THE EFFECTIVENESS OF USING MODEL-OBSERVE-REFLECT-EXPLAIN (MORE) THINKING FRAME TO IMPROVE THE PERFORMANCE IN HIGH SCHOOL CHEMISTRY

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Abstract **The main purpose of the study is to determine the Effectiveness of Model-Observe-Reflect-Explain (MORE) Thinking Frame on the performance of students in high school chemistry. Specifically, it seeks to answer the following questions: 1) What is the achievement of the students in Chemistry before and after they were taught selected topics using MORE Thinking Frame in the laboratory? 2) Is there a significant difference in the achievement of students in Chemistry before and after they were taught selected topics using MORE Thinking Frame in the laboratory? 3)What is the performance of the students in the laboratory when they are subjected to MORE Thinking Frame?4) Is there a difference in the model of the students before and after the use of MORE Thinking Frame? The study was conducted at the General Emilio Aguinaldo National High School in Palico IV, Imus City Cavite, during the second grading period of the school year . The samples of the study involved 55 third year students. The study tested for four weeks. This study utilized the single group pretest post test pre experimental design. Quantitative as well as qualitative data analyses were employed. The 40 item chemistry achievement test, chemistry activities with Model-Observe-Reflect-Explain Thinking Frame activity sheets, and perception survey questionnaires were used as instruments of the study.**

**   The result of the Diagnostic test was used as the basis for ranking the students to form formal groups. The t-test was used to determine the significant difference between the means of the students' pretest and post test scores in Chemistry. The results of the t-test at 0.05 level of significance revealed that there is a significant difference between the pre and post test scores in Chemistry using Model-Observe-Reflect-Explain Thinking Frame. The results revealed that the performance of the students in Chemistry before and after the utilization of Model-Observe-Reflect-Explain Thinking Frame differ significantly with a mean difference of 13.62. A significant difference was obtained showing that the mean score of the post test of 30.82 is significantly higher than the mean of the pretest of 17.20. After the exposure to Model-Observe-Reflect-Explain Thinking Frame, perception survey questionnaire was used to assess students' level of acceptance of MORE Thinking Frame. Based on the overall mean rating on the perception questionnaire the respondents favored the use of Model-Observe-Reflect-Explain Thinking Frame.**

Index Terms— **Model-Observe-Reflect-Explain (MORE), Effectiveness , Significant, Improvement.**

I. INTRODUCTION

The primary purpose of teaching is learning. The teachers are entrusted the responsibility of educating the students to become worthy members

of society where they belong. Teachers therefore should help learners acquire knowledge and points of view, which will equip them with generalized method of understanding themselves and changing the world in which they live.

Learning is what many science teachers expect to happen in their students. Science specifically the area of Chemistry is an interesting subject to learn but most of the students fear this subject because it is a combination of complicated procedures and principles.

Science teachers continually search for effective ways to help students understand more science concepts and principles. Chemistry lecture discusses the theories and principles involved in Chemistry whereas laboratory experiments focus on the application of these theories. When students can already understand the concept of the lesson, the number of lectures must be decreased to increase the use of activities that incorporate students' inquiry.

In a traditional chemistry class, majority of the time is spent on lectures and discussions of theories; this strategy allows the teacher to be in control throughout the lesson while the attentiveness of the students drops as the discussion proceeds. Experiments serve as supplements to the theories presented in the class.

When students conduct activities in the laboratory, they will learn to think since they perform guided activities. Students discuss their observations and they will think more. They will also learn to associate these observations from what they have learned during the lecture and results in their theories. Amidst the drastic changes in our society, the quality of science education in the country remained half baked. Science teachers should be concerned with the development of the skills and techniques for solving scientific problems. Students who are equipped with these skills learn how to think creatively and critically enabling them to make significant contributions in the society. Hence, there is really a need for teachers to maximize and improve teaching among students.

In response to the challenge of using effective method of teaching, the researcher thought of significance that can be created by adopting a contemporary teaching strategy which can be incorporated in the development in science education and can develop all the science skills needed by the students

However, students need guidance regarding how to think through the inquiry process but such scaffolding is often missing from secondary laboratory programs; that is why the researcher will try to infuse the use of model-observe-reflect-explain thinking frame in the activities to enrich the laboratory performance of the third year high school students. The Model-Observe-Reflect-Explain (MORE) Thinking Frame can provide the structure necessary for students to engage in high level inquiry. The MORE Thinking Frame prompts students to become aware of their personal ideas and compel students to analyze and revise those ideas in light of experimental evidence. Students enhance their understanding of chemistry ideas and of connections between macroscopic observations and the underlying molecular level behavior by refining models. (Harrison and Treagust 2000)

Since Predict-Observe-Explain is integrated on the traditional settings of teaching the laboratory aspects of Chemistry, hence in the Philippine Educational System, the incorporation of MORE thinking frame can encourage students to participate in the laboratory activities.

MORE thinking frame was considered to lead innovative investigations for students to enhance their capability using the higher thinking skills.

II. STATEMENT OF THE PROBLEM

This study aims to determine the effectiveness of using Model-Observe-Reflect-Explain (MORE) Thinking Frame to improve the Chemistry the performance of the third year students in General Emilio Aguinaldo National High School.

Specifically, the study attempted to answer the following questions:
1. Is there a difference in the achievement of students before and after they will be subjected MORE?
2. Is there a gain in scores of the students when they are presented with the MORE strategy?
3. What is the laboratory performance of the students in Chemistry using MORE Thinking Frame?
4. What is the students' perception of the use of MORE?

III. HYPOTHESIS

The following research hypotheses was tested at the 0.05 level of significance and stated in the null form:
1. There is no significant difference in the achievement of the students before and after they were subjected to MORE thinking frame.
2. There is no significant gain in scores of the third year high school students subjected to MORE thinking frame.

IV. SIGNIFICANCE OF THE STUDY

This study could be beneficial to administrators, teachers, students and future researchers. Findings of the study could encourage the following.

Administrators. After determining the achievement level of the third year students, administrators can plan lecture forums and seminars on how to conduct Model- Observe-Reflect-Explain Thinking Frame on different subject areas.

Teachers. This study enables them to determine the laboratory performance of the third year high school students dealing with the activities presented in the laboratory manual. This also encourages teacher to develop instructional materials patterned from the MORE thinking frame model. It will also lead them to become more resourceful and innovative in using instructional materials that would retain and arouse student's interest and enthusiasm towards the subject. It will also help them in preparing their lectures than starts with the students' viewpoint rather than the teacher.

Students. This study could serve as an improvement assessment in developing the higher-order thinking skills as related to the use of MORE thinking frame. They will be able to achieve maximum self development and will easily absorb fundamental concepts and understanding from their own personal efforts. It will also enhance their critical and analytical thinking skills which can be used on other situations in school and community.

Future researchers. The findings of the study encourage the other researchers to correlate the achievement rate of the students between the use of Predict-Observe-Explain (POE) strategy and the Model-Observe-Reflect-Explain Thinking Frame. This will also promote to adopt and conduct other related study about modern approach in teaching that will motivate students to study Chemistry as well as other subjects to help them improve their performance.

V. SCOPE AND LIMITATIONS OF THE STUDY

This study was conducted at General Emilio Aguinaldo National High School, in Palico IV, Imus Cavite during the second grading period of school year. One intact class from third year high school students were the respondents of this study.

The effectiveness of Model Observe Reflect Explain Thinking Frame on the performance of the students was its objective.

The topics included in the study were the lessons on the properties of gases based on the Kinetic Molecular Theory, Boyle's Law, Charles' Law, Gay Lussac's Law and Diffusion of Gases.

The pretest and posttest was administered to the students. Likewise, to determine the perceived learning of MORE, a perception survey questionnaire was given to all members of each group to assess the positive and negative perception from one intact class after the completion of the MORE strategy. The study includes the development, implementation and evaluation of the MORE thinking frame activity sheets on the topic of Gases.

VI. RESEARCH METHODOLOGY

This study used the pretest-post test single group pre-experimental design to determine the effectiveness of the MORE Thinking Frame in the achievement of the students in high school Chemistry.

Table 1. One- shot case study design

	Observation Pre-test	Treatment	Observation Post test
Study Group Pretest Post Test Pre-Experimental Design	O_1	X	O_2

Table 1 showed the difference between the treatment as X and observation O. X is represented as the experimental group from General Emilio Aguinaldo National High School using one intact

class in the Division of Cavite. This intact class was composed of the third year high school students taking up Chemistry subject.

O_1 is presented as observer and pertains to the pretest on the achievement test followed by the treatment X (Model Observe Reflect Explain Thinking Frame) which is the strategy of this study and lastly, O_2 pertains to the post test of the achievement test scores. The perception interview questionnaire was used in getting the perception of the students on the use of model-observe-reflect-explain thinking frame. The pretest-post test and the perception interview guide were constructed by the researcher and validated by some chemistry experts from General Emilio Aguinaldo National High School.

A. The Sample

The subjects used in this study came from the third year students from General Emilio Aguinaldo National High School during the second grading period of the school year 2012-2013. There were four sections handled by the researcher all in the morning. The researcher also considers the availability of the observer. Purposive sampling was utilized in the study because of the convenience in time for the students and for the researcher. A total of 55 students were enrolled in the particular section and are subjected to model observe reflect explain thinking frame. The respondents was consisted of a homogeneous class and considered as the first section in all the third year high school students in General Emilio Aguinaldo National High School. The scores of the students in the Diagnostic test were used by the researcher as the basis for their groupings. (Appendix N). The researcher grouped the students according to their scores and rank those from IA to 11K which was composed of five students per group see Appendix N. All the respondents answered the perception survey questionnaire assessing their positive and negative perceptions on model-observe-reflect-explain thinking frame. The interview was gathered in the form of perception survey questionnaire. The study was conducted for 5 days/ week for one month in fifty minutes per meeting. The scheduled of the activities was found in Appendix H.

VII. RESEARCH INSTRUMENT

The instruments used in this study were: 1) Chemistry Lesson Survey Form which was found in Appendix C 2) Teachers' Observation Guide (Appendix) which was adapted from the study of Ibanez (2011) 3) Scoring Rubrics which was adapted from http://s3.amazonaws.com/labday-resources/Enhancing_Science_Teaching__11.pdf, (Appendix) 4) Achievement Test, MORE Activity sheets and the Perception Survey Questionnaire which was constructed by the researcher and validated by chemistry experts from General Emilio Aguinaldo National High School.

B. Chemistry Lesson Survey Form

The chemistry teachers from the General Emilio Aguinaldo National High School (GEANHS) were used as the respondents of the study. They were asked to rank the topics listed according to the following scale 1-very easy 2-easy 3-average 4- difficult and 5- very difficult which was outlined from the study of Ibanez (2011) .There are ten units discussed in chemistry subjects based on the Philippine Secondary School Learning Competencies of the Department of Education (Appendix A)**.** The mean ratings of the topics were ranked from highest to lowest. The result of the survey showed that Solution and Gases ranked as the most difficult (see Appendix C). However,

the researcher chose the topics on gases for the conduct of study because the study focused on different experiments that could be used in the study.

C. Chemistry Achievement Test

A multiple choice test consisting fifty(50) items test was constructed by the researcher using the Table of Specification (TOS) for the content validity (see Appendix D). The researcher requested the chemistry experts from the General Emilio Aguinaldo national High School to analyze, criticize, and evaluate the content of the chemistry achievement test. The test items measured the application, comprehension, and knowledge based on the Table of Specification (TOS) Appendix D which was based on the Philippine Secondary School Learning Competencies of the Department of Education (Appendix A). After the content validation done by the expert, the researcher asked for their comment of the test. This was initially administered to three sections from the fourth year students who have already taken and passed their chemistry subject last year. The number of test items was reduced to forty (40) based on the item analysis after discarding the poor items and revising the fair items, based on the discrimination index of 0.2 and above on the difficulty index range from 0.11-0.90 was used to identify the good items of the test (see Appendix F). The final draft was administered again to second set of fourth year student in General Emilio Aguinaldo National High School before the actual conduct of the study. (see Appendix G) for the application of Kuder-Richardson Formula (KR-20) .

D. MORE Activities

The researcher developed three (3) experiments from the Philippine Secondary School Learning Competencies of the Department of Education (Appendix A) covering the topics of Boyles' Law, Charles Law, and Graham's Law of Diffusion (see Appendix J). The MORE activity sheets were incorporated in the lesson plan for every lesson (Appendix I). These activity sheets were also validated by some chemistry experts, their comments and suggestions were incorporated in this instrument. These learning activities are based on the criteria for conducting the MORE thinking frame.

E. MORE Rubrics

MORErubricswasadaptedfromhttp://s3.amazonaws.com/labdayresources/Enhancing_Science_Teaching__11.pdf .(Appendix L) is a guideline used in assessing the student's models. It was developed to make sure that students addressed every part of both initial and refined model. The rubric consisted of six steps where each step earned a maximum of five points and this was considered the highest point.

F. Perception Survey Questionnaires

This instrument was originally constructed by the researcher and was validated by chemistry experts. A 5-item statement was used by the researcher to be answered by all of the students from one intact class. The students rated each item in the perception survey questionnaire with 5(highly favorable) 4(favorable) 3 (fair) 2(unfavorable) 1(highly unfavorable). The respondents were asked to answer statements based on their level of acceptance to model-observe-reflect-explain thinking frame.

VIII. PRESENTATION, ANALYSIS AND INTERPRETATION OF DATA

Students' Performance in the Achievement Test

A pretest and post test were given to students and their gain in scores were compared and computed as shown in table 4.

Table 4. Pretest and Post test Scores

Variables	Mean	Standard Deviation
Pretest	17.20	3.97
Post test	30.82	4.23
Total	N=55	

It can be gleaned from the data in table 4 that the scores of the students differ with a mean difference of 13.62. The standard deviation is low which indicates that the data points tend to be very close to the mean. This means that the pretest and post test differ significantly since the post test is higher than the pretest as reflected in the culled mean value.

Achievement in Chemistry Before and After Subjected to Model-Observe-Reflect-Explain Thinking Frame

The table below shows the paired sample t-test in chemistry achievement test of the third year high school students on General Emilio Aguinaldo National High School.

Table 5. Paired Sample t-test in Chemistry Achievement Test

Variable Interpretation	Mean	Std. Dev	t-value	df	Sig. Value
Pretest Significant	17.20	3.97	-20.64	54	.000
Post test	30.82	4.23			

$\alpha = 0.05$ level of significance

Table 5 shows the summary of the results of the pretest and post test of the students' achievement when they are exposed to model-observe-reflect-explain thinking frame. It can be gleaned from the table that the post test result s increased from 17.20 to 30.82 with the corresponding standard deviation of 3.97 and 4.23 respectively. The paired sample t-statistics revealed that there is a significant difference between the pretest and post test results reflective of the t-value equal to -20.64 with the corresponding probability value of 0.000 which is less than the alpha 0.05. It can be surmised that the MORE thinking fame could hold a promise as an effective strategy in teaching chemistry concepts.

When Model-Observe-Reflect-Explain Thinking Frame was introduced to the students, there is a significant difference in their scores in achievement. Based on the result, the hypothesis that there is no significant difference on the achievement of the third year high school students before and after subjected to MORE was rejected.

Gain in Scores of the Students Subjected to Model-Observe-Reflect-Explain Thinking Frame

To describe whether the students improved in their performance when they are exposed to model-observe-reflect-explain thinking frame, the researcher used the Hake Factor by Richard Hake (1998) to distinguish whether there was significance in the results.

Table 6. Result Using Normalized gain Scores

Variables	Mean	Normalized gain
Pretest	17.20	0.16
Post test	30.82	

The result revealed that there is a significant difference between the pretest and post test based on the t-test statistics. This revealed that there is a gain in scores after subjected to MORE Thinking Frame. This result is supported by the students' quizzes and activities which they showed better scores during the conduct of the study. Thus, the hypothesis that there is no significant gain in scores of the third year high school students subjected to MORE thinking Frame could not be accepted.

IX. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This chapter presents the summary, conclusions, and recommendations of the study, specifically the study sought to answer the following questions:
1. Is there a difference in the achievement of students before and after they will be subjected MORE?
2. Is there a gain in scores of the students when they are presented with the MORE strategy?
3. What is the laboratory performance of the students in Chemistry using MORE Thinking Frame?
4. What is the students' perception of the use of MORE?

G. Summary

The study was conducted at General Emilio Aguinaldo National High School during the school year 2012-2013. One intact class with 55 respondents was used as the sample of the study. One Shot Case Study design was used in the study using purposive sampling method. There were four phases involved in the study and these are the following:
1. Implementation of the study which includes the administration of pretest in which the distribution of questions was based on the table of specification with content validation of chemistry experts and tried to one section of the fourth year students in General Emilio Aguinaldo National High School and had an item analysis for effectiveness and reliability of the test.
2. Conduct of the actual instruction of the strategy using Model-Observe-Reflect-Explain Thinking Frame.
3. Conduct of the post test. After the treatment, post test was administered to the respondents.
4. Conduct of Students' Perception Survey. The respondents' reactions, comments, perceptions, and ideas about the model-observe-reflect-explain thinking frame were determined using the students' perception questionnaire. The respondents were asked to answer the statement based on their level of acceptance.
5. Qualitative and quantitative analyses were used in the conduct of the study. Paired t-test at 0.05 level of significance was used to determine the results of the study. Descriptive approach was also used in determining the gain in score of the students subjected to model-observe-reflect-explain thinking frame using Hake Factor for normalized gain.

Based on the statistical analysis obtained, the findings of the study were the following:
1. The results revealed that the students had a low performance in the achievement before subjected to model-observe-reflect-explain thinking frame.

2. The results showed that there is a significant difference in the achievement in chemistry of the third year high school students before and after subjected to model-observe-reflect-explain thinking frame.

3. Using the Hake Factor (Normalized gain) the results revealed that the performance of the students in chemistry before and after the utilization of model-observe-reflect-explain thinking frame approach differ significantly with a mean difference of 13.62. A significantly difference was obtained showing the mean score of the post test of 30.82 is significantly higher than the mean score of pretest of 17.20.

4. Based on the overall mean rating on the perception survey questionnaire, the respondents favored the use of Model-Observe-Reflect-Explain Thinking Frame as a learning strategy in Chemistry.

CONCLUSION

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

- There is a significant difference on the achievement in Chemistry of the third year students before and after subjected to Model-Observe-Reflect-Explain Thinking Frame.
- There is a gain in score of the students subjected to Model-Observe-Reflect-Explain Thinking Frame.
- Students tend to favor teaching strategy that allows them to predict outcomes of experimentations using models, observe results, compare results and explain reasons for discrepancy. They also enjoy teaching-learning situation where they can work independently and apply the lessons in practical activities

RECOMMENDATIONS

Based on the findings of the study and the conclusions derived, the following were hereby recommended:

- Since the study used only one class in Chemistry, other class may try this strategy in their laboratory experiments
- The developed and evaluated MORE activities should be used as a learning module in teaching the lessons in Chemistry at GEANHS.
- Students in the laboratory classes should be given activities that give them unlimited time to work independently and participate actively, think and reason out, sequence the activities in orderly manner and apply theories in practice
- The use of Model-Observe-Reflect-Explain Thinking Frame (MORE) must be used in other topics in Chemistry
- In conducting MORE, classes should not more than 50 students because larger class may obstruct significantly and may reduce interactions between the group and teacher.
- Other investigations may be carried out in other science subjects using the MORE Thinking Frame to determine the applicability of this method in science education.

- The type of room utilized for MORE Thinking Frame plays an important role inestablishing an environment conducive to learning. A bigger size of room is highly recommended

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