



1-PACK with ESI: One-Page Assessment in Chemistry Knowledge with Environmental Science Integration

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Abstract: *A one-page activity sheet was designed by the researcher to serve as an assessment tool after MELC 7 in science 9 was discussed in the class. Topics on percentage composition, empirical and molecular formula were included and were intended to be taught in two days before giving the assessment. These topics were mathematical in nature and required more time and drill as Filipino students scored significantly lower than the average points in mathematics (PISA 2022). This was also made to address the problems with time to cover all the competency required by the curriculum while making the students aware of the environmental problems to inculcate love for nature. Finally, 1-PACK with ESI was intended to encourage students to read and work independently, an act that could eventually turn into a habit of learning through reading and comprehension before evaluating mathematical problems with science concepts.*

Keywords: *1-PACK with ESI, assessment, integration, PISA*

I. INTRODUCTION

In the learning poverty indicator provided by the UNESCO Institute of Statistics and World Bank lunched in 2019 stated that 25% of pupils in the world are not proficient in reading. This problem worsens and becomes more of the global concern due to COVID 19, where in students in most countries underwent great learning losses due to distance learning and taking different learning modalities. Reading and comprehension are basic skills that will lead learners to a greater chance to grasp skills and understanding. When learners struggle with reading, it suggests that the system is lacking effective organization to support comprehensive learning in subjects like mathematics, science, and humanities (TWB, 2021), this fact was supported by the result released by the Organization for Economic Cooperation and Development (OECD) for the Program for International Student Assessment (PISA) 2022 wherein the Philippines mean-performance estimated 347 in reading, 355 in math, and 356 in science. This is compared to the mean scores, 476 for reading, 472 for mathematics and 485 for science among the countries participated in 2022 PISA; placing the country ranked 77th out of 81 countries.

The Department of Education (DepEd) implemented several programs like National Learning Camp to address learning losses due to pandemic and to improve the quality of education. This is in support to the call of urgent actions to heal the marks of the pandemic and to promote progress in education to meet the aspirations of SDG 4. Thus, to ensure an inclusive and fair provision of high-quality education and to foster opportunities for lifelong learning for everyone, various learning recovery initiatives were made sure to be part of every school's Strategic Improvement Plan (SIP) adhering to the call of President Ferdinand Marcos Jr. in his first State of the Nation Address 2022.

One of the programs included in Quezon City Science High School's SIP aims to increase the Mean Percentage Score (MPS) in national and standardized assessments such as the National Achievement Test (NAT) contributing to increase the PISA results. With this, the researcher used 1-PACK with ESI: A one page assessment in chemistry knowledge with environmental science integration. This is a simplified activity sheet designed by the researcher to help the students understand and learn concepts in chemistry with problems and concepts on environmental science. This was made to address the problems with time to cover all the competency required by the curriculum while making the students aware of the environmental problems to inculcate love for nature. This will also encourage students to read and work independently, an act that may eventually turn into habit of learning through reading and comprehension.

ACTION RESEACH QUESTIONS

1-PACK with ESI aims to provide assessment to grade 9 students that will help them improve reading and comprehension before evaluating mathematical formulas while appreciating the environment. It specifically aims to:

- measure the effectiveness of 1-PACK with ESI compared to traditional assessment tools.
- provide instructional material that will suit 21st century learners.
- create a framework about the learner's experiences in using 1-PACK with ESI.

II. INNOVATION/ INTERVENTION/ STRATEGY

Grade 9 Science for the second quarter has nine most essential learning competencies (MELCs) and is intended to be taught in 32 days. But in public high school setting, holidays, suspension of classes, school activities not to mention the re-teaching and giving of more examples or drill to make the students comprehend with the lesson failed to achieve the target competencies with the given time.

1-PACK with ESI was inspired from the One-pagers developed by Advancement Via Individual Determination (AVID), this allows the learners to make creative responses from their learning experience. It makes the learners respond imaginatively while making connections between words and images. One-pager was found effective with concepts taken from history textbook, a novel, a poem, a podcast, a Ted Talk, a guest speaker, and a film as they made highlights with single piece of paper.

A one-page activity sheet was designed by the researcher then validated and checked by a Chemistry major teacher; it is intended to serve as an assessment tool after MELC 7 was discussed in the class. Topics on percentage composition, empirical and molecular formula are included and is intended to be taught in four days. These topics are mathematical in nature that would require more time and drill as Filipino students scored significantly lower than the average points in mathematics (PISA 2022).

The researcher thought of using 1-PACK with ESI to make learning in Chemistry, in hydrocarbons to be specific, be more memorable to students since they can mix images or figures with information, as the students learn best when they did things by themselves.

III. ACTION RESEARCH METHODS

For a more effective utilization of the 1-PACK with ESI;

A. Participants

The tool was purposively given to three (3) sections in the 9th grade in one of the schools in Quezon City to assess their understanding in the concepts of percentage composition, empirical and molecular formula in independent manner. To ensure the adherence to Republic Act No. 10173, otherwise known as the Data Privacy Act the researcher asked for the parents' and students' consent as they agreed to be part of the study while their identities and name to kept confidential. The groupings of students in the said school was heterogenous in nature, regardless of grades, gender, or individuality, thus the researcher chose the three sections to be the respondents.

B. Data Gathering Methods

Experimental research design was utilized in this study. The teacher taught the concept in the class, gave them the theories and examples about percentage composition, empirical formula, and molecular formula before the teacher gave the assessment. During the assessment, a class was divided into two; first half utilized the validated 1-PACK with ESI and the other half utilized a traditional assessment tool with the same content.

The teacher recorded the time of the students finish the task and compared the scores of the two groups. The results were compared using statistical method of central tendencies while the other factors and feedback was measured using a questionnaire to be answered by the students after using a validated tool.

To ensure the validity and reliability, tools were subjected for checking and validation of experts and knowledgeable others in the field.

C. Conceptual Frameworks

Assessment and evaluation are two important parts of the teaching and learning process. Often these terms were used interchangeably, but assessment emphasizes primarily on determining learning progress and achievement, while evaluation emphasizes on making judgments and decisions based on gathered data. Assessment is formative in nature to provide feedback, while evaluation is collective to provide an overall judgment. Finally, assessment is used to recognise strengths and weaknesses, whereas evaluation is used to determine the efficiency and effectiveness of materials or interventions.

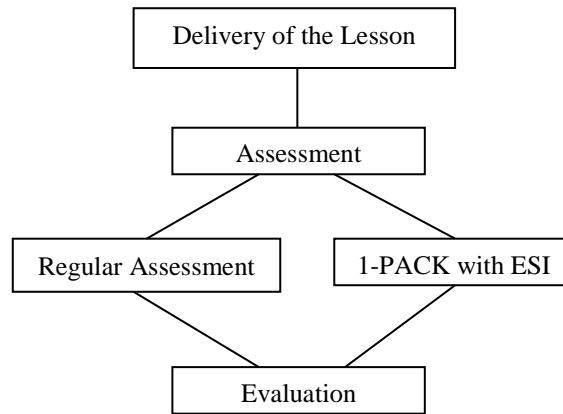


Fig. 1: Conceptual Framework

D. Research Design

The researcher utilized an experimental research design, this is a systematic approach used to investigate cause-and-effect relationships between group of students utilized the 1-PACK with ESI compared to the group of students performing a traditional method of assessment. The researcher aims to measure the impact of using 1-page assessment to students after the discussions of the subject matter.

E. Procedure

The study started with the preparation and validation of the tool, particularly integrating Environmental Science into Chemistry topics for grade 9 level. The teacher discussed the lesson in class, specifically to three selected sections available and agreed to be part of the research. After the discussion, the teacher divided the class into two before giving the assessment. The impact of 1-PACK with ESI (Set A) was measured after it was employed in one half (15-17 students of the selected classes while the other half will answer an assessment in two pages (Set B) after the teacher’s class discussion. The content, font style and font size of the prepared assessment was set the same except in the number of pages received by the students. Time finished, scores and the student’s impression of the activity was collected.

F. Results

After the utilization of 1-PACK with ESI to 3 sections of grade 9 students in the school, the following data were gathered.

Table 1: Comparison of Time for Set A and B

Time finished the assessment		
9 - X	Set A	Set B
First student	41 min 20 sec	50 min 32 sec
Last student	55 min 12 sec	60 minutes

Time finished the assessment		
9 - Y	Set A	Set B
First student	52 min 08 sec	42 min 15 sec
Last student	60 min	60 minutes

Time finished the assessment		
9 - Z	Set A	Set B
First student	39 min 15 sec	49min 35 sec
Last student	53 min	55 minutes 19 sec

The researcher recorded the time students finished answering the assessments. Table 1 on the left showed that students in grade 9 – X and grade took who took the 1-PACK with ESI assessment (Set A) finished faster than those students took the two pages assessment (Set B) of the same competency. While students took the two pages assessment finished faster from the group in grade 9-Y.

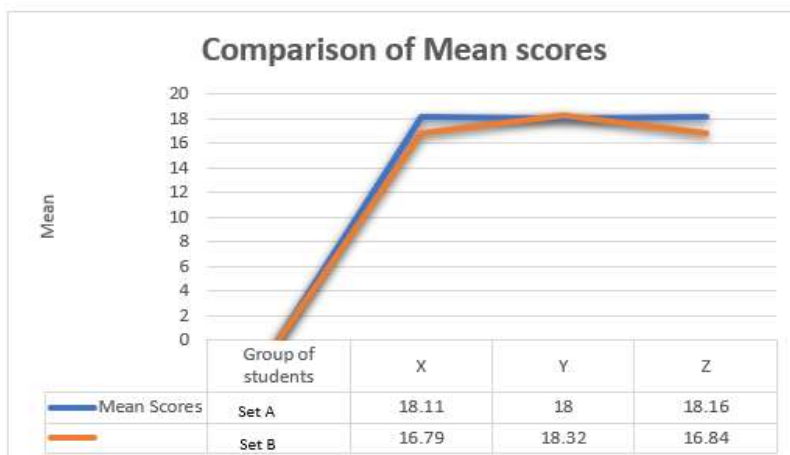


Figure 1: Comparison of Mean Score for Set A and B

Assessment results from the group of students were also compared, figure on the right showed higher mean was calculated from the group of students took 1-PACK with ESI (Set A) than the other group of students in 9-X and 9-Z, while a 0.32 mean difference was observed in 9-Y favoured to two-pages assessment (Set B).

With the open-ended questions included in the questionnaire, responses of the students were summarized into two ideas.

1. *How do you want your exams/ activities to be prepared, in one page or in more than two pages? Explain your answer.*
 - A. It depends, usually our periodical test is prepared with two or more pages. Now, I don't prefer answering two pages especially if there is a lot of reading involved.
 - B. I would like it if it was only one page, because if there are two or more pages a lot of topics will be covered, and it is hard to study at nighttime and in school.
 - C. One page because it's simple and I personally would enjoy answering it because yeah, one page. Two or more pages is kinda overwhelming.
 - D. One-page activities. I understand better when the instruction is simplified or when the questions are short and straight to the point.
 - E. Personally, I want my test or activities to only consist of one page as two or more pages makes me nervous or overwhelmed and it makes my mind see it as a short and easy activity.

Some of the students prefer two or more pages dependent on the type of assessment or activity. Periodical test and DEAR (Drop Everything And Read) activities were expected to be in two or more pages, but activities and assessments more than one page appeared to be overwhelming.

In question number 2, the majority found the inclusions of figures and illustrations to be helpful and beneficial while other types of learners found it to be confusing.

2. Does it help you understand more concepts if you draw your own figure/ illustrations in an activity? Why or why not?
 - A. No, I don't think that will help. I'm not exactly artistic, it would just confuse me.
 - B. Yes, it helps me, because I understand them much more if it is illustrated than full words or just text.
 - C. I guess, kinda. I'm not a guy who likes drawing figures or illustrations, concept maps are okay for me.
 - D. Yes, figures help me visualize the lesson and let me understand easily.
 - E. For me, yes since I am a visual learner and makes me understand concepts easier.

CONCLUSION

This study confirms that a one-page assessment tool is preferred and more understood by the learners in today's generation. One page assessment in chemistry knowledge with environmental integration (1-PACK with ESI) was accomplished faster and gained higher mean scores in two out of three groups of students that served as respondents in the study.

Gen Z (mid-to-late 1990 to 2010) learners and Alpha Gen (2010-2024) prefer visual contents, reading short text is more applicable while long manuscript will be found boring. Using short and simple text in an activity made them interested and this will eventually be helpful in achieving the educational goal. From short and simple text, the teacher may increase its complexity and may add text little by little until eventually, learners will used to reading and working with reading activities.

While illustrations and graphics helped some of the students, others saw it as distractions and added to their confusions. Future researchers may include the types of graphics and illustrations to be included in the activity that will suit different types of learners. One page assessment tool is not only beneficial for students, but future researcher may also include its benefits to the teachers in relation to their workload.

ACKNOWLEDGMENT

The researchers would like to extend appreciation and gratitude to all the people involved in the process and completion of this study. Mr. Joshua Soriano, TUP Professor for his encouragement and drive to made us finish action research. To the validators, school principal, grade level coordinators and to all grade 9 students that served as respondents.

To my family and to Our God Almighty for the strength and wisdom. Mabuhay!

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Appendix 1: Questionnaire after using 1-PACK with ESI

Good dzy!

In line with the action research entitled, 1-PACK with ESI: One-Page Assessment in Chemistry Knowledge with Environmental Science Integration conducted as partial requirement in Environmental Science, the researcher is asking for your help as respondents to the said study which the result is believed to contribute to a more comprehensive and effective way of preparing activity sheet for junior high school students.

Your answer and identity will be treated with utmost confidentiality as the researcher abide with the Republic Act 10173 also known as Data Privacy Act of 2012.

Thank you

Name (optional): _____

Grade & Sec.: _____

A. On a scale of 1-5 (1 – not interested at all, 2 – slightly interested, 3 – moderately interested, 4 – very interested and 5- extremely interested), rate yourself when are asked.


- | | 1 | 2 | 3 | 4 | 5 |
|--------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| 1. To answer a one (1) page activity sheet in science. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. To do a task/ activity in science that required reading. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. To read simplified text in an activity sheet in science. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. To answer activities in science with graphics and figures. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 5. To do tasks on a 2 or more pages activity sheet in science. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 6. To do an activity that requires you to read two or mor pages texts in science. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 7. To include graphs to better understand science topics with mathematical concepts. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

B. Please answer the following questions.

3. How do you want your exams/ activities to be prepared, in one page or in more than two pages? Explain your answer.

4. Does it help you understand more concepts if you draw your own figure/ illustrations in an activity? Why or why not?

Set B



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Class number: _____
Name: _____ **Date:** _____
Grade & Sec.: _____ **Teacher:** _____

Directions: Solve what is being asked. Show your solution and box your final answer.

According to the World Health Organization (2023), air pollution is responsible for 6.7 million premature deaths every year. Pollutants including particulate matter or PM, carbon monoxide or CO, ozone or O₃, nitrogen dioxide or NO₂, and sulfur dioxide or SO₂ showed great effects on public health.

A. Molar Mass

$$\sum (\text{No. of atoms} \times \text{atomic mass})$$

1. Calculate the molar mass of Carbon monoxide. (Given the atomic mass; C = 12 g/mol, O =16 g/mol).

2. Calculate the molar mass of ozone. (Given the atomic mass; O =16 g/mol)


3. Calculate the molar mass of Nitrogen dioxide. (Given the atomic mass; N = 14 g/mol, O =16 g/mol)

4. Calculate the molar mass of Sulfur dioxide. (Given the atomic mass; S = 32 g/mol, O =16 g/mol)

B. Percentage Composition


$$\% \text{ of element} = \frac{\text{mass of element}}{\text{molar mass of compound}} \times 100$$

1. Calculate the percentage composition of the elements in Carbon monoxide then draw a pie graph to represent the distribution of the elements.



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MELALAIN B. AUSTRIA | 2nd Quarter



1 – PACK with ESI **Set A**

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QUEZON CITY SCIENCE HIGH SCHOOL
Golden Acres Road, Cor Misamis St., Bago-Bantay, Quezon City

Class number: _____
Name: _____ **Date:** _____
Grade & Sec.: _____ **Teacher:** _____

Directions: Solve what is being asked. Show your solution and box your final answer. Draw a graph or other representations of the elements and compound you solve.

According to the World Health Organization (2023), air pollution is responsible for 6.7 million premature deaths every year. Pollutants including particulate matter or PM, carbon monoxide or CO, ozone or O₃, nitrogen dioxide or NO₂, and sulfur dioxide or SO₂, showed great effects on public health.

A. Calculate the molar mass of the following. (Given the atomic mass; C = 12 g/mol, O = 16 g/mol, N = 14 g/mol, S = 32 g/mol).

$$\Sigma (\text{No. of atoms} \times \text{atomic mass})$$

1. Carbon monoxide
2. Ozone
3. Nitrogen dioxide
4. Sulfur dioxide

B. Calculate the percentage composition of the elements in the following compounds then draw a pie graph to represent the distribution of the elements.


$$\% \text{ of element} = \frac{\text{mass of element}}{\text{molar mass of compound}} \times 100$$

1. Carbon monoxide
2. Nitrogen dioxide
3. Sulfur dioxide

C. *A 13.8-gram compound contains nitrogen and oxygen. It produced 4.2 g of nitrogen upon decomposition. What is the empirical formula and molecular formula of the compound if the molar mass is 90.3 g/mol?*

1. Empirical formula

2. Molecular formula



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Set B

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2. Calculate the percentage composition of the elements in Nitrogen dioxide then draw a pie graph to represent the distribution of the elements.

3. Calculate the percentage composition of the elements in Sulfur dioxide then draw a pie graph to represent the distribution of the elements.

C. A 13.8-gram compound contains nitrogen and oxygen. It produced 4.2 g of nitrogen upon decomposition. What is the empirical formula and molecular formula of the compound if the molar mass is 90.3 g/mol?

1. Empirical formula



2. Molecular formula



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Appendix 4: Validation form from a Chemistry Expert

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VALIDATOR'S PROFILE

Name : [REDACTED]
Current Station : TECHNOLOGICAL UNIVERSITY OF THE PHILIPPINES
Designation : ASSOCIATE PROFESSOR V
Years of Teaching Experience : 14

Educational Background

Doctor's Degree : DOCTOR OF PHILOSOPHY IN SCIENCE EDUCATION MAJOR IN CHEMISTRY
School : DE LA SALLE UNIVERSITY - MANILA
Year Graduated : 2016

Master's Degree : MASTER OF ARTS IN SCIENCE EDUCATION MAJOR IN CHEMISTRY
School : PHILIPPINE NORMAL UNIVERSITY - MANILA
Year Graduated : 2012

Bachelor's Degree : BSE MAJOR IN CHEMISTRY
School : PHILIPPINE NORMAL UNIVERSITY - MANILA
Year Graduated : 2008

Research Title: 1-PACK with ESI: One Page-Assessment in Chemistry Knowledge with Environmental Science Integration.

Research Objectives:

1-PACK with ESI aims to provide a hands-on assessment to grade 9 students that will help them improve reading and comprehension before evaluating mathematical formulas while appreciating the environment. It specifically aims to:

- measure the effectiveness of 1-PACK with ESI compared to traditional assessment tools.
- improve students' reading and mathematical skills using science concepts.
- provide instructional material that will suit 21st century learners.
- create a framework about the learner's experiences in using 1-PACK with ESI.



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To the Evaluator: Please check the appropriate box for your ratings:
 1 - Poor 2 - Fair 3 - Good 4 - Very Good 5 - Excellent

Category	5	4	3	2	1
Clarity of directions and items The vocabulary, language structure and concepts suit the level of participants, and the items are written in clear and understandable manner	/				
Presentation and Organization of items The items are presented and organized in logical manner.	/				
Suitability of items The items are appropriate, and they represent the substance of research. The statements are designed to determine the conditions, knowledge, perceptions and/or the attitudes that are supposed to be measured		/			
Adequateness of items per category The items represent the coverage of the research adequately. The number of statements per area is representative enough for the questions needed for the research	/				
Attainment of Purpose The instrument fulfills the objectives for which it is constructed.		/			
Objectivity No aspect of the questionnaire suggest bias on the part of the researcher (s)	/				
Scale and Evaluation Rating Scale The scale adopted is appropriate for items					

Remarks/Recommendations: Add more (2-3 sentences) about the impact of pollutants mentioned, the give questions to measure the reading and comprehension of the students. (Note that 1 of the objectives is to improve these two aspects).

Jandiel

Signature over Printed Name of Evaluator