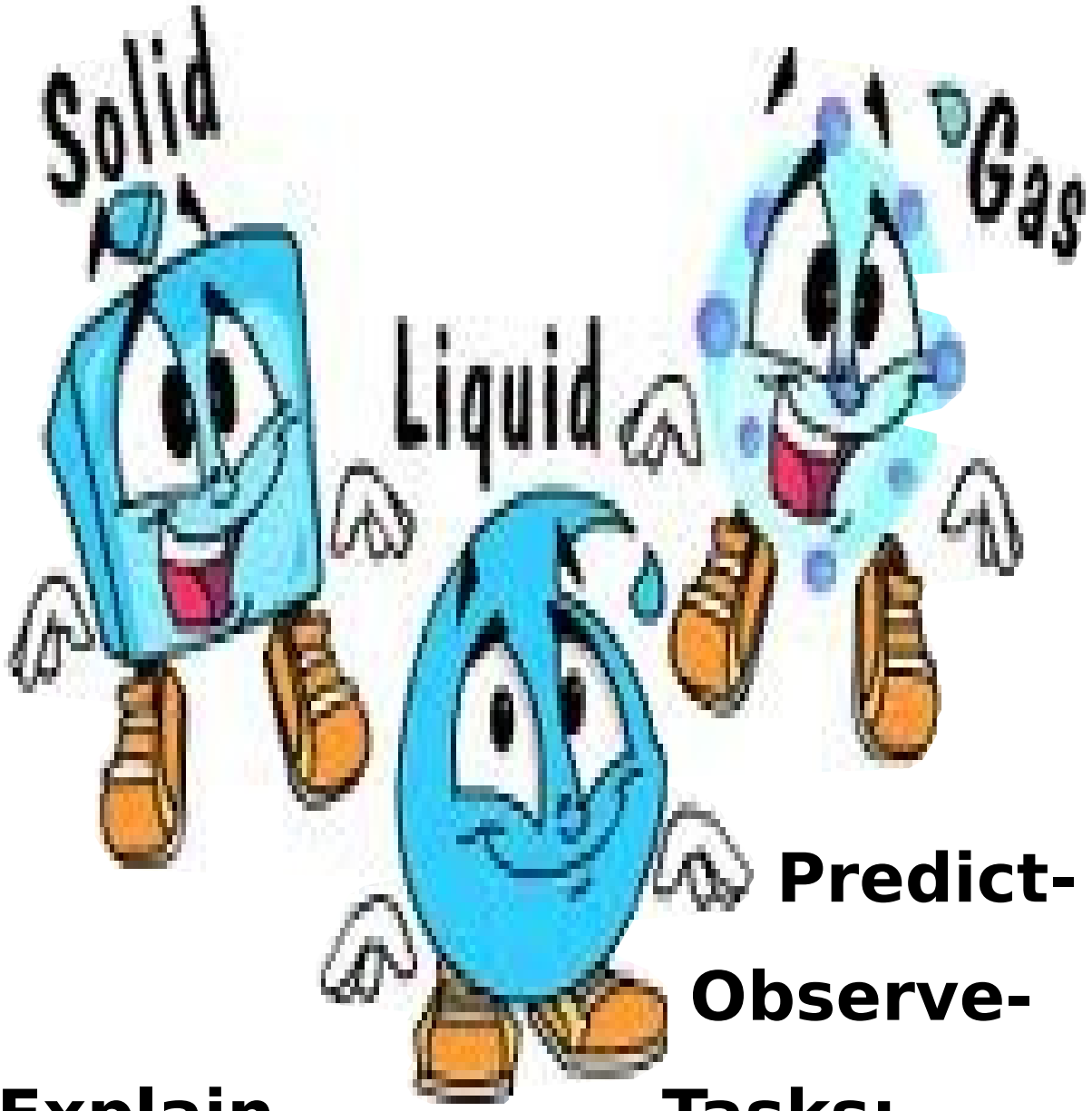
V. Assignment

Give two examples of solutions found at home. Identify what is the solute and solvent.

Appendix I.2

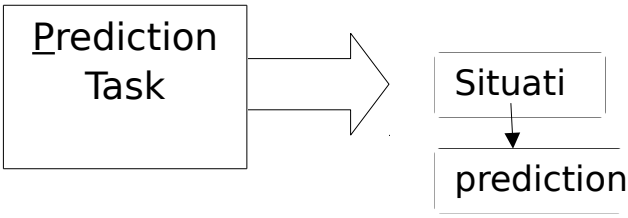
Predict Observe Explain

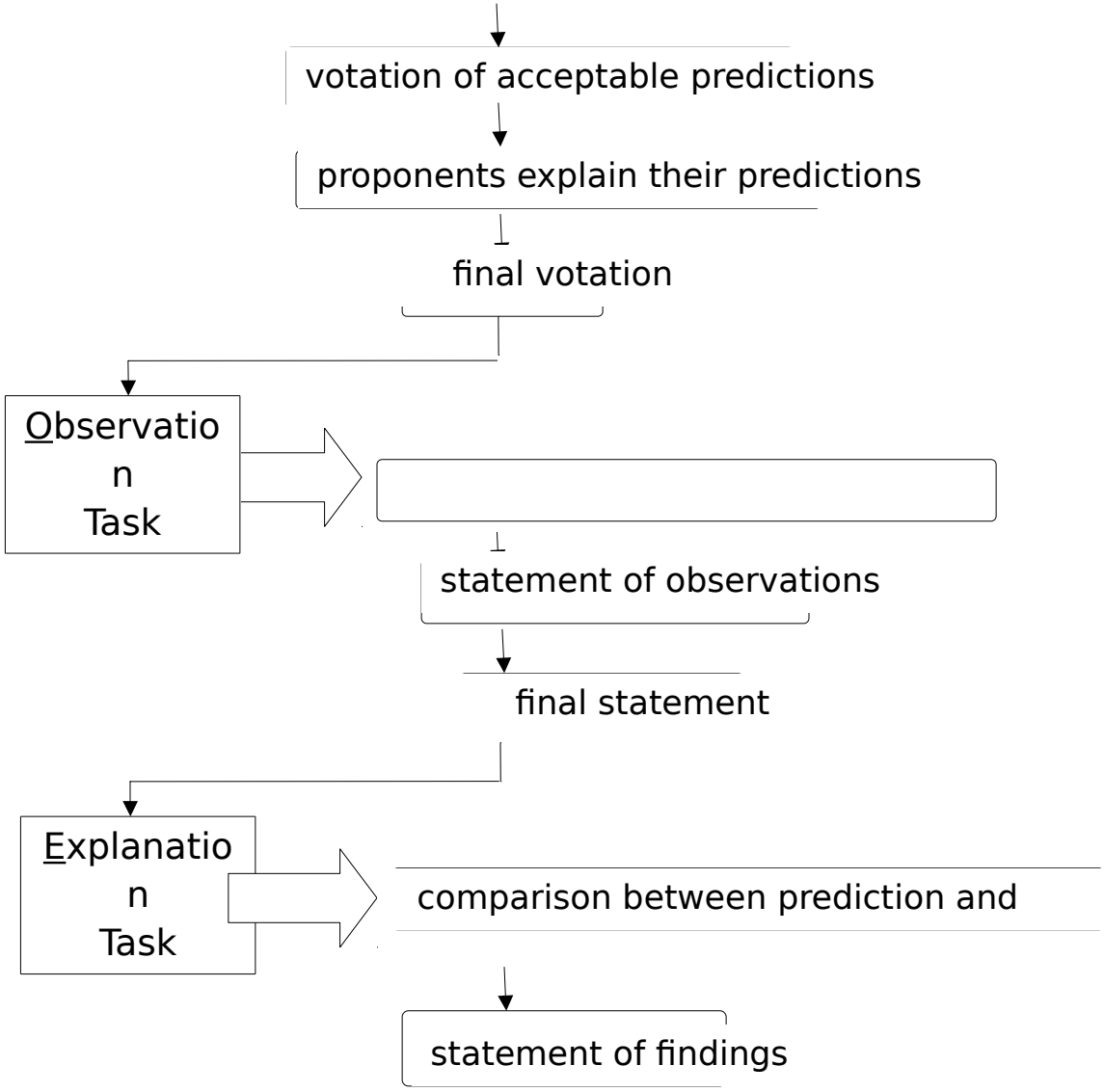
Mixtures & Solutions



Predict-Observe-Explain Tasks:

Mixtures and Solutions





As you explore Mixtures and Solutions, you are asked to do these tasks:

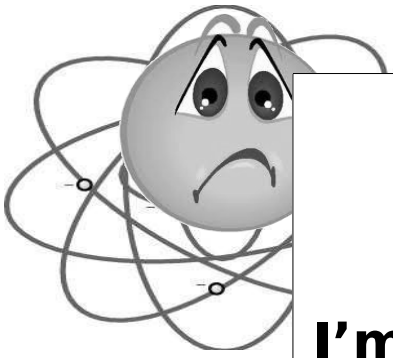
1. Predict, to state your prior knowledge

2. Observe, to test your predictions

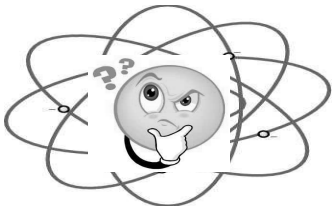
3. Explain, to state your findings and conclusions

Since matter is everywhere, you should be prepared to make maximum use of available resources found at home or your school. You will be given three sheets to work on. The Prediction Sheet, Observation Sheet and Explanation Sheet where you will write your answer before stating it to the class.

Mr. Mixtures..



Hello! I am Mr. Mixtures. I'm planning to go to the park this morning. Before going there, I need to do differenet POE Tasks. Can you help me find my way by doing all the tasks through Prediction, Observation and Explanation?



POE Task 1: "Let's Separate Solids from Solids"

If you have a mixture of iron filings and sawdust, how will you separate this mixture?

Note: This is not a laboratory work so just list down your prediction/s, observations and explanations. The procedures and activity will be discussed and demonstrated by the teacher.

PREDICTI

Write your answers on the space provided.

Prediction 1: _____

Explanation of prediction: _____

_____

Prediction 2: _____

Explanation of prediction: _____

_____

OBSERVATI

List down your observations.

1. _____

_____

2._____

_____

EXPLANAT

Compare your predictions from your observations. Give possible explanation why a certain reaction happens.

Q	Prediction	Observation	Explanation

1			
2			

CONGRATULATIONS!!!!You have just finished POE Task 1!!!

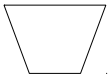
1. If you mix powdered milk on hot water, what do you observe?

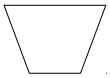
powdered milk hot water

2. How about if you mix powdered milk in cold water, what do you observe?

powdered milk cold water

3. Which situation will milk dissolve faster?





PREDICTI

Write your answers on the space provided.

Prediction 1: _____

Explanation of prediction: _____

_____

Prediction 2: _____

Explanation of prediction: _____

_____

Prediction 3: _____

Explanation of prediction: _____

_____

OBSERVATI

List down your observations.

1. _____

_____

2._____

_____

3._____

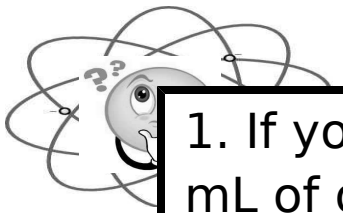
_____

EXPLANAT

Compare your predictions from your observations. Give possible explanation why a certain reaction happens.

Q	Prediction	Observation	Explanation
1			
2			
3			

CONGRATULATIONS!!!!You have just finished POE Task 5.



e”

1. If you mix 5.0 mL of water and 5.0 mL of oil, what do you observe?

2. What physical property of liquids is involved in this case?

3. Which is more dense? less dense? Why?

PREDICTI

Write your answers on the space provided.

Prediction 1: _____

Explanation of prediction: _____

_____

Prediction 2: _____

Explanation of prediction: _____

_____

Prediction 3: _____- more dense _____- less dense

Explanation of prediction: _____

_____

OBSERVATI

List down your observations.

1. _____

_____

_____

2. _____

_____

_____

3. _____- more dense _____- less dense

_____

_____

EXPLANAT

Compare your predictions from your observations. Give possible explanation why a certain reaction happens.

Q	Prediction	Observation	Explanation

2			
3	_____- more dense _____ - less dense	_____- more dense _____ - less dense	

CONGRATULATIONS!!!!You have just finished POE Task 7.

Identify the solute and solvent in each solution.

Solution	**Component**	**Solute**	**Solvent**	**Explanation**
1.seawater	salt & water			
2.Gin	Alcohol & water			
3.Rubbing Alcohol	Alcohol 40% & water			
4.Sugar	Sugar and			

PREDICTI

Write your answers on the space provided.

Solution	Component	Solute	Solvent	Explanation of Prediction
1.seawater	salt & water			
2.Gin	Alcohol & water			
3.Rubbing Alcohol	Alcohol 40% & water			
4.Sugar and water	Sugar and water			

OBSERVATI

List down your observations.

Solution	Component	Solute	Solvent	Explanation of Observation

1.seawater	salt & water			
2.Gin	Alcohol & water			
3.Rubbing Alcohol	Alcohol 40% & water			
4.Sugar and water	Sugar and water			

EXPLANAT

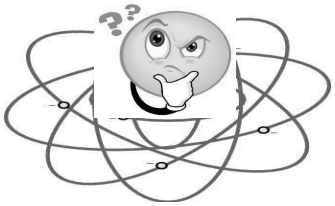
Compare your predictions from your observations. Give possible explanation why a certain reaction happens.

Solutions	Prediction	Observation	Explanation

	solute	solvent	solute	solvent	
1.seawater					
2.Gin					
3.Rubbing Alcohol					
4.Sugar and water					

CONGRATULATIONS!!!!You have just finished POE Task 8.

POE Task 9:”Nature of Solute and Solvent”



A. If you place a pinch of the given solute in a 5mL of solvent, predict and observe what happens?

Solute	Water (Polar Solvent)	Kerosene (Non Polar Solvent)
1. salt		
2. coffee powder		
3. naphthalene powder		

B. Put a check ( ) mark if the above solutes are soluble in water and in kerosene and cross (X) if insoluble.

1. Will salt dissolve in water?
2. Will coffee powder dissolve in water?
3. Will napthalene powder dissolve in water?
4. Will salt dissolve in kerosene?
5. Will coffee powder dissolve in kerosene?
6. Will naphthalene powder dissolve in kerosene?
7. Is water polar or nonpolar?Why?
8. Is kerosene polar or non polar? Why?

PREDICT!

Write your answers on the space provided.

Prediction 1: salt and water? _____

Explanation of prediction: _____

_____

Prediction 2: coffee powder and water? _____

Explanation of prediction: _____

_____

Prediction 3: naphthalene powder and water? _____

Explanation of prediction: _____

_____

Prediction 4: salt and kerosene? _____

Explanation of prediction: _____

_____

Prediction 5: coffee powder and kerosene? _____

Explanation of prediction: _____

_____

Prediction 6: naphthalene powder and kerosene? _____

Explanation of prediction: _____

_____

Prediction 7: _____

Explanation of prediction: _____

_____

Prediction 8: _____

Explanation of prediction: _____

_____

OBSERVATI

List down your observations.

1. **salt and water?** _____

_____

_____

2 **. coffee powder and water?** _____

_____

_____

3. **naphthalene powder and water?** _____

_____

_____

4 **. salt and kerosene?** _____

_____

_____

5**. coffee powder and kerosene?** _____

_____

_____

6. **naphthalene powder and kerosene?** _____

_____

_____

7._____

_____

_____

8._____

_____

_____

EXPLANATIO

Compare your predictions from your observations.

	Prediction	Observation	Explanation
1. salt & water			
2. coffee powder & water			
3.naphthalene powder & water			
4. salt & kerosene			
5. coffee powder & water			
6. naphthalene powder & water			
7.			
8.			

CONGRATULATIONS!!!!You have just finished POE Task 9.

Appendix I. 3

A Semi-Detailed Lesson Plan in the Science Grade V
Lesson 1: non POE Group

I. Objective

Describe what happens when solids are mixed with other solids.

II. Subject Matter: Describing what happens when solids are mixed with other solids

Topic: Mixing Solids-to-Solids

References: BEC-PELC 1.2 (2010)

Science for Active Learning, Science and Health

Science Concept: A mixture is a combination of two or more substances that are not chemically united and do not exist in fixed proportions to each other.

Solids are the materials having definite volume and shape. Picking, use of magnet and sieving are some methods that can be used in separating solids to solids.

Science Process Skills: predicting, observing, describing, drawing conclusion

Materials: iron filings, sawdust, magnet

Time Frame: 60 minutes (as required by the DEPEd)

Values: Careful handling of materials.

III. Procedures

A. Preliminary Activities

1. Personal Hygiene Reporting
2. Science Trivia
3. Word Drill

Give the meaning of the following words:

magnet
metal
iron
picking

4. Review

Say something about the following: (written on the flashcards)

mixtures
pure
solutio

5. Checking of Assignment

B. Developmental Activities

1. Motivation

Name solid materials you can see inside the classroom.

2. Presentation

Today, we are going to discuss the ways on separating solid materials from other solids.

3. Activity and Discussion

Perform Science Activity No. 1

In separating solids to solids, you can do picking and some are through the use of a magnet.

4. Concept Formation

What happens when solids are mixed with other solids? How will you separate solids from other solids? How can you separate metals and irons easily from other solids?

5. Application

What is the use of a magnet in a refrigerator? Are all solids attracted to magnet? Why or why not?

IV. Evaluation

Identify what will happen when solids are mixed with other solids. Write COMBINE or SEPARATE.

_____ 1. paper and sand
_____ 2. salt and colored chalk powder
_____ 3. sugar and milk powder
_____ 4. round pepper and rock salt
_____ 5. loam soil and sand

V. Assignment

Write 1-3 other ways of separating solids to solids.

A Semi-Detailed Lesson Plan in Science Grade V
Lesson 5: non POE Group

I. Objective

Describe the effect of temperature on materials that are mixed.

II. Subject Matter

Topic: Common Conditions Affecting How Materials are Mixed (solid & liquid)
References: BEC-PELC 2010
Science for Active Learning, Science and Health
Science Concept: Liquids and solids solidify and melt at different temperatures. Temperature is one of the factors affecting the behavior of materials that are mixed.
Science Process Skills: predicting, observing, describing, drawing conclusion
Materials: 2 tablespoons of milk powder, 1 glass of hot water,
1 glass of cold water
Time Frame: 60 minutes (as required by the DEPEd)

Values: Careful handling of materials when doing an experiment.

III. Procedures

A. Preliminary Activities
1. Personal Hygiene Reporting
2. Science Trivia
3. Word Drill
Pronounce and spell the following words correctly. Try to give your prior knowledge/definition about these scientific words:
temperature
density
4. Review
What are the two types of mixtures? How do they differ?

B. Developmental Activities

1. Motivation

Show pictures of solid and liquid substances.

2. Presentation

What state of matter is in column A? How about column B? How do the temperature affects the state of matter?

. 3. Activity and Discussion

Perform Science Activity 5

How does the temperature affect the materials that are mixed?

4. Concept Formation

What is temperature? How does it affect the materials that are mixed?
(Write the generalizations drawn from the students on the board)

5. Application

It's late at night when you want to drink cold milk. As you mix the milk powder on the glass of cold water, you notice that the powder just floats instead of dissolving it. Why does this happen?

IV. Evaluation

Fiil-in the blanks with the correct answer. Choose your answer from the choices given.

*solidifying	* hot water	*cold water
*temperature	* melting	

1. The _____ is the physical property of matter that quantitatively expresses the common notions of hot and cold.
2. A solute dissolves faster on _____.
3. A solid can be transform to liquid through the process of _____.
4. A coffee powder when placed in _____ dissolves slower.
5. In_____ the liquid, it is important to have a cold temperature.

V. Assignment

Are dissolving and melting the same process? If not, in what way do they differ?

Lesson 7: non POE Group

I. Objective

Describe the effect of viscosity of liquid materials when mixed.

II. Subject Matter

Topic: Mixing Liquids-to-Liquids

References: BEC-PELC 2010

Science for Active Learning, Science and Health

Science Concept: Liquids are state of matter that have indefinite shape and a definite volume. Some liquids are denser than other liquids. This is because of what we call as viscosity.

Viscosity is the property of a fluid that describes its ability to flow. To roughly determine the viscosity of one fluid to another, one can simply pour each fluid from a pitcher, and qualitatively observe the ease with which each fluid exits.

Science Process Skills: predicting, observing, describing, drawing conclusion

Materials: 5.0 mL water, 5.0 mL cooking oil

Time Frame: 60 minutes (as required by the DEPEd)

Values: Realize that curiosity is next to learning.

III. Procedures

A. Preliminary Activities

1. Personal Hygiene Reporting
2. Science Trivia
3. Drill

What are the two classifications of mixtures?

4. Review

How does the temperature affect the materials that are mixed? In what temperature of liquid does a certain solute dissolve faster?

B. Developmental Activities

1. Motivation

Name two liquids that cannot be mixed.

2. Presentation

Today, we will discover the properties of different kinds of liquids and their reactions when mixing together.

3. Activity and Discussion

Perform Science Activity 7

What happens when liquids are mixed with other liquids? What property of liquids affect its behavior when mixed with other liquids?

4. Concept Formation

What is viscosity? density? Why do some liquids cannot be mixed easily? (Write the generalizations drawn from the students on the board)

5. Application

Suppose there are two boys sitting on the table holding 2 cups; one holds soda and one holds honey. If a careless person passes by that lets 2 cups fall down, which cup will become empty first? Why?

IV. Evaluation

Fill-in the blanks with the correct answer. Choose your answer from the given choices.

1. A more viscous fluid such as honey has _____ (stronger, weaker) intermolecular forces compared to a less viscous fluid like water.
2. One way to decrease the viscosity of a liquid is to _____(heat, cool) the fluid.
3. Adding corn starch to water _____ (increases, decreases) the overall viscosity.
4. _____ (honey, water, corn starch) has the highest viscosity.
5. More viscous fluids tend to have a _____ (slow, fast) pipe flow.

V. Assignment

Define the following scientific terms in 1-2 sentences:

1. sieving
2. filtration
3. decantation
4. evaporation

A Semi-Detailed Lesson Plan in Science Grade V
Lesson 8: non POE Group

I. Objective

Identify the solute and solvent in a given mixture.

II. Subject Matter

Topic: Identifying the Solute and Solvent in a Given Mixture

References: BEC-PELC 2010

Science for Active Learning, Science and Health

Science Concept: Solutions are types of mixtures where in one substance undergoes dissolving. Solute is the constituent of a solution that acts as a dissolving agent and solvent does the dissolving process. It is constituent that is present in larger quantity is considered the solvent.

Science Process Skills: predicting, observing, describing, drawing conclusion

Materials: 1 cup of seawater 1 cup of Gin
1 cup of rubbing alcohol 1 cup of water
3 tbsp of white sugar

Time Frame: 60 minutes (as required by the DEPEd)

Values: Carefulness.

III. Procedures

A. Preliminary Activities

1. Personal Hygiene Reporting
2. Science Daily Facts
3. Word Drill

Pronounce and spell the following words correctly:

decanting	mixtures
sieving	solute
homogeneous	solvent
heterogeneous	solution

4. Review

What are the common conditions that affect how materials are mixed?

B. Developmental Activities

1. Motivation

Classify the following according to their state of matter.

chalk powder	honey syrup
soft drinks	chocolate bar
water	refined sugar

2. Presentation

What states of matter do the substances belongs to? What is the difference between these states of matter?

3. Activity and Discussion

Perform Science Activity 8.

What is a solution? solute? solvent? Give examples.

4. Concept Formation

What is a solute and solvent?

5. Application

What can you do to dissolve the solute faster?

IV. Evaluation

Write the letter of the correct answer.

___ 1. Which of the following solute dissolves faster on water?

A. dark chocolate bar
B. iodized salt
C. juice powder

___ 2. What process is involved in a solution?

A. mixing substances
B. separating substances
C. removing substances

___ 3. Which of the following mixtures is a solution?

A. sand and water
B. calamansi bits and water
C. salt and water

___ 4. What will happen to the solute when mixed with a solvent?

A. solute disappears
B. solute dissolves on water
C. solvent becomes solute

___ 5. Which of the following classification of mixtures undergoes dissolving?

A. solution
B. suspension
C. colloid

V. Assignment- Give two examples of solution found at home. Identify what is the solute and solvent.

A Semi-Detailed Lesson Plan in Science Grade V
Lesson 9: non POE Group

I. Objective

Identify the nature of solute and solvent.

II. Subject Matter

Topic: Identifying the Nature of Solute and Solvent

References: BEC-PELC 2010

Science for Active Learning, Science and Health

Science Concept: Solubility of a solute in a solvent purely depends on the nature of both solute and solvent. A polar solute dissolved in polar solvent. Solubility of a non-polar solute in a solvent is large. A polar solute has low solubility or insoluble in a non-polar solvent.

Polarity refers to a separation of electric charge leading to a molecule or its chemical groups having an electric dipole or multipole moment. Polar solutes are usually soluble in polar solutes. Example: H_2O is an example of a polar solvent. Salts are examples of polar solutes (NaCl). Nonpolar solutes are usually soluble in nonpolar solvents. Example: CCl_4 is an example of a nonpolar solvent. Hydrocarbons are examples of nonpolar solutes (CH_4).

Science Process Skills: predicting, observing, describing, drawing conclusion

Materials: salt, coffee powder, naphthalene powder

Time Frame: 60 minutes (as required by the DEPEd)

Values: Carefulness

III. Procedures

A. Preliminary Activities

1. Personal Hygiene Reporting
2. Science Trivia
3. Drill

Identify what type of mixtures are the following:

sand & water
iodized salt & warm water
milk powder & warm water

4. Review

What are solutions?

B. Developmental Activities

1. Motivation

Present a practical situation: Why do you think bath soap is better to use in removing blood stain on clothes rather than detergent bar?

2. Presentation

What do you think are the chemical components of bath soap that differ in a detergent soap?

3. Activity and Discussion

Perform Science Activity 9

Observe what happens in the following set-ups.

a. rock salt combines with hot water
b. rock salt combines with cold water
c. iodized salt combines with hot water
d. iodized salt combines with cold water

What are the natures of solute and solvent that may affect solubility?

4. Concept Formation

What is a polar solute and solvent? non polar?

5. Application

Explain this statement: “Like dissolves like.”

IV. Evaluation

Write **True** if the statement is correct. If **False**, change the underlined word to make it correct.

_____ 1. Like dissolves <u>unlike</u>.

_____ 2. Alcohol is a polar <u>solvent</u>.

_____ 3. <u>Solute</u> acts as a dissolving agent.

_____ 4. Solvent is present in a <u>larger</u> quantity.

_____ 5. Water is a polar <u>solvent</u>.

V. Assignment

Give two examples of solutions found at home. Identify what is the solute and solvent.

Appendix I.4

Science Activity 1

Separating Solids to Solids

Grade V

I. Objective: Describe what happens when solids are mixed with other solids.
Demonstrate ways on separating solids to solids

II. Materials

stone	crumpled paper	saw dust
magnet	iron filings	

III. Procedures and Questions

1. Place the stone and crumpled papers together in a container. What happens? How will you separate these two solids? _____
_____
_____
_____

2. Place the saw dust and iron filings in the evaporating dish. What happens to the saw dust and iron filings when combine? How will you separate the iron filings from the saw dust? _____
_____
_____
_____

IV. Conclusion

_____
_____
_____
_____

Science Activity 5
Effect of Temperature on Solutions
Grade V

I. Objective: Describe the effect of temperature on materials that are mixed.

II. Materials

2 tbsp. of milk powder
1 glass of cold water
1 glass of hot water

III. Procedures and Questions

1. Mix the powdered milk on hot water. What do you observe?

_____
_____
_____
_____

Note: To avoid any incident, the teacher will be the one mix the milk powder on hot water.

2. Mix the powdered milk on cold water. What do you observe?

_____
_____
_____
_____

3. Which set-up makes the milk powder dissolved faster? What is the effect of temperature of materials that are mixed?

_____
_____
_____
_____

IV. Conclusion

_____
_____
_____
_____

Science Activity 7
Effect of Viscosity on Mixtures
Grade V

I. Objective: Describe the effect of viscosity of liquid materials when mixed.

II. Materials

5.0 mL water 5.0 mL cooking oil

III. Procedures and Questions

1. Mix 5.0 mL of water and 5.0 mL of oil in a beaker. What do you observe?

_____
_____
_____
_____

2. What physical property of liquid is involved in this case?

_____
_____
_____
_____

3. Which is more dense? less dense?

_____
_____
_____
_____

IV. Conclusion

_____
_____
_____
_____

Science Activity 8
Identifying Solute and Solvent
Grade V

I. Objective: Identify the solute and solvent in a given mixture.

II. Materials

5.0 mL of rubbing alcohol
2 tbsp. of salt
2 tbsp. of sugar
water

III. Procedures and Questions

Identify the solute and solvent in the following solutions.

Solution	Component	Solute	Solvent
1. sugar and water	sugar and water		
2. seawater	salt and water		
3. rubbing alcohol	alcohol and water		

IV. Conclusion

_____
_____
_____
_____

Science Activity 9
Nature of Solute and Solvent
Grade V

I. Objective: Identify the nature of solute and solvent

II. Materials

2 tbsp. of salt
1 tbsp. of coffee powder
1 tbsp. of naphthalene powder
5.0 mL of water
5.0 mL of kerosene

III. Procedures and Questions

Note: To avoid any incident, the teacher will be the one mixing the solutes in the kerosene.

1. Mix the given solutes in water and kerosene. Write what happens inside the table below.

Solute	Water (Polar Solvent)	Kerosene (non Polar Solvent)
1. salt		
2. coffee powder		
3. naphthalene powder		

2. Is water polar or non polar? Why? _____
_____
_____
_____

3. Is kerosene polar or non polar? Why? _____
_____
_____
_____

IV. Conclusion

_____
_____
_____

Appendix J

G. Gatchalian Elementary School

S.Y. 2012-2013

Name:_____ Date: _____
Grade & Section: _____

Learning Styles Quiz

Direction: This quiz reflects your preferred learning style/s. Check (√) the statements that you are comfortable with. Note: There are no right or wrong answers.

_____1. I would rather read instructions than listen to the teacher explain them.

_____ 2. I like having someone explain the directions out loud.

_____ 3. When I study, I have to take a lot of breaks to get up and move around.

_____ 4. I remember things better if I write them down.

_____ 5. I study spelling words by reciting them out loud.

_____ 6. I draw a lot of pictures during class.

_____ 7. Charts, diagrams, and maps help me understand what I'm reading

_____ 8. I like to listen to music while I'm studying.

_____ 9. I can concentrate better if I have a snack when I study.

_____ 10. I am good at visualizing what I'm studying in my mind.

_____ 11. It's easy for me to remember jokes.

_____ 12. I can think better if I tap my foot or play with a pencil.

Note: Do not answer beyond this part.

Score

L. S.	
V	
A	
K	

Adopted from "Learning Style Survey for Young Learners" by Andrew D. Cohen and Rebecca L. Oxford

Appendix K. Validation Results

Appendix K.1

RESULTS OF VALIDATION ON ACHIEVEMENT TEST

CRITERIA

Outstanding	4
Highly Satisfactory	3
Satisfactory	2

Needs Improvement 1

I. Format Design	E1	E2	E3	E4
1. The printing is clear and readable.	4	4	4	4
2. The quality of the paper is acceptable.	4	4	4	4
3. The layout is attractive and uniform.	4	4	3	4
4. The fonts are comprehensible and appropriate.	4	4	4	4
5. The spacing on the pages contributes to the ease of reading and responding	4	3	3	3

II. Language and Style	E1	E2	E3	E4
1. The language and style are appropriate.	4	4	4	4
2. The language used is consistent.	4	4	3	4
3. The checklist is free from grammatical errors.	3	3	3	4
4. The sentences are properly constructed and punctuated.	3	3	3	4
5. The words used in the checklist are simple	4	4	4	4

III. Content	E1	E2	E3	E4
1. The items are factual and objective.	4	3	3	4
2. The items are aligned with Basic Education Curriculum-Philippine Elementary Learning Competencies (BEC-PELC) which covers Mixtures and Solutions.	4	4	4	4
3. The choices for each item are independent and do not overlap.				

	3	3	3	4
4. The items are sound convenient, useful, and proper in determining achievement of students in science.	3	4	3	4
5. The information is complete and key to correction are given.	3	4	3	4
6. The items match with the objectives through Table of Specifications (TOS)	3	4	4	3
7. Error-free (grammar, spelling, erasures, computations)	3	3	3	4
8. All test items have directions that are well stated and complete	3	3	3	4

Comments and Suggestions: Revise some questions so as not to overlap with each other. Other questions are too easy. Pretest can be used for finding out pupils initial ideas. Allot a space between the last option and next item number. Items 3 and 37 are almost the same.

Appendix K.2

RESULTS OF VALIDATION ON PREDICT-OBSERVE-EXPLAIN (POE) TASKS

CRITERIA

Outstanding	4
Highly Satisfactory	3
Satisfactory	2

Needs Improvement 1

I. Format Design	E1	E2	E3	E4
1. The printing is clear and readable.	4	4	4	4
2. The quality of the paper is acceptable.	4	4	4	4
3. The layout is attractive and uniform.	4	4	4	4
4. The fonts are comprehensible and appropriate.	4	4	4	3
5. The spacing on the pages contributes to the ease of reading and responding	4	4	4	4

II. Language and Style	E1	E2	E3	E4
1. The language and style are appropriate to grade five.	4	4	4	4
2. The language used is consistent.	4	4	3	4
3. The checklist is free from grammatical errors.	4	4	3	3
4. The sentences are properly constructed and punctuated.	4	4	3	4
5. The words used in the checklist are simple	4	4	3	4

III. Content	E1	E2	E3	E4
1. The items are applicable in a student's life.	3	4	4	3
2. The POE Activities are appropriate and suitable to the comprehension level of Grade V students.	3	4	4	3
3. The activities are relevant to the topics tackled (Mixtures and Solutions)	3	4	4	3
4. The topics in each POE Activity is aligned with Basic Education Curriculum-Philippine Elementary Learning Competencies	4	4	4	3

(BEC-PELC)				
5. The activities measure the ability of the students to predict, observe and explain.	3	3	3	3
6. The items are sound convenient, useful, and proper instrument in getting the prior knowledge and the knowledge gained from the discussion.	2	4	4	3

Comments and Suggestions: Allow time to focus on observation. Ask pupils to write down what they do observe. Ask pupils to amend or add to their explanations to take account of the observation. After the pupils have committed their explanation, discuss their ideas together. While to predict, ask the pupils to independently write their predictions of what will happen after observing, then what they think will see and why they think this.

It is a good strategy, but I think pupils may have difficulty reasoning. Practice pupils' communication skills first. Follow-up some predictions that are wrong, encourage them to explore why it was wrong. Do not allow pupils to make wild guesses.

Some concepts maybe difficult to our pupils so choose carefully your activities, present alternatives or options when needed.

Appendix K.3

RESULTS OF VALIDATION ON LESSON PLANS

CRITERIA

Outstanding	4
Highly Satisfactory	3
Satisfactory	2
Needs Improvement	1

Criteria	E1	E2	E3	E4
I. Overall Plan				
1. It is written in a clear and understandable manner.	3	4	4	4
2. It is practical (can be carried out in an actual school situation).	3	4	4	4
3. It is geared to the level of the students for which it was prepared.	2	4	4	4
4. It includes a clear title for the lesson that accurately reflects the lesson content.	3	4	4	4
5. It includes a complete list of all supplies and materials needed for the lesson.	3	4	4	4
II. Objectives				
6. It includes a clear title for the lesson that accurately reflects the lesson content.	2	4	4	4
7. Objectives are clear, concise and easily understood.	4	4	4	4
8. They are designed to support identified student “outcomes” for the whole chapter.	3	4	4	4
III. Lesson Introduction				
9. It provides students with a logical orientation to the content of the presentation.	2	4	4	4
10. It serves to involve students as active participants in the presentation to follow.	3	4	4	4
IV. Lesson Presentation				
11. It uses methods, techniques and learning experiences appropriate to the lesson objectives.	3	4	4	4
12. It provides students with opportunities to become actively engaged in the learning process.	3	4	4	4
13. It meets student needs, interests and abilities.	2	4	4	4

Criteria	E1	E2	E3	E4
V. Content				
14. It is sufficient and appropriate to the level of the students and the level of the course.	3	4	4	4
15. It includes information necessary for the achievement of the stated objectives.	2	4	4	4
VI. Closure				
16. It allows students to draw conclusions consistent with the objectives of the lesson.	3	4	4	3
17. It allows students to actively participate in summarizing what they have learned.	4	4	4	4
VII. Assessment				
18. Assessment is aligned with the stated objectives and the type of performance appropriate to desired student outcomes for the lesson.	3	4	4	4
19. Instructions can be understood by an elementary student.	3	3	4	4

Comments and Suggestions: The parts of the lesson plan which was required in science was carefully followed. The objectives were aligned in the Basic Education Curriculum-Philippine Elementary Learning Competencies 2010.

Appendix K.4

RESULT OF VALIDATION ON
LEARNING SCIENCE ATTITUDE INVENTORY (LSAI)

CRITERIA

Outstanding	4
Highly Satisfactory	3
Satisfactory	2
Needs Improvement	1

I. Format Design	E1	E2	E3	E4
1. The printing is clear and readable.	4	4	4	3

2. The quality of the paper is acceptable.	4	4	4	4
3. The layout is attractive and uniform.	4	3	3	4
4. The fonts are comprehensible and appropriate.	4	4	4	4
5. The spacing on the pages contributes to the ease of reading and responding	4	3	4	3

II. Language and Style	E1	E2	E3	E4
1. The language and style are appropriate.	4	4	4	4
2. The language used is consistent.	4	4	3	4
3. The checklist is free from grammatical errors.	3	4	3	4
4. The sentences are properly constructed and punctuated.	3	4	3	4
5. The words used in the checklist are simple.	4	4	4	4

III. Content	E1	E2	E3	E4
1. The items are factual and objective.	4	3	4	4
2. The items are appropriate in the grade level of the students and could be easily understood by the students.	4	4	4	4
3. The translation of statements to Filipino are well-stated and constructed that helps students understand the statements.	4	3	4	4
4. The choices for each item are independent and do not overlap.	3	4	3	4
5. The items are sound convenient, useful, and proper in determining attitude of students towards science.	4	4	3	4
6. The information is complete and key to correction was given.	3	4	3	4
7. Error-free (grammar, spelling, erasures, computations)	4	3	4	4
8. All test items have directions that are well stated and complete				

	3	4	3	4

Comments and Suggestions: The translation of statement to Filipino could help the students understand the meaning of each statement. Make sure each statement were explained for all students especially to the slow learners.

Appendix L. Observation Checklist

Appendix L.1

National Capital Region
Division of City Schools- Las Piñas
Las Piñas I District
G. GATCHALIAN ELEMENTARY SCHOOL

OBSERVATION CHECKLIST FOR EXPERIMENTAL GROUP (POE)

Name: _____ Date Observed: _____
School: G. GATCHALIAN ELEMENTARY Subject: _____
Grade/Section: _____ Time: _____
Objective: _____
_____
_____

PART I-Check the capabilities demonstrated by the teacher under appropriate columns.

Numerical/Description

5 - Advanced
4 - Proficient
3 - Approaching Proficiency
2 - Developing
1 - Beginning

CRITERIA	OBSERVED					NOT OBSERVED	REMARKS/ COMMENTS
	5	4	3	2	1		
A.CLASSROOM/PREPARATION/MANAGEMENT							
1. Classroom is clean, orderly, properly structured, well ventilated/lighted, and has good seating arrangement.							
2. Appropriate and adequate teaching devices are well prepared.							
3. Time allotment per learning is observed.							
4. Discipline and order are maintained in the classroom.							
B. TEACHING-LEARNING PROCESS							
5. States objectives in behavioral terms							
6. Conducts relevant and appropriate drill and checks assignment (as needed)							
7. Uses motivational techniques that arouse pupil's interests.							
8. Unlocks difficult words and concepts.							
9. Uses language that is easily understood by the pupils/students							
10. Observes correct grammar and uses appropriate vocabulary both in speaking and in writing.							
11. Uses appropriate strategies and/or techniques to achieve objectives of the lesson.							
	OBSERVED					**NOT OBSERVED**	**REMARKS/ COMMENTS**
	5	4	3	2	1		
12. Provides varied learning opportunities for: * pupil-pupil interaction * material-pupil interaction							

* teacher-pupil interaction							
13. Asks questions that develop higher order thinking skills.							
14. The POE Tasks are suited in the grade level of							
students.							
15. Provides assessment tools that are congruent with the objectives of the lesson.							
16. Demonstrates mastery of the lesson							
C. STUDENT-LEARNING PROCESS							
17. The students show interest in learning through POE as evidenced by their participation in the learning activities.							
18. The students show enthusiasm in answering the POE (Predict-Observe-Explain) Activity Sheets							
19. The students are well-motivated to participate actively and get involved in class discussion.							
20. The students enjoy the POE Tasks and give positive feedback about their class discussion.							
D. LEARNING OUTCOMES							
21. Attainment of objectives is evident.							

PART II-Agreement/s

_____

_____

_____

_____

_____

Observer: Signature of Teacher Over Printed Name

_____

Signature Over Printed Name

Numerical/Description

5 - Advanced
4 - Proficient
3 - Approaching Proficiency
2 - Developing
1 - Beginning

Appendix L.2

National Capital Region
Division of City Schools- Las Piñas
Las Piñas I District
G. GATCHALIAN ELEMENTARY SCHOOL

OBSERVATION CHECKLIST FOR THE CONTROL GROUP (non POE)

Name: _____ Date Observed: _____
School: G. GATCHALIAN ELEMENTARY Subject: _____
Grade/Section: _____ Time: _____
Objective: _____
_____
_____

PART I-Check the capabilities demonstrated by the teacher under appropriate columns.

Numerical/Description

5 - Advanced
4 - Proficient
3 - Approaching Proficiency
2 - Developing
1 - Beginning

CRITERIA	OBSERVED					NOT OBSERVED	REMARKS/ COMMENTS
	5	4	3	2	1		
A.CLASSROOM/PREPARATION/MANAGEMENT							
1. Classroom is clean, orderly, properly structured, well ventilated/lighted, and has good seating arrangement.							
2. Appropriate and adequate teaching devices are well prepared.							
3. Time allotment per learning is observed.							
4. Discipline and order are maintained in the classroom.							
B. TEACHING-LEARNING PROCESS							
5. States objectives in behavioral terms							
6. Conducts relevant and appropriate drill and checks assignment (as needed)							
7. Uses motivational techniques that arouse pupil's interests.							
8. Unlocks difficult words and concepts.							
9. Uses language that is easily understood by the pupils/students							
10. Observes correct grammar and uses appropriate vocabulary both in speaking and in writing.							
11. Uses appropriate strategies and/or techniques to achieve objectives of the lesson.							
	OBSERVED					**NOT OBSERVED**	**REMARKS/ COMMENTS**
	5	4	3	2	1		
12. Provides varied learning opportunities for: * pupil-pupil interaction * material-pupil interaction							

* teacher-pupil interaction							
13. Asks questions that develop higher order thinking skills.							
14. Provides assessment tools that are congruent with the objectives of the lesson.							
15. Demonstrates mastery of the lesson							
C. STUDENT-LEARNING PROCESS							
16. The students show interest in learning is evidenced by their participation in the learning activities.							
17. The students show enthusiasm in answering the questions in the experiment/science activities							
18. The students are well-motivated to participate actively and get involved in class discussion.							
19. The students enjoy the Science activities/experiments and give positive feedback about their class discussion.							
D. LEARNING OUTCOMES							
20. Attainment of objectives is evident.							

PART II-Agreement/s

_____

_____

_____

_____

_____

Observer: Signature of Teacher Over Printed Name

_____

Signature Over Printed Name

Numerical/Description

5 - Advanced
4 - Proficient
3 - Approaching Proficiency
2 - Developing
1 - Beginning

Appendix O

Basic Education Cirriculum

(Philippine Elementary Learning Competencies)

First Part of Third Grading Period

Topic: Mixtures and Solutions

Learning Competencies

1. Explain what happens when materials are mixed

    1.1 Describe what happens when solids are mixed with other solids

    1.2 Describe what happens when liquids are mixed with other liquids

    1.3 Describe what happens when liquids are mixed with solids

2. Perform experiments to show that common conditions affect how materials are mixed

    2.1 Describe the effect of stirring materials that are mixed

    2.2 Describe the effect of temperature on materials that are mixed

    2.3 Describe the effect of size of solid particles when mixed with other materials

    2.4 Describe the effect of viscosity of liquid materials when mixed with other materials (e.g.honey, syrup)

3. Demonstrate how certain mixtures can be separated through:

    • picking

    • sieving

    • decanting

    • filtering

    • evaporating

    • use of magnets

Source: Basic Education Curriculum (Philippine Elementary Learning Competencies) 2010

CURRICULUM VITAE

Janel P. Gernale
385 Milkyway St. Gatchalian Subd. Manuyo Dos,
Las Piňas City

PERSONAL DATA

Sex	Female
Civil Status	Single
Date of Birth	June 11, 1984
Place of Birth	San Rafael, Bulacan
Nationality	Filipino

EDUCATIONAL ATTAINMENT

School	Philippine Normal University
Address	Taft Avenue, Manila
Degree	Master of Arts in Science Education with Specialization in General Science
Year Graduated	2013
School	Philippine Normal University
Address	Taft Avenue, Manila
Degree	Bachelor of Elementary Education
Year Graduated	2007
High School	Binagbag High School
Address	Binagbag, Angat, Bulacan
Year Graduated	2000
Elementary	Pulo Elementary School
Address	Pulo, San Rafael, Bulacan
Year Graduated	1996

WORK EXPERIENCES

2010-present	Faculty Member G. Gatchalian Elementary School Las Piňas City

2011-present	Part-time College Instructor (with permit to teach) STI College of Paraňaque Paraňaque City
2007-2010	Faculty Member Holy Rosary Academy of Las Piňas City

Organizations

Youth for Environment in Schools Organization (YES-O)
Red Cross Youth Advisers' League-Las Piňas Sub-Chapter
Boy Scouts of the Philippines
Las Piňas Science Coordinators League
Adviser: Dengue Brigade (DOST Larvae Trapping)

Examinations Passed

Licensure Examination for Teachers (LET)
August 26, 2007

Faculty Competency Certification in Biology and Environmental Science
STI College of Paraňaque, December 13, 2012

Qualifications

Demonstration Teacher in integrating the Environmental Awareness Program
Youth for Environment in Schools Organization (YES-O)
Demonstration Teacher in the Micro Demo Teaching-Least Mastered Skills in the NAT Science 2012

Seminars Attended

Division Seminar-Workshop on Content and Strategy Based on the Least Mastered Skills (LMS) in the 2012 National Achievement Test (NAT).
Las Piňas National High School, Las Piňas City. October 22-25, 2012

In-Service Training for Teachers. Graduate Department of Olivarez College, Paraňaque City. October 17-19, 2012

Classroom Management and Code of Ethics. Graduate Department of Olivarez College, Paraňaque City. October 24, 2012

Division Seminar-Workshop on Science Investigatory Project for Elementary and Secondary SIP Advisers. Las Piňas East National High School, Las Piňas City. November 21-23. 2011

Appendix P

The experimental group was exposed to POE Approach and had been observed by science teachers.

Appendix Q

These pictures were taken during the actual instruction in the control group (non POE group). The teacher discusses the lesson first then the students accomplished the science activities.

Appendix C

Classical test theory statistics

Number of subjects	Number of items	Number of missing responses	Score's mean	Score's standard deviation	Cronbach's Alpha
48	***50***	***0***	***33.771***	***3.732***	***0.273***

Revised Item No.	Original Item No.	diff	disc	Revised Item No.	Original Item No.	diff
1	*21*	0.854	0.369	31	*22*	0.583
2	*30*	0.854	0.087	32	*13*	0.563
3	*6*	0.833	0.176	33	*25*	0.563
4	*15*	0.813	0.170	34	*28*	0.563
5	*32*	0.813	0.261	deleted	*46*	0.563
6	*47*	0.813	0.215	35	*4*	0.542
7	*48*	0.813	0.023	deleted	*23*	0.542
8	*11*	0.792	0.152	36	*35*	0.500
9	*27*	0.792	0.053	37	*31*	0.479
10	*14*	0.771	0.013	38	*39*	0.479
11	*16*	0.771	0.136	39	*44*	0.479
12	*19*	0.771	0.333	deleted	*5*	0.438
deleted	*29*	0.771	-0.145	deleted	*18*	0.396
deleted	*33*	0.771	-0.106	40	*38*	0.396
13	*34*	0.771	0.150			
deleted	*45*	0.771	-0.106			
14	*49*	0.771	0.040			
15	*9*	0.750	-0.087			
16	*42*	0.750	0.042			
17	*20*	0.729	0.378			
18	*24*	0.729	0.309			
19	*26*	0.729	0.149			
20	*50*	0.729	0.020			
21	*12*	0.708	0.036			
22	*17*	0.708	0.086			
23	*36*	0.708	0.086			
24	*40*	0.708	-0.014			
25	*8*	0.688	0.089			
deleted	*37*	0.688	-0.128			
26	*41*	0.688	0.228			
27	*43*	0.688	-0.057			
deleted	*1*	0.667	-0.236			
deleted	*7*	0.646	-0.092			
28	*2*	0.625	0.150			
29	*3*	0.625	-0.039			

30	*10*	0.583	0.009

disc
-0.014
0.143
-0.018
0.062
-0.195
0.139
-0.251
0.275
0.083
0.095
-0.042
-0.231
-0.137
-0.001

Appendix E

Interpretation of Basic Data

Group	0=Control 1=Experimental
Sex	0=Female 1=Male
Learning Style	0=Visual 1=Auditory 2=Kinesthetic
Age	Actual age in years
Q1	1st Grading Period Rating in Science
Q2	2nd Grading Period Rating in Science
Q	Average of the 1st and 2nd Grading Period Ratings in Scie
PR	Achievement Pretest
PO	Achievement Post test
C	Difference Score for Achievement Test (PO-PR)
APR	Pre-Attitude Test
APO	Post-Attitude Test
AC	Difference Score for Attitude Test
df	degree of freedom
tsep	separated t-test
	chi-square

nce

Appendix D

BASIC DATA											
STUD	GRP	SEX	LS	AGE	Q1	Q2	Q	PR	PO	C	APR
1	0	1	0	11	84	85	85	12	20	8	32
2	0	1	1	10	83	85	84	14	18	4	34
3	0	1	2	12	76	78	77	13	17	4	33
4	0	1	2	11	84	84	84	12	15	3	35
5	0	1	2	11	78	79	79	13	17	4	34
6	0	1	2	10	77	78	78	12	18	6	35
7	0	1	1	12	86	87	87	12	19	7	34
8	0	1	2	12	88	89	89	16	21	5	32
9	0	1	2	10	79	80	80	11	20	9	33
10	0	1	2	11	86	86	86	11	15	4	34
11	0	1	2	11	84	86	85	7	12	5	34
12	0	1	0	13	85	86	86	15	13	-2	26
13	0	1	0	11	80	81	81	15	15	0	28
14	0	1	2	11	81	78	80	12	16	4	33
15	0	1	0	10	80	81	81	12	17	5	33
16	0	1	2	11	78	82	80	15	16	1	35
17	0	1	1	11	79	79	79	12	15	3	33
18	0	0	2	11	75	75	75	13	14	1	32
19	0	0	2	11	77	80	79	15	21	6	34
20	0	0	2	11	88	90	89	15	16	1	37
21	0	0	0	11	79	80	80	17	17	0	33
22	0	0	2	11	82	83	83	13	15	2	32
23	0	0	2	12	79	80	80	14	16	2	33
24	0	0	1	11	81	82	82	12	15	3	34
25	0	0	2	11	83	82	83	14	17	3	33
26	0	0	2	12	79	78	79	18	23	5	35
27	0	0	2	11	75	76	76	11	25	14	29
28	0	0	0	10	80	81	81	19	20	1	34
29	0	0	2	11	79	79	79	17	17	0	32
30	0	0	2	11	75	75	75	11	21	10	38
31	0	0	2	11	81	80	81	17	20	3	34
32	0	0	1	12	88	89	80	14	18	4	35
33	0	0	0	11	87	88	88	13	17	4	34
34	0	0	2	10	84	86	85	14	16	2	35
35	0	0	0	10	79	80	80	12	21	9	34
36	0	0	1	11	81	81	81	10	22	12	31
37	0	0	1	11	80	81	81	13	21	8	35
38	0	0	2	10	79	77	78	14	19	5	35
39	0	0	2	10	84	85	85	13	18	5	34
40	0	0	2	10	78	77	78	12	25	13	35
41	0	0	0	10	77	78	78	16	22	6	34

42	0	0	1	11	77	79	78	16	21	5	32

43	0	0	0	11	78	79	79	13	15	2	34
44	0	0	0	11	80	81	81	12	15	3	35
45	0	0	2	11	80	83	82	14	16	2	36
46	0	0	2	10	79	80	80	11	19	8	36
47	0	0	1	11	78	80	79	16	21	5	35
48	0	0	2	10	80	81	81	23	24	1	33
49	0	0	2	11	77	78	78	19	23	4	33
50	0	0	2	11	81	75	78	10	17	7	24
51	1	1	1	11	76	77	77	11	20	9	37
52	1	1	2	10	76	78	77	20	21	1	36
53	1	1	2	12	82	84	83	14	23	9	35
54	1	1	2	11	88	89	89	19	25	6	35
55	1	1	1	11	83	85	84	15	25	10	36
56	1	1	2	10	81	80	81	15	28	13	37
57	1	1	2	12	79	89	82	15	30	15	37
58	1	1	2	12	81	79	80	14	33	19	37
59	1	1	2	10	84	85	85	15	29	14	34
60	1	1	2	11	80	80	80	23	34	11	34
61	1	1	1	11	79	80	80	13	29	16	38
62	1	1	2	13	79	80	80	11	24	13	30
63	1	1	2	11	84	86	85	21	30	9	32
64	1	1	2	11	90	92	91	18	32	14	37
65	1	1	0	10	81	83	82	13	30	17	33
66	1	1	2	11	79	80	80	17	29	12	34
67	1	1	2	11	80	80	80	18	30	12	34
68	1	1	0	11	85	86	86	21	29	8	35
69	1	1	2	11	80	79	80	14	26	12	32
70	1	1	1	11	80	81	81	19	30	11	33
71	1	1	2	11	81	85	83	15	30	15	33
72	1	1	2	11	80	81	81	20	28	8	33
73	1	1	0	12	76	77	77	14	32	18	32
74	1	0	1	11	90	92	91	23	29	6	32
75	1	0	2	11	77	78	78	15	19	4	37
76	1	0	1	12	78	80	79	15	19	4	34
77	1	0	2	10	83	80	82	19	28	9	35
78	1	0	0	11	79	78	79	9	16	7	36
79	1	0	0	11	83	84	84	13	25	12	33
80	1	0	1	11	81	81	81	14	28	14	34
81	1	0	0	12	75	76	76	15	29	14	36
82	1	0	2	11	80	80	80	20	30	10	28
83	1	0	1	10	77	77	77	15	29	14	36
84	1	0	2	10	78	79	79	10	28	18	33

85	1	0	1	11	83	84	84	13	31	18	37
86	1	0	2	11	81	81	81	15	33	18	38

87	1	0	2	10	75	75	75	16	32	16	37
88	1	0	0	10	83	84	84	14	31	17	33
89	1	0	0	10	78	79	79	13	27	14	36
90	1	0	2	10	80	83	82	18	29	11	37
91	1	0	2	11	78	81	80	13	29	16	33
92	1	0	2	11	82	81	82	19	28	9	33
93	1	0	2	11	88	88	88	22	31	9	35
94	1	0	1	11	82	80	81	14	31	17	35
95	1	0	2	10	78	79	79	15	29	14	33
96	1	0	2	11	85	86	86	19	31	12	26
97	1	0	2	10	83	85	84	17	20	3	35
98	1	0	2	11	78	79	79	12	27	15	32
99	1	0	2	11	80	80	80	16	29	13	35

APO	AC
38	6
38	4
38	5
35	0
35	1
36	1
36	2
34	2
35	2
39	5
38	4
30	4
32	4
37	4
36	3
36	1
34	1
35	3
37	3
36	-1
35	2
39	7
34	1
35	1
36	3
35	0
32	3
36	2
34	2
40	2
36	2
35	0
34	0
36	1
37	3
33	2
36	1
38	3
35	1
35	0
36	2

33	1

82

36	2
36	1
39	3
36	0
36	1
35	2
36	3
30	6
39	2
37	1
36	1
38	3
38	2
40	3
40	3
37	0
36	2
35	1
39	1
38	8
38	6
40	3
37	4
38	4
39	5
39	4
38	6
36	3
37	4
36	3
36	4
37	5
38	1
40	6
38	3
38	2
39	6
38	4
38	2
36	8
39	3
37	4

39	2
40	2

83

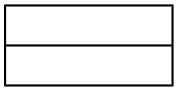
40	3
38	5
38	2
39	2
38	5
37	4
39	4
37	2
39	6
39	13
38	3
37	5
38	3

Appendix G

TABLE OF SPECIFICATIONS
ACHIEVEMENT TEST IN SCIENCE GRADE V
(3RD GRADING) S.Y. 2012-2013

Time Allotment	**Learning Competencies**	**Knowledge**	**Compre.**	**Applic**	**Analysis**	**Syn**
for Discussion						
	1. Describe what happens to solids				1	
	when mixed with other solids.					
	2. Describe what happens to liquids					
	when mixed with other liquids.				8	
1 hour	3. Describe what happens when	3	6			
	gas and liquids are mixed.					
30 min	4. Identify the types of mixtures as	7			4	
	homogenous or heterogeneous					
1.5 hours	5. Classify mixtures as to solution,	15,24			19	
	suspension or colloid.					
2 hours	6. Identify the nature of solutions.	17,18,23	5,40	12	11,20,22	16,39
		31,32			35-37,34	
1 hour	7.Describe the effect of temperature	38				
	when materials are mixed					
	8. Describe the effect of stirring	33				
	when materials are mixed					
1 hour	9. Identify ways of separating mixtures		2			
	10. Identify how certain mixtures can	10				
	be separated through: scooping and					
	use of vacuum truck					
	11. Identify how certain mixtures can			14,25		
	be separated through: decantation					
	12. Identify how certain mixtures can			26		
1 hour	be separated through: evaporation					
	13. Identify how certain mixtures can	30		27		
	be separated through: distillation					
	14. Identify how certain mixtures can					
1 hour	be separated through: crystallization			28		
	15. Identify how certain mixtures can	13		9		
	be separated through:use of magnets					
	16. Identify how certain mixtures can		21	29		
	be separated through:filtration					
TOTAL						
10 hours						

Eval	# of items	%
	2	**5%**
	1	**2%**
		11%
	17	**39%**
	2	**5%**
	1	**2%**
	1	**2%**
	1	
		5%
	2	
		5%
	2	
	2	**5%**
	1	**2%**
	2	**5%**
	2	**5%**
	40	100%



Appendix B

Result of Aciehevement Test in the Pilot Testing

Stud. No.	No. of Items																																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41
1	1	0	0	0	1	0	1	0	1	0	1	0	1	0	1	1	0	1	1	0	0	0	1	1	1	0	0	0	1	1	0	1	1	1	0	0	1	1	0	0	0
2	1	1	0	0	1	0	0	1	0	0	0	0	0	0	1	0	1	0	0	0	1	0	1	1	1	1	1	0	1	0	0	1	1	0	0	1	1	1	0	1	1
3	0	1	0	1	0	0	1	1	1	1	0	1	0	1	0	0	1	0	0	0	1	1	1	0	1	0	1	0	1	1	0	1	1	0	0	1	1	0	0	1	0
4	1	0	1	0	0	1	0	1	1	0	0	1	1	1	0	1	0	1	0	0	1	1	1	0	1	1	1	0	0	1	0	1	1	1	0	1	0	0	0	1	1
5	1	1	1	0	0	1	1	0	0	1	1	1	0	0	1	1	1	0	1	0	1	0	1	1	0	1	0	1	1	1	0	1	0	1	1	0	1	0	0	1	0
6	0	1	1	1	1	0	1	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	0	1	1	0	1	1	1	1	1	0	1	1	0	0	1	0	0	1	1
7	1	1	1	1	0	1	1	1	1	0	1	1	1	1	1	0	1	0	1	1	1	0	1	1	1	1	0	1	0	0	1	1	1	0	1	1	1	1	0	1	0
8	0	0	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	0	1	0	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	0	0	0	1	1
9	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	0	0	1	1	1	0	1	0	1	0	1	1	0	0	1	1	0	0	0	1
10	1	1	0	1	0	1	1	1	1	0	0	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	0	0	0	0
11	0	1	1	0	0	1	1	1	0	1	1	1	1	1	1	0	1	0	0	1	1	0	1	1	0	1	1	0	1	1	1	0	1	1	0	1	0	0	0	1	1
12	1	0	1	0	1	0	1	0	1	1	1	1	0	1	0	1	0	1	0	1	1	1	0	0	0	1	0	1	1	1	0	1	1	0	0	1	1	0	0	1	1
13	1	0	0	1	0	1	0	1	0	1	0	1	1	1	0	1	1	0	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0	1	1	1	1
14	1	1	0	0	0	0	1	0	1	0	1	1	1	1	1	1	1	0	1	1	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	0	0	0	1	1
15	0	1	1	1	0	1	1	1	1	0	1	0	1	1	1	1	1	0	1	1	1	0	0	1	0	1	1	1	1	1	0	1	1	1	1	0	1	1	1	0	1
16	1	0	0	1	1	1	1	0	1	1	0	1	1	1	1	1	0	1	1	1	0	0	1	1	1	0	1	1	1	1	0	1	1	1	0	0	1	0	0	1	1
17	0	1	0	1	0	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	1	1	0	0	1	1	1	0	1	0	1	1	0	0
18	0	0	0	1	0	1	1	1	1	1	1	1	0	1	0	1	1	0	1	1	1	1	0	0	1	1	1	0	1	1	1	1	0	1	0	0	0	0	1	1	1
19	1	1	1	0	1	1	1	0	1	1	1	0	0	1	1	1	0	0	1	1	0	1	0	0	0	0	1	1	1	1	0	0	1	1	0	1	1	0	0	1	1
20	1	0	1	1	0	1	1	0	1	0	1	0	0	1	1	1	1	0	0	1	1	1	1	1	1	1	0	0	1	0	0	0	0	1	0	1	0	0	0	1	1
21	0	1	0	1	1	1	1	1	1	1	0	0	1	1	0	0	1	0	1	1	1	1	0	1	1	1	1	0	0	1	1	1	1	0	1	1	1	1	1	1	1
22	1	0	1	1	0	1	1	1	0	1	1	1	0	0	1	1	1	1	0	1	0	1	1	0	1	1	1	1	1	1	0	1	1	1	0	0	1	0	1	1	0
23	0	1	0	1	0	1	0	1	1	1	1	1	1	0	1	1	0	1	1	1	1	0	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1
24	1	1	0	1	0	1	0	1	1	1	0	0	1	1	1	1	1	0	1	1	1	0	0	0	0	1	1	1	0	1	1	1	0	1	1	1	1	1	1	0	1
25	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1	1	0	0	0	1	0	1	1	1	0	0	0	1	1	0	1	1	0	1	1	1	0	1	1	1	1

26	1	0	1	1	1	1	0	1	1	0	0	0	1	1	1	0	1	0	0	0	0	0	0	0	0	1	1	0	0	1	1	0	0	0	1	0	0	1	1	0	1
27	0	1	1	1	1	1	0	1	0	1	1	1	0	1	1	1	1	0	1	1	1	1	0	1	1	0	1	0	1	1	1	1	1	1	1	1	1	0	0	1	1
28	1	1	0	1	0	0	1	1	1	1	1	1	0	0	1	1	1	0	1		1	1	0	0	0	1	1	1	0	1	1	1	0	1	1	1	0	0	1	1	1
29	0	0	0	0	1	1	0	0	1	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	1	0	1	1	1	0	0	0	1	1	0
30	1	1	1	0	0	1	0	1	1	1	1	0	0	1	1	1	1	0	0	0	1	1	0	0	0	1	0	1	1	0	0	1	1	0	0	1	1	0	1	1	1
31	0	0	0	1	1	0	0	1	0	1	1	1	1	1	1	1	1	0	1	1	1	0	0	1	1	0	1	1	1	0	1	1	0	1	1	0	1	1	1	0	1
32	1	0	1	0	1	1	1	0	0	1	1	1	0	1	1	1	0	0	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	0	0	1	1	0	0	1	1
33	1	1	1	0	0	1	1	1	1	0	0	1	1	1	1	0	0	0	1	0	1	1	1	1	1	1	0	1	1	1	0	1	1	1	1	0	1	0	1	1	1
34	1	1	1	0	0	1	0	1	0	1	1	1	0	1	1	0	1	1	1	1	1	0	1	1	0	1	1	0	1	1	1	0	1	1	1	0	1	1	1	0	1
35	0	0	1	1	0	1	1	0	1	1	1	0	1	1	1	1	0	0	1	1	0	1	1	0	1	0	1	1	1	1	1	1	0	1	1	1	1	1	0	1	1
36	1	1	0	1	0	1	1	1	0	0	1	1	0	1	0	1	1	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	0	1	1	1
37	0	1	1	0	1	1	0	1	1	0	1	1	1	1	1	0	1	0	1	1	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1
38	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	0	1	1	1	0	1	1	1	0	1	1	1	0	0	1	1	0
39	0	1	1	0	1	1	1	0	1	1	1	0	1	1	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	1	0	1	1	0	0
40	1	1	1	0	1	1	1	0	1	1	1	0	1	1	1	0	0	1	1	1	1	0	0	0	0	0	1	0	1	1	0	1	1	0	1	1	1	1	1	1	1
41	1	1	1	0	0	1	1	0	1	1	1	1	0	0	1	1	1	1	1	0	1	0	1	1	1	1	1	0	0	1	1	1	1	1	0	1	1	1	0	1	1
42	1	0	1	1	0	1	0	1	1	0	1	1	0	1	1		1	1	1	1	1	1	1	1	0	1	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0
43	1	1	1	0	1	1	1	0	1	1	1	0	0	1	1	1	1	0	1	1	1	0	0	1	0	1	1	1	1	1	0	0	1	1	0	1	1	0	0	1	0
44	0	0	1	0	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1	1	1	1	0	1	1	1	1	0	0	1	1	1	0	1	0	1	1	1	1	0	1
45	1	0	1	1	0	1	0	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1	0	0	1	0
46	1	0	1	0	1	1	0	1	1	0	1	1	0	1	0	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1	0	0	1	1	1	0	1	0	1	0	0
47	1	1	1	1	0	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	0	1	1	1	0	1	1	1	1	1	0	0	1	0	1	1	1
48	1	1	1	1	0	1	1	1	0	0	1	0	0	0	1	0	1	1	1	0	0	0	1	0	0	0	1	0	1	1	1	0	1	1	0	1	1	1	0	0	0

Legend:

1- correct answer

0- incorrect answer

42	43	44	45	46	47	48	49	50
1	0	1	1	1	0	1	1	1
1	1	1	1	1	1	1	1	1
1	0	1	0	1	0	1	0	0
1	1	1	1	1	1	1	1	1
1	0	1	1	1	1	1	1	1
1	1	1	0	0	0	1	1	1
1	0	0	1	1	1	0	0	1
1	1	0	1	1	1	1	1	1
1	0	1	0	0	1	1	1	1
1	0	0	1	1	1	0	1	1
1	1	0	1	0	1	1	1	1
1	1	0	1	0	1	1	1	1
0	1	0	0	0	1	1	1	1
1	1	0	1	0	1	1	1	1
1	1	0	1	1	1	1	1	1
1	1	0	0	1	0	1	0	1
0	0	1	1	1	1	1	1	1
1	1	0	1	1	1	1	1	1
1	1	0	1	0	1	0	1	0
1	1	0	1	1	1	1	1	1
0	1	0	1	0	1	1	1	1
1	0	0	1	0	1	1	1	1
1	1	1	1	0	1	0	0	0
0	1	1	0	1	1	1	1	1
1	1	1	1	1	1	1	1	1

0	0	0	0	1	1	0	0	1
1	1	1	1	1	1	1	1	1
1	1	1	1	0	1	1	1	1
0	1	1	1	1	1	1	1	1
1	1	0	0	0	1	0	0	1
0	0	0	1	1	1	1	0	1
1	1	0	1	0	1	0	0	0
1	0	0	1	1	1	1	0	0
0	0	1	1	1	1	1	1	1
1	0	1	1	0	1	1	1	0
1	1	1	1	0	1	1	1	1
1	0	0	1	0	1	1	1	1
1	1	1	1	0	1	1	0	0
0	1	1	1	1	0	1	1	0
1	1	1	1	1	1	1	1	1
1	1	1	0	1	0	1	1	0
1	1	0	1	0	0	1	1	1
1	1	0	1	0	1	1	1	1
0	1	0	1	0	0	0	1	0
1	1	0	0	1	1	0	1	1
0	0	0	1	0	1	1	0	0
1	1	1	0	1	1	1	0	0
0	1	0	1	1	0	0	1	0

Appendix K.5

Summary of Evaluator's Rating of the Instruments Used in the Study

A. Achievement Test

Criteria	Expert 1	Expert 2	Expert 3	Expert 4
I. Format	4.00	3.80	3.60	3.80
II. Language and Style	3.60	3.60	3.40	4.00
III. Content	3.25	3.50	3.25	3.87

B. POE Tasks

Criteria	Expert 1	Expert 2	Expert 3	Expert 4
I. Format	4.00	4.00	4.00	3.80
II. Language and Style	4.00	4.00	3.20	3.80
III. Content	3.00	3.83	3.83	3.00

C. Lesson Plan

Criteria	Expert 1	Expert 2	Expert 3	Expert 4
I. Overall Plan	2.80	4.00	4.00	4.00
II. Objectives	3.00	4.00	4.00	4.00
III. Lesson Introduction	2.50	4.00	4.00	4.00
IV.Lesson Presentation	2.66	4.00	4.00	3.66
V. Content	2.50	4.00	4.00	4.00
VI. Closure	3.50	4.00	4.00	4.00
VII. Assessment	3.00	3.50	3.50	4.00

D. Learning Science Attitude Inventory

Criteria	Expert 1	Expert 2	Expert 3	Expert 4
I. Format	4.00	3.60	3.80	3.60
II. Language and Style	3.60	4.00	3.40	3.80
III. Content	3.60	3.60	3.50	4.00

Mean
3.80
3.65
3.47

Mean
3.95
3.75
3.42

Mean
3.70
3.75
3.63
3.58
3.63
3.88
3.50

Mean
3.75
3.70
3.67

Evaluator's Rating of the *Achievement Test*

Domain	Mean	Remark
I. Format	3.80	Outstanding
II. Language and Style	3.65	Outstanding
III. Content	3.47	Outstanding
Composite	**3.64**	**Outstanding**

Evaluator's Rating of the *POE Tasks*

Domain	Mean	Remark
I. Format	3.95	Outstanding
II. Language and Style	3.75	Outstanding
III. Content	3.42	Outstanding
Composite	**3.71**	**Outstanding**

Evaluator's Rating of the *Lesson Plan*

Domain	Mean	Remark
I. Overall Plan	3.70	Outstanding
II. Objectives	3.75	Outstanding
III. Lesson Introduction	3.63	Outstanding
IV.Lesson Presentation	3.58	Outstanding
V. Content	3.63	Outstanding
VI. Closure	3.88	Outstanding
VII. Assessment	3.50	Outstanding
Composite	**3.67**	**Outstanding**

Evaluator's Rating of the Learning Science Attitude Inventory (LSAI)

Domain	Mean	Remark
I. Format	3.75	Outstanding
II. Language and Style	3.70	Outstanding
III. Content	3.67	Outstanding

Composite	**3.71**	**Outstanding**

Appendix M

Observation of Classes Result in the Experimental group (POE)

	Observers									
Area	**O1**	**O2**	**O3**	**O4**	**O5**	**O6**	**O7**	**O8**	**O9**	**Mean**
I. Classroom Management	4.75	5.00	5.00	5.00	5.00	4.75	5.00	5.00	5.00	4.94
II. Teaching-Learning Process	5.00	5.00	5.00	5.00	4.92	4.75	5.00	5.00	4.75	4.94
III. Student-Learning Process	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
IV. Learning Outcomes	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Mean	**4.94**	**5.00**	**5.00**	**5.00**	**4.98**	**4.875**	**5.00**	**5.00**	**4.938**	**4.97**

Table 9

Observation of Classes Result in the Control Group (non POE)

	Observers									
Area	**O1**	**O2**	**O3**	**O4**	**O5**	**O6**	**O7**	**O8**	**O9**	**Mean**
I. Classroom Management	5.00	4.75	5.00	5.00	5.00	4.75	5.00	5.00	4.75	4.92
II. Teaching-Learning Process	3.50	4.64	4.91	4.64	4.55	4.46	4.64	4.82	4.55	4.52
III. Student-Learning Process	3.00	3.50	4.00	3.50	3.00	4.00	4.00	4.00	3.00	3.56
IV. Learning Outcomes	4.00	4.00	3.00	4.00	4.00	4.00	4.00	4.00	3.00	3.78
Mean	**3.88**	**4.22**	**4.23**	**4.29**	**4.138**	**4.3**	**4.41**	**4.46**	**3.82**	**4.20**