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GUILD: AN AID IN IMPROVING THE GRADE 10 STUDENTS' PERFORMANNCE IN CALCULATING PROBLEMS IN VAPOR PRESSURE LOWERING

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ABSTRACT: This study aimed to look into the effectiveness of Guided Inquiry-based Learning Design in calculating problems in vapor pressure lowering to Grade 10 students. Using Quasi-Experimental research design, two groups were given a pretest on vapor pressure lowering. The experimental group of 18 students, was exposed to the guided inquiry-based learning design method; the control group of 17 students was exposed to the traditional way of teaching. The post test was administered after five (5) class sessions. Using Independent Samples t-test, the computed p-value is 0.026, which is lesser than the significance level, 0.05. Therefore, there is a significant difference on the post-test scores between the experimental and the control group. This is an indication that the performance of the students being exposed to Guided Inquiry-based Learning Design is better than the students under the traditional method.

Keywords: *Guided Inquiry-based Learning Design, Vapor Pressure Lowering*

I. INTRODUCTION

Education has an important role in creating a quality future generation for the country's future. Republic Act No. 9155 (RA No. 9155), otherwise known as the Governance of Basic Education Act of 2001, mandates the Department of Education (DepEd) to formulate national educational policies to improve the delivery of its services and achieve basic education outcomes. In line with this, DepEd implemented Republic Act No. 10533 (RA No. 10533) entitled "Enhanced Basic Education Act," also known as the K to 12 Program, which aims to equip Filipino learners with skills and competencies that address the demands of the 21st Century. The goal of this program is to give Filipino students enough time to master skills and concepts, to prepare them for tertiary education. Hence, it strongly encourages students to be active in the learning process for them to develop and understand concepts related to the subjects they are studying.

In 2018, Philippines joined the Programme for International Student Assessment (PISA) of the Organization for Economic Co-operation and Development (OECD), as part

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of the Quality Basic Education Reform Plan and a step towards globalizing the quality of Philippine basic education. Released on December 3, the 2018 PISA results revealed that the Philippines scored 357 in science which is below the average of participating OECD countries. (DepEd.gov.ph. PISA 2018 National Report).

With the PISA results also reflecting the learners' performance in the National Achievement Test, DepEd recognizes the urgency of addressing issues and gaps in attaining quality basic education in the Philippines. The department said it will take measures to attain quality basic education by launching Sulong *Edukalidad* as rallying call which involves (1) K to 12 review updating, (2)Improvement of learning facilities, (3) Teachers and school heads' upskilling and reskilling through a transformed professional development program and (4) Engagement of all stakeholders for support and collaboration. (DepEd.gov.ph. PISA 2018 National Report).

With the various changes that are happening in our world today, what are the challenges that we must respond as we meet the demands of time. One of the subjects included in the curriculum of Tuguegarao City Science High School is Advanced Chemistry. The teaching of Chemistry lessons among high school students is in no way simple and easy. "Chemistry is difficult" is the usual students' perception of understanding and learning the subject. This perception is primarily due to the nature of Chemistry; most of the topics are abstract and require understanding of molecular or sub microscopic concepts. Moreover, since learning or re-learning it requires computing mathematical computations, students find chemistry highly challenging. Vapor pressure lowering is a colligative property of solutions. Calculating problems on vapor pressure lowering is one of the competencies included in the course syllabus of Advanced Chemistry and one of the fundamental skills that is needed to be mastered by the students who are scientifically and mathematically inclined.

The results of the item analysis of the Third Periodic Test, school year 2018-2019 reveal that students have low mastery in calculating problems in vapor pressure lowering. Only 49.29% of the students got the correct answer in an item under the said competency. Another item only attained a percentage of 57.46% which means that the competency was also not mastered. Anchored on this premise, the teacher-researcher developed a Guided Inquiry-based Learning Design activities to help improve Grade 10 students' performance in calculating problems in Vapor Pressure Lowering, one of the colligative properties of solutions.

Statement of the Problem

This paper aimed to improve the performance of Grade 10 learners' in calculating problems in vapor pressure lowering through the Guided Inquiry-based Learning Design in teaching.

Specifically, it aimed to answer the following questions:

1. What is the pre-test mean and standard deviation scores of the control and experimental groups?
2. What is the post-test mean and standard deviation scores of the control and experimental groups?

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3. Is there a significant difference between the pre-test of the control and experimental groups?
4. Is there a significant increase in the pre-test and post-test of the control group?
5. Is there a significant increase in the pre-test and post-test of the experimental group?
6. Is there a significant difference between the post-test of the control and experimental groups?

Innovation, Intervention, and Strategy

An old adage states: "Tell me and I forget, show me and I remember, involve me and I understand." The last part of this statement is the essence of inquiry-based learning. Inquiry implies involvement that leads to understanding. Furthermore, involvement in learning implies possessing skills and attitudes that permit a learner to seek resolutions to questions and issues while constructing new knowledge. In terms of its effects, inquiry-based instruction can successfully help students to develop a deep comprehension of knowledge and scientific process skills which are vital to development of the students' literacy (Chabengula, Mumba, & Moore, 2008). It also encourages students' science literacy (Trna and Trnova, 2015).

In this study, the researcher developed activities and worksheets on colligative properties of solution, which is called the GUILD (**GU**ided **I**nquiry based **L**earning **D**esign). The worksheets created used the guided inquiry cycle, developed by David M. Hanson (Hanson,2005). Designing Process-Oriented Guided- Inquiry Activities consists of orientation, exploration, concept formation or concept invention, application, and conclusion.

Orientation

The orientation prepares students for learning. It provides motivation for the activity and creates interest, generates curiosity, and makes connections to prior knowledge. Learning objectives and criteria for success are identified.

Exploration

Each activity gives students a plan or set of tasks to follow that embody what is to learn and leads to meeting the learning objectives. In the exploration stage, students have the opportunity to make observations, design experiments, collect, examine, and analyze data or information, investigate relationships, and propose, question, and test hypotheses.

Concept Formation

As a result of the exploration, concepts are invented, introduced, or formed. Rather than presenting information as in texts or lectures, conceptual understanding is developed by engaging students in guided inquiry or discovery. This process is structured by supplying questions that compel students to think critically and analytically as they engage in the exploration. These questions, which are called guided-inquiry, critical-thinking, or key questions, guide the learner in the exploration.

Application

Once the concept is identified, it is reinforced and extended. Application involves using the new knowledge in exercises, problems, and even research situations. Exercises give the learner the opportunity to build confidence in simple situations and familiar context. True understanding and learning are exhibited in problems that require the learner to

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transfer the new knowledge to unfamiliar contexts, synthesis it with other knowledge, and use it in new and different ways to solve real-world problems. Research questions identify opportunities for the learner to extend learning by raising new issues, questions, or hypotheses.

Closure

Each activity ends with the students validating their results, reflecting on what they have learned, and assessing their performance. Validation can be obtained by reporting results to peers and the teacher to obtain their perspectives regarding the content and the quality.

Activity Template

The components in the Activity Template below contribute to high-quality guided inquiry based learning design activities.

Title	Label the activity
Learning Objectives	List what is to be learned
Success Criteria	Determine the desired outcomes and abilities that will be used to measure performance and achievement
Prerequisites	Identify the prior skills and knowledge to the activity
Resources	List essential references related to the activity.
Vocabulary	Provide key terminology
Information	Provide information needed for the activity. Additional information can be provided to help students consolidate their learning after they have completed the Key Questions.
Plan or Tasks	List plan and/or tasks for meeting the learning objectives.
Model	Include representations or methodologies of what is to be learned.
Key Questions	Pose questions that guide the execution of the plan and/or tasks, exploration of the model, and processing of the information and resources in order to stimulate thought, introduce or form of concepts, and construct understanding.
Skill Exercises	Apply the new knowledge in simple situations and familiar contexts.
Problems	Use the knowledge in new contexts or real-world contexts requiring transference, synthesis, and integration of concepts.
Research	Identify opportunities for the learner to extend the learning to new situations and create knowledge that is unique or new.
Validation	Results are shared with peers and assessed
Reflection on Learning	Have students think about what has been learned and assess how well the material has been mastered.

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Self- Assessment	Have students identify what has been done well, how they could improve, and strategies for improvement

II. METHODOLOGY

a. Participants and/ Sources of Data and Information

The researcher made use of the random sampling technique to identify the participants. A class consisting of 35 students was used as the participants of the study. It was randomly divided into two; the control group has 17 students while the experimental has 18.

Data were gathered through primary source where in scores from the pre-test and post-test of the participants were directly collected by the researcher.

b. Data Gathering Methods

After securing the necessary approval from the school authorities, School Research Committee, and parents/guardian, the research proposal was implemented.

Leading to the introduction of the intervention, data gathering period or the administration of pre- test on vapor pressure lowering was done. The outputs were checked, and scores were tabulated. The discussion on guided inquiry- based learning design as an intervention was given to the students.

The implementation of the intervention lasted for five (5) sessions/meetings. The post-test was administered after the five (5) sessions. After checking, the post-test scores were encoded and tabulated. The tabulation of the pre- and post-test of students were given to the SRC Statistician for analysis. The results of the statistical analysis were interpreted and discussed for the completion of the study.

c. Ethical Issues

The researcher observed protocol. Letter of intent to conduct the research was given to the proper school authorities. Letter of consent was also sent to parents of target participants of the study. Only those leaners who were allowed by their respective parents' or guardians were included in the study. Identities of the leaners were not revealed. Results and participants' responses were reported and presented as a whole to further protect their anonymity. Other ethical issues prescribed in the Research Management Guidelines under DepEd Order No. 16, s. 2017 were followed.

III. DISCUSSION OF FINDINGS

This study used the quasi-experimental research design. This research employed mean and standard deviation for the analysis of pre-test and post-test scores, paired sample t-test for the determination of the significant increase in the test scores of the

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control and experimental groups and independent sample t-test for the determination of the significant difference of the post-test scores of the control and experimental groups. The 5% Level of Significance was used as reference level in all analyses. Data were analyzed through the Statistical Package for Social Science (SPSS) Student Version.

Table 1. Mean and Standard Deviation of the Pre-test Scores of the Control Group and the Experimental Group

Groups	N	Mean	Standard Deviation
Control	17	6.22	2.08
Experimental	18	6.94	2.44

Table 1 shows that the mean pre-test score of the control group is 6.22 with a standard deviation of 2.08 while the pre-test mean score of the experimental group is 6.94 with a standard deviation of 2.44. While the mean score of the control group is lower than the mean score of the experimental group, students' individual scores in the control group are more clustered than the students' individual scores in the experimental group as evidenced by a lower standard deviation.

Table 2. Mean and Standard Deviation of the Post-test Scores of the Control Group and the Experimental Group

Groups	N	Mean	Standard Deviation
Control	17	12.59	1.28
Experimental	18	13.94	2.04

Table 2 shows that the post-test scores of the control group is 12.59 with a standard deviation of 1.28 while the post-test scores of the experimental group is 13.94 with a standard deviation of 2.04. While the mean score of the control group is lower than the mean score of the experimental group, students' individual scores in the control group are more clustered than the students' individual scores in the experimental group as evidenced by a lower standard deviation.

Table 3. Independent t-Test Results on the Significant Difference of the Pre-Test Scores of the Control Group and Experimental Group

Groups	N	df	t	p-value	Interpretation
Control	17	**33**	**-0.916**	**0.36**	**Not Significant**
Experimental	18				

As shown in the table, there is no significant difference between the pre- test scores of the control and experimental groups. This indicates that the two groups have the same

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prior knowledge of the topic.

Table 4. Dependent t-Test Results on the Significant Increase of the T-Test Scores of the Control Group

Groups	N	df	t	p-value	Interpretation
Pre-Test Contro	17	**16**	**-0.914**	**0.00**	**Significant**
Post-Test Control	17				

From the table, it could be seen that there is a marked increase in the pre-test and post-test scores of the students under the control group. This ascertains that traditional method of teaching (lecture method) is effective in improving performance in calculating problems in vapor pressure lowering.

Table 5. Dependent t-Test Results on the Significant Increase of the T-Test Scores of the Experimental Group

Groups	N	df	t	p-value	Interpretation
Pre-Test Experimental	18	**17**	**-13.54**	**0.00**	**Significant**
Post-Test Experimental	18				

From the table, it could be seen that there is a marked increase in the pre-test and post-test scores of the students under the experimental group. This ascertains that the guided inquiry-based learning design in teaching is also effective in improving performance in calculating problems in vapor pressure lowering.

Table 6. Independent t-Test Results on the Significant Difference of the Post-Test Scores of the Control Group and Experimental Group

Groups	N	df	t	p-value	Interpretation
Control	17	**33**	**2.34**	**0.026**	**Significant**
Experimental	18				

While it is true that both methods of instruction are effective in improving performance in calculating problems in vapor pressure lowering, the guided inquiry-based learning design in teaching is deemed a better method of instruction as evidenced by significantly higher mean score of students under the experimental group than the mean score of students under the control group.

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