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Development and Validation of Prototype 5E's Lesson Plans in Research I

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***Abstract*—** The study aimed to develop and validate prototype 5E's lesson plans for Research I in Grade 7 STE (Science, Technology, and Engineering) students at Bulan National High School, Sorsogon Province, for the academic year 2023-2024. The research employed a pre-experimental, single-group pretest-posttest design and a developmental research methodology.

The developed lesson plans covered various topics, including conducting guided experiments, gathering qualitative and quantitative data, organizing data into tables and graphs, and analyzing and interpreting data. These lesson plans were aligned with the K to 12 Grade 7 STE Learning Competencies.

The study utilized pre-post tests, evaluator's evaluation tools for print resources, and attitude tests to gather data. Statistical tools such as mean scores, t-tests for dependent samples, and frequency counts were employed to analyze the data.

The results showed that the developed 5E's lesson plans were rated as "very satisfactory" in terms of content, format, presentation, organization, and accuracy by the evaluators. The lesson plans effectively improved students' academic performance in Research I, as evidenced by the higher post-test mean score compared to the pre-test score. Additionally, the majority of students developed positive attitudes towards research after implementing the lesson plans.

The study concluded that the developed 5E's lesson plans were valid and recommended for adoption in teaching Research I in STE schools. It was recommended that teachers handling Research I or other grade levels in STE schools develop similar inquiry-based 5E's lesson plans for other topics, adopt and improve the developed lesson plans, and further validate them using true experimental designs. The study also encouraged the development of instructional materials to support positive attitudes towards the learning area and research on developing and validating instructional materials for the STE curriculum.

***Keywords*—** 5E Learning Cycle, Prototype Lesson Plan, Research

INTRODUCTION

"Failing to plan is planning to fail" is an aphorism that reminds every teacher in the classroom regarding the crucial role of lesson planning. Having no lesson plan in the classroom may increase the student's tendency to become a passive learner. Truly, lesson planning is at the heart of the teaching and learning process since it affects instruction delivery and the quality of learning.

Effective lesson plans strongly rely on previous information gathered through different forms of assessment and provide inclusive opportunities for all students. Effective curriculum plans are characterized by coherence, flexibility, integration of knowledge etc. (Lika, 2017). Lesson plans are also designed based on curriculum. Initiated in 2013, the K to 12 Program Curriculum aimed to extend basic education, enhance critical skills and align the Philippines with international standards (Descartin, 2023). It introduces programs and projects that aim to expand and improve the delivery of basic education in the country. It aims to make the basic education system in the Philippines at par with international standards by ensuring that it is appropriate, responsive and relevant to the learners (DepEd Order No. 21 s. 2019).

Research subject is introduced to students as early as Junior High School in the STE Program. For grades 7 and 8, research is part of the Science curriculum where it is more focused on conducting science investigatory projects. (Arrieta and Marasigan, 2021). It offers students a concrete demonstration of the principles and concepts covered in textbooks and lab sections. Various intervention and strategies, formal and informal, have been tried to inculcate research culture among future citizens (Meeran & Arsad, 2010). Having research as a

subject is just the initial step in taking the course towards becoming a research-oriented learner. However, a recent study reported that learners considered Research subject as a difficult subject that makes them less interested. Research theories and concepts appropriate for Junior High School must be identified for curriculum revision. Teachers believed that they need to enhance their knowledge and skills and gain more experience to become creative and confident research teachers (Arrieta and Marasigan, 2021). As prescribed by Republic Act no 10533, Department of Education shall adhere to a curriculum that use pedagogical approaches that are constructivist, inquiry-based, reflective, collaborative, differentiated and integrative (RA 10533). Inquiry based learning puts a premium on questioning, investigating, proving, probing, explaining, predicting and establishing connection of evidence. The learners of the 21st century are poised to join a workforce that requires them to ask questions, problem-solve and think critically, pursue investigation and share and apply their findings through multisensory lenses. In order to provide the learners of today with the tools to participate fully in this challenging workforce, the understandings of teaching methodology in the classroom must be altered (Puja, 2024).

It is an aspiration for educators to improve student's engagement in the classroom and facilitate the role of teachers with more effective instructional strategies. An old adage states: "Tell me and I forget, show me and I remember, involve me and I understand" (Huber and Moore, 2001). This signifies the value of engaging the learner in a task as a more meaningful way to learn. One such teaching approach is learning through inquiry in which knowledge is found in the manipulation of ideas rather than the transmission of facts. Inquiry implies involvement that leads to understanding. Furthermore, involvement in learning implies possessing skills and attitudes that permit to seek resolutions to questions and issues while constructing new knowledge.

Anchored on this observation, the researcher aims to integrate inquiry-based learning through the use of 5E learning model in lesson planning in research. In addition, the researcher hopes to contribute to the improvement of research instructions in Bulan National High School and aims to the development of prototype 5E's lesson plans in Grade 7 Research which may serve as instructional materials to improve learning and encourage students in engaging in research. Furthermore, the researcher believed that the use of 5E learning cycle in the school environment gives impact on students' content knowledge and understanding, skills, especially on behavior and attitudes towards research subject. The researcher believed that this study would help the students meet the skills needed by STE learners in preparing them to become holistically developed Filipinos with 21st century skills.

METHODOLOGY

Research Design

This study aimed to develop and validate prototype 5E's lesson plans in Research I for grade 7 STE students in Bulan National High School, Division of Sorsogon Province, for the school year 2023-2024. The study employed pre-experimental, single-group pretest-posttest design. This study is also developmental research since it developed Research 5E's Lesson Plans. Moreover, the study utilized the ADDIE model in the development and evaluation of the 5E's lesson plans. The teacher-made test, evaluators' assessment tool & validation sheet and attitude test were used as instruments to gather the necessary data. Statistical tools such as mean for the mean score and t-test for dependent sample for the pre-test and post-test results and frequency count were used in the study. These statistical measures were utilized to determine the improvement in the performance level and how significant the improve is after the implementation of the 5E's Lesson Plans in Research 1.

The respondents of this study were the Grade 7 Special Science Class Section A, STE learners, who are officially enrolled at Bulan National High School (BNHS), during the school year 2023-2024. Thirty (30) students from the section were selected through randomization. Research evaluators were selected from the different schools in the Schools Division of Sorsogon Province who are Master Teacher or teachers teaching research for five years and above.

Table 1: *The Respondents*

Respondents	Frequency	Percentage
Students	30	86%
Evaluators	5	14%
Total	35	100%

This study used simple random sampling in selecting the respondents from homogenous class composed of 40 students. The 30 student-respondents were chosen by lottery to eliminate subjectivity. The respondents of the study were the students being taught by the researcher with the 5E's Lesson plans in Research 1.

The Instrument

This study utilized various instruments to develop and validate the 5E's Lesson Plan in Research 1. In-depth discussions of each instrument were as follows: Pre-test and Post-test was a 30-item teacher made test designed to measure the mastery level of the students on the identified learning competencies. Table of Specifications (TOS) was made indicating the number of items per learning competency based on the curriculum guide for Research 1-4. The TOS served as guide of the teacher-researcher to construct test questions focusing on the learning competencies for the specified quarter. The pre-test was administered to the respondents before and a post-test after the utilization of the 5E's lesson plans.

This study also utilized the Evaluator's Validation Tool for Print Resources. To support the adequacy of the 5E's Lesson Plan in Research to its intended users, evaluator's judgment was sought by the researcher through the evaluator's validation sheet adopted from DepEd LRMDS Guidelines and Processes for LRMDS Assessment and Evaluation. The validation sheet is composed of four factors namely: content, format, presentation & organization and accuracy.

An Attitude Test was utilized to determine the attitude towards research, the researcher adapted a developed attitude test. The 15-item instrument was designed to measure the perceptions or feelings of agreement or disagreement of the students towards the subject. The attitude, towards research test was not designed to measure the absolute attitudes of the students toward research. Rather, it was adapted to determine changes in attitude generally from the start and the end of each lesson.

Data Collection Procedures

Before the conduct of this study, permission was sought from the superintendent of the Schools Division of Sorsogon Province. Approved letter from the superintendent was attached to the letters and was sent to the school head for the dry run of the teacher-made test and evaluators. Likewise, permission was sought from the principal of the school where the study was implemented.

The 5E's lesson plans were developed by the researcher anchored in most essential learning competencies. The developed 5E's lesson plan in Research 1 were validated by evaluators on second quarter of the school year 2023-2024. The researcher implemented the 5E's lesson plans to Grade 7 STE Learners on the third quarter of the current school year.

III. RESULTS AND DISCUSSION

1.Developed 5E's Lesson Plans in Grade 7-Research 1.

This study developed 5E's lesson plans for Grade Research 1. The developed 5E's Lesson plans focused on the identified most essential learning competencies that need to be covered by the grade 7 STE students for the third quarter. The topics include: a) experimenting; b) gathering data; c) organizing data; and d) analyzing and interpreting data. The developed 5E's lesson plans specifically consists of six topics which are: a)conduct a guided experiment; b) gathering qualitative data; c) gathering quantitative data; d) organizing data into table; e)organizing data into graphs; f)analyzing and interpreting data. These topics are aligned to four competencies namely: conduct a guided experiment; gather and record qualitative and quantitative data from actual observations; organizing data into table and graphs; and analyze or examine data, make necessary interpretation.

Each lesson plan contained the basic parts based on Dep Ed Order 42, s. 2016 (Policy Guidelines on Daily Lesson Plan Preparation for the K to 12 Basic Education Program) which are the objectives, content, learning resources, and procedures. Each developed lesson plan has the same content and performance standards but differs with the cover page, note to the teacher, learning competency, content, and procedures. Generally, the 5E's Lesson Plans were composed of five (5) major parts under procedure which are Engage, Explore, Explain, Elaborate and Evaluate.

It can be gleaned from Table 1A that six (6) 5E's lesson plans (LP) were developed namely: 5E'sLP No. 1: Integrated Process Skills: Conducting a Guided Experiment; 5E'sLP No. 2: Integrated Process Skills: Gathering Qualitative Data; 5E'sLP No. 3: Integrated Process Skills: Gathering Quantitative Data; 5E'sLP No. 4: Integrated Process Skills: Organizing Data Using

Table; 5E'sLP No. 5: Integrated Process Skills: Organizing Data Using Graphs and 5E'sLP No. 6: Integrated Process Skills: Analyzing and Interpreting Data.

2. Validity of the 5E's Lesson Plan in Research I

This section reveals the validity of the developed 5E's lesson plan in Research I in terms of content, format, presentation and organization and accuracy based on DepEd standards.

Table 1A. *Summary of the 5E's Lesson Plans in Research 1*

TOPICS	COMPETENCIES	SPECIFIC TOPICS	LESSON PLAN NO.	LESSON PLAN TITLE
A)EXPERIMENTING	I. Conduct a guided experiment	Conducting a Guided experiment	1	Integrated Process Skills: Conducting a Guided experiment
B)GATHERING DATA	II. Gather and record qualitative and quantitative data from actual observations	Gathering Qualitative Data	2	Integrated Process Skills: Gathering Qualitative Data
		Gathering Quantitative Data	3	Integrated Process Skills: Gathering Quantitative Data
C)ORGANIZING DATA	III. Organizing data into table and graphs	Organizing Data Using Table	4	Integrated Process Skills: Organizing Data Using Table
		Organizing Data Using Graphs	5	Integrated Process Skills: Organizing Data Using Graphs
D)ANALYZING & INTERPRETING DATA	IV. Analyze or interpret data, make necessary interpretation	Analyzing and Interpreting Data	6	Integrated Process Skills: Analyzing and Interpreting Data

Integrated Process Skills: Conducting a Guided Experiment (5E's LP No. 1). The overall mean rating of 5E's LP No. 1-Integrated Process Skills: Conducting a Guided Experiment under the validity of its content, presentation and organization and accuracy is 4.0 while 3.9 for format validity which are all interpreted as very satisfactory. The 5E's LP No.1 passed the criteria on content, format, presentation and organization, and accuracy by garnering total points of 16, 70.6, 20 and 24 respectively.

Integrated Process Skills: Gathering Qualitative Data (5E's LP No. 2). The 5E's LP no. 2- Integrated Process Skills: Gathering Qualitative Data got an overall mean rating of 4.0 under the validity of its content and presentation and organization, 3.93 under the validity of format and 3.9 for the validity of Accuracy which are all interpreted as very satisfactory. 5E's LP No.2 passed the criterion on content by accumulated 16 total points, passed the criterion on format with 70.8 total points, passed the criterion on presentation and organization with 15 total points and passed the criterion on accuracy by accumulated 23.6 total points.

Integrated Process Skills: Gathering Quantitative Data (5E's LP No. 3). The overall mean rating of 5E's LP no. 3- Integrated Process Skills: Gathering Quantitative Data under the validity of its content is 3.95, format is 3.9, presentation and organization is 4.0, and accuracy is 4.0 which are all interpreted as very satisfactory. 5E's LP No. 3 gained total points of 15.8, 70.6, 20 and 24 which allowed it to pass the content, format, presentation and organization, and accuracy criteria respectively. Integrated Process Skills: Organizing Data into Table (5E's LP No. 4). The 5E's LP no. 4- Integrated Process Skills: Organizing Data into Table garnered an overall mean rating of 4.0, 3.98, 4.0, 4.0 under the validity of content, format, presentation and organization, and accuracy respectively which are interpreted as very satisfactory. 5E's LP No. 4 achieved

16 total points for content, 71.6 total points for format, 20 total points for presentation and organization, and 24 total points for accuracy which are all interpreted as Passed. Integrated Process Skills: Organizing Data into Graph (5E's LP No.5). The overall mean rating of 5E's LP No. 5-Integrated Process Skills: Organizing Data into Graph under the validity of its content and accuracy is 4.0, format is 3.96, and presentation and organization is 3.92 which are interpreted as very satisfactory. 5E's LP No. 5 passed the four criteria which are content, format, presentation and organization, and accuracy through the obtained total points of 16, 71.2, 19.6 and 16 correspondingly.

Integrated Process Skills: Analyzing and Interpreting Data (5E's LP No. 6). The 5E's LP No. 6-Integrated Process Skills: Analyzing and Interpreting Data obtained an overall mean rating of 3.95 for its content validity, 3.97 for its format and accuracy validity, and 4.0 for its presentation and organization which are all interpreted as very satisfactory. 5E's LP No.6 passed all the criteria by achieving 15.8 total points for content, 71.4 total points for format, 20 total points for presentation and organization and 23.8 total points for accuracy. All of the six (6) developed 5E's lesson plan did not receive a perfect mean rating of 4.0 for its format due to the not so appropriate design, lay-out and illustrations of the lesson plan. Yet, all the experts recommended the approval of the 5E's Lesson plan for Grade 7-Research for possible utilization of school offering STE Curriculum provided that the comments and suggestions of the experts were followed in the revision and improvement of the 5E's lesson plan.

3. Effectiveness in Students' Academic Performance of 5E's Lesson Plan in Research 1.

This part reflects the academic performance of the students in the pre-test and post-test for Quarter 3 in Research 1. The difference between their performance in the said tests was also revealed in this section. The mean score and performance level was computed in the pre-test and post-test for each topic.

One of the major goals of the developed 5E's Lesson Plan is to enhance and enrich students' knowledge and skills, specifically along Integrated Process Skills in Research 1.

A 30-item teacher-made multiple choice type of examination covering the four identified topics in Research 1 for Grade 7 in the third quarter of school year 2023-2024 was utilized to measure the performance of the students. It was administered before and after the implementation of 5E's Lesson Plan in Research 1.

Table 3A shows that the overall performance of the students during the pre-test is 38.9 interpreted as Did Not Meet Expectation while the overall post-test' performance level is 84.22 interpreted as Fairly Satisfactory.

The result shows that the student's academic performance meet the passing rate set by Department of Education which is 75% in the post-test. It also revealed that the students' academic performance increased after the implementation of the 5E's lesson plan.

Table 3A. *Academic Performance of the Students in the Pre-test and Post-test*

Lesson	**Pre-Test**			**Post-Test**		
	Mean Score	PL	Description	Mean Score	PL	Description
1. 5E's Lesson 1: Integrated Process Skills-Conducting a Guided Experiment	1.87	6.2	DNME	4.10	13.67	FS
2. 5E's Lesson 2: Integrated Process Skills-Gathering Qualitative Data	2.10	7.0	DNME	4.17	13.89	FS
3. 5E's Lesson 3: Integrated Process Skills-Gathering Quantitative Data	2.20	7.3	DNME	4.40	14.67	FS
4. 5E's Lesson 4: Integrated Process Skills-Organizing Data into Table	2.00	6.7	DNME	4.20	14.00	FS
5. 5E's Lesson 1: Integrated Process Skills-Organizing Data into Graph	1.73	5.8	DNME	4.27	14.22	FS
6. 5E's Lesson 1: Integrated Process Skills-Analyzing and Interpreting Data	1.77	5.9	DNME	4.13	13.78	FS
Overall Weighted Mean	11.67	38.9	DNME	25.27	84.22	FS

Legend: PL-Performance Level | DNME-Did Not Meet Expectation | FS-Fairly Satisfactory

The result also implies that student's mastery of the skills improved. Before the implementation of 5E's Lesson plan, the students have low performance wherein they did not meet the standard performance set by the Department of Education which is 75%. After the implementation of the 5E's LP, students' performance has increased. It could be attributed to the utilization of the 5E's Lesson plan which are inquiry-based which provided them opportunities and experiences to develop the necessary skills in mastering a certain competency.

Additionally, Explore Phase may also contribute to the improvement of student's performance. According to Vigeant (2017), it is the phase in which students carry out hands-on activities. Through their experiments or other interactions with the material, they deepen their understanding of the content. This leads to the improvement in the mastery of competency. It is supported by the student's answer in unstructured interview. A student stated that working cooperatively with their groupmates, they were able to collect and record data faster while making it accurate. This is supported by the response made when a student was asked how did working cooperatively/collaboratively help them accomplish the task of learning.

Nung ginawa naming ang activity ng by-group, ang bawat isa ay may role to collect o record the data, that is why natapos namin ang activity ng mabilis pero accurate pa rin ang result (When we performed the activity by group, each of us has role to with collecting or recording the data, that is why we were able to finish the activity quickly but still with accurate results.)

Analyzing Table 3A, it can be observed that all of the Lessons had achieved a passing PL in Post-Test which are fairly satisfactory. It implies that students met the 75% rate set by the Department of Education. It may be contributed to the sequence of each lesson as presented in the classroom using the 5E. According to Bybee (1997), the 5E model is best used in a unit of two to three weeks in which each phase is the basis for one or more distinct lessons. This means that sustained use of an instructional model can help students learn fundamental concepts in a learning area. This is supported of a student's response when asked of how they usually feel after each lesson.

Ang mga lessons mo kaya ma'am, may on mga activities na maisip tlga kami san simbag, tapos maski pirme by group, di kami nagsasawa kay challenging ma'am ang activities like yadto na naghimo kami paper airplane taz pig-measure an distance travelled by the plane, nakaaram kami maggamit sin meterstick taz an metro, naiexperience namo actual kaya Madali namo nasasabutan and diri tulos nalilimutan (The lessons you have had activities where we need to think of our answer, though most of the time, it's by group, like when we did the Paper Airplane activity then we have to measure the distance covered by it, we learn how to use meterstick and professional tape measure, we had actual experience. Thus, we can grasp easily and will not be forgotten easily)

A student said that because each 5E's lesson plan provided them with activities to actively explore new concept and communicate with their peers and allowed them to share what they learned in the activity. As Choowong (2021) found that hands-on practice enhances student participation and effective in facilitating the teaching and learning.

Furthermore, Table 3B shows the difference between the pre-test results of the students. As reflected, the test value of 20.93 is greater than the critical value of 2.045 at 0.05 level of significance with 29 degrees of freedom. Therefore, the null hypothesis is rejected. The data reveals a notable disparity in the students' performance between the pretest and posttest. Specifically, the posttest scores surpass those of the pretest, indicating a potential enhancement in student performance due to the implementation of the 5E's lesson plans. Additionally, the Cohen's D value of 5.70 signifies a large effect size.

TABLE 3B. *Difference between the Pretest and Posttest Results of the Students*

Statistical Basis	Statistical Analyses
Level of Significance	0.05
Degrees of Freedom	29
Critical Value	2.045
Computed t-value	20.93
Decision on Ho	Reject
Conclusion	Significant
Cohen's D	**5.70**

Since 5E's lesson plan is an inquiry-based learning, it strengthens the student's involvement and participation in every phase of the lesson but there were phases that were well-performed than the others. Elicit Phase provides motivation and engagement that also contribute to the improvement of student's performance. Although this phase showed less evidence of student's

performance because this phase focused on soliciting prior knowledge or preconception for them to construct new knowledge, it affects the learning outcome. As Amtu et.al (2020) stressed out that motivation improves student learning outcome. Explore phase had the greatest student's performance compared to other phases in the lesson. Students spent larger amount of time exploring, investigating and answering guide questions in this phase.

Through the explore phase, the teacher-researcher as the learning facilitator, enable the learners to perform and engage them with a task to develop their skills in observing and measuring using concrete materials. This is in line with the suggestion of Eisenkraft (2023) that the students must be given opportunities to manipulate materials in order to be able to construct knowledge of phenomena and related scientific concepts. Furthermore, it is worth mentioning that students did not perfectly achieve the numerical correctly because error in rounding off integers was encountered. The teacher helped them by guiding them in performing the operation.

During the conduct of the 5Es Lesson, students showed cooperation in answering the activity guide questions. Majority of the group of students openly discussed their opinions/ideas until they reached a consensus although there were few students noted to not join in group discussions. In addition, Duran & Duran (2004) pointed out that the students must have the opportunity to express their own explanations and ideas before the teacher provide an explanation.

In the elaboration phase, students are encouraged to apply their new understanding of concepts while reinforcing new skills (Duran and Duran 2004). Through the 5Es lesson in Research I, the teacher-researcher made this possible by providing learners with activities that probe student's learning and application in the Elaborate phase. In the activity, learners recorded the time it takes for a toy car to reach a specific distance and they plot the result using a graph. Learners were required to analyse the data for them to determine the appropriate graph to be used in presenting their data. The activity also gave the learners opportunity to integrate other discipline such as Mathematics in their output. This is in support with Duran and Duran (2004) idea that 5E learning cycle presents opportunities for the teacher to integrate subject with other content areas.

The activities done by the students in the different phases of 5Es Lesson supported Wale and Bishaw (2020) point who emphasized that inquiry-based learning involves students in making observations, posing questions, gathering, analyzing, interpreting, and synthesizing data; proposing answers, explanation and predictions, communicating findings through discussion and reflection; applying findings to the real situation and following up new questions that may arise in the process.

4. Students' Attitudes toward Research after the Implementation of 5E's Lesson Plans

The positive attitude of the students toward the subject could be one of the factors that can affect their academic performance. According to Kocabas (1997), having a negative attitude towards a learning area had a decreasing tendency of their scores. Attitudes plays an important role in the realization of learning due to the impact in the formation of the decisions and behavior of the students.

As long as the students cannot see the relevance of what they are learning and cannot develop its connection to other things, then, it will be very difficult for them to appreciate and develop their skill. That is why, it is very important to help students see the relevance of concepts being presented.

This study adopted with few modifications a standardized attitude questionnaire. Students took the test after every implementation of 5E's Lesson Plan. Table 4 shows the result of the attitude towards research for the six 5E's Lesson Plans in Research I for third quarter topics.

It can be gleaned from Table 4 that for 5E's LP No.1, indicator 1, 5, 12, 13, 14 and 15 garnered a perfect percentage of 30. This means that all of the students believed that the lesson on conducting a guided experiment was interesting and stimulating, exciting and not boring, helps them develop the skills of thinking, excites questions, opinions and ideas and stimulates their curiosity to learn more about it. Likewise, all of them find their Research teacher encouraging. These could be attributed through the utilization of 5E's lesson

Bybee (1997) emphasized that the use of 5E learning model helps students redefine, organize, examine and change the ideas that they already have through interacting with their peers and environment. The

sequence of lessons using 5E lesson plan on Integrated Process Skills: Conducting a guided experiment made this emphasis of Bybee possible for students to experience. This is supported by one of the responses of student when asked why he find the subject interesting and stimulating.

"dahil sa activity na ginawa namin sa Explore part, narerealize namin na mali pala ang unang ginawa namin. Nagtutulungan rin kaming magkakagrupo na ayusin ang pagkakasulat ng mga steps sa experiment. Nabigyan din kami ng pagkakataon na i-share ang aming ideas bago checkan ang aming sagot"

(because of the activity that we answered in the Explore part, we realized that what we did before was wrong. We also helped each other in our group to write properly the steps in experiment. We were also given the chance to share our ideas before our answers were checked.)

However, indicator 8 obtained the lowest percentage for 'Yes' answer. Only thirty-three percent (33%) of the learners agreed to the statement that "I am motivated to prepare my assignment in Research". It is maybe because the teacher-researcher did not give an assignment for this lesson in third quarter. This is supported by the response of one student when asked why, one student stated that:

"wara man kami inansweran na assignment sa lesson na conducting a guided experiment" (We had no assignment when taught with the lesson on conducting a guided experiment.)

Furthermore, It can be deduced from the table that for 5E's LP No. 2, all the learners considered research topics interesting and stimulating, find research class exciting and not boring, research excites questions, opinions and ideas, research stimulates curiosity to learn more about it and they find research teacher encouraging as shown by a perfect percentage of 100 for indicators 1, 5, 13, 14 and 15 respectively. This result supported the findings of Zavesky (2022) that students' attitudes in science improved with the 5E Learning Model.

Table 4: *Students Attitude Toward Research plan that gave the learners opportunity to be active and construct knowledge relevant to the lesson.*

Indicators	5E's LP No. 1		5E's LP No. 2		5E's LP No. 3		5E's LP No. 4		5E's LP No.5		5E's LP No. 6	
	f (n=30)	(%)	f (n=30)	(%)	f (n=30)	(%)	f (n=30)	(%)	f (n=30)	(%)	f (n=30)	(%)
1. I find research topics interesting and stimulating	30	100	30	100	30	100	30	100	30	100	30	100
2. I consider the subject useful to my daily activities	29	97	29	97	29	97	30	100	29	97	29	97
3. I am excited to attend my Research class regularly and promptly	25	83	25	83	29	97	29	97	28	93	28	93
4. I love to recite in my research class and ask my teacher how the lessons are related to my daily life	25	83	16	83	11	37	18	60	13	17	16	53
5. I find my research class exciting and not boring	30	100	30	100	30	100	30	100	29	97	29	97
6. I can understand the world better after learning concepts in Research	25	83	28	93	30	100	30	100	30	100	29	97
7. I find pleasure in doing interactive classroom activities in Research	29	97	29	97	29	97	29	97	29	97	29	97
8. I am motivated to prepare assignments in Research	10	33	17	57	26	87	26	87	18	60	17	57
9. I am motivated to prepare and present our group output in Research	21	70	22	73	25	83	21	70	25	83	28	93
10. I feel challenged answering enrichment exercises	29	97	29	97	30	100	30	100	28	93	28	93
11. I like talking to my friends and classmates about Research	28	93	22	73	28	93	28	93	26	87	25	83

12. I like Research because it helps me to develop the skills of thinking	30	100	29	97	30	100	30	100	30	100	30	100
13. Research excites questions, opinions and ideas	30	100	30	100	30	100	30	100	30	100	30	100
14. Research stimulates my curiosity to learn more about it	30	100	30	100	30	100	30	100	30	100	30	100
15. find my Research teacher encouraging	30	100	30	100	30	100	30	100	30	100	30	100

On the other hand, indicators No. 4 garnered the lowest percentage since only fifty-three percent (53%) of the learners agreed with the statement: "I love to recite in my class and ask my teacher how the lessons are related and useful to my daily life". As one student stated,

Makaraway man maghapot kun nakay related an lesson ni Ma'am kasi siya ang naghahapot saato kung paano related an lesson sa uruadlaw-adlaw na pamumuhay tsaka nagpapahimo man siya activity na an naaraman namo, may on application sa amo buhay. (It is shameful to ask my teacher how related our lesson is where in fact, it is the teacher who asked us how the lesson is related to our everyday life and activity is accomplished wherein application of our learning in daily life is evident.)

Therefore, it is imperative that learners did not find it meaningful to ask the teacher on the relatedness and usefulness of lesson in their daily life when activities were provided to apply their learning. This is supported by the study of Nkurikiyimana (2022) which emphasized that the 5Es educational model provides a learning environment where students are exposed to activities that foster discovering concepts or phenomena using their pre-requisite knowledge.

Moreover, the attitude test was also administered after the implementation of 5E's Lesson Plan No. 3: Integrated Process Skills: Gathering Qualitative Data. It can be noted from the table that eight (8) indicators out of 15 garnered a highest percentage of 100. These are indicators, 1, 5, 6, 10, 12, 13, 14 and 15 respectively. This implies that after the implementation of the third lesson in Quarter 3, students still find the subject interesting, stimulating and exciting.

In addition, they agreed that they can understand the world better after learning the concepts in Research; they are challenged answering enrichment exercises. They also find Research to excites questions, opinions and ideas, and stimulates their curiosity. All of them also agreed that their research teacher is encouraging. This may be attributed to the use of inquiry-based lesson plan, as pointed by Aulia (2018), that 5E inquiry-based learning was one of the teaching methods that create an environment where students interact with each other.

On the contrary, one (1) indicator out of fifteen (15) achieved the lowest percentage for agreement. Indicator 4 earned only thirty-seven percent (37%) of the students who agreed that they loved to recite in the research class.

Furthermore, Table 4 illustrated the attitude of the learners after the implementation of the fourth lesson by utilizing the 5E's Lesson Plan: Integrated Process Skills: Organizing Data into Tables. The data shows that indicators 1, 2, 5, 6, 10, 12, 13, 14 and 15 garnered a highest percentage of 100 for 'Yes' response. This implies that all of the students agreed that the lesson on Organizing Data into Table is an interesting, exciting and stimulating topic and useful to their daily activities.

In like manner, students believed that they understand the world better after learning the concepts in organizing data, felt challenged answering enrichment exercises and stimulated their curiosity to learn more about the topic. They also find their Research teacher encouraging in teaching the lesson

…dahil sa lesson na ini, nasabutan ko kun ano an mga parts san data table, and mas importante na napasabot saako kun paano an tamang paghimo and pag-aayos ng data sa saro na table na magagamit ko na skill kapag nagconduct na kami scientific research in the future(Because of this lesson, I was able to understand the parts of a table and more importantly, I understand how to write and organize data using a table which is a needed skill when we conduct scientific research in the future)

This was the response of a learner when asked about the significant of the lesson in their life. Learners perceived the lesson on organizing data into table as relevant to their life as a learner. This may be attributed to the activities given in the different phases of the 5E's

Lesson Plan which enabled the students to be engaged meaningfully. This idea is supported by Nyirahagenimana et al. (2022) who pointed out that under inquiry-based learning, the 5Es educational model, consisting of a sequence of five interdependent phases-Engage, Explore, Explain, Elaborate and Evaluate, is a learning cycle that improves students' attitudes toward Biology.

On the contrary, indicator number 4 which states that "I love to recite in my research class and ask my teacher how the lessons are related to my daily life" achieved the lowest percentage of agreed students.

Wara lang, habo ko lang po. (Nothing, I just don't like to do it.) This was the response of one learner when asked why he is not asking question to the teacher regarding the lesson's relatedness in their daily life.

Moreover, respondents answer on the attitude towards the fifth lesson which is Integrated Process Skills: Organizing Data into Graph. The data revealed that six (6) out of fifteen (15) statements were agreed by all the students since it achieved a perfect percentage of 100. These are statements number 1, 6, 12, 13, 14 and 15.

When asked how the lesson helped them to develop the skills of thinking, these are the most frequent responses given by the learners. This maybe because 5E lesson plan under the 'Explore' and 'Elaborate' parts provided them moments to work collaboratively and cooperatively with their peers.

Sa lesson na ito, binibigyan ako/kami ng chance to express and present our ideas and answer pakatapos gumawa ng isang activity. Natututunan din naming magtrabaho ng tulong-tulong sa pag-iisip ng isasagot sa guide questions. (In this lesson, I/we was/were given the chance to express and present our ideas and answer after accomplishing an activity. We also learned to work cooperatively to think on the answer to guide questions).

When asked why they find research exciting and not boring, a student replied,

Tuwing research class, hindi nawawala 'yung time na maingay kami..maingay kami kasi busy kami sa pagperform ng activity lalo na dun sa naging activity namin na 'Timed-Car'. Nag-enjoy ako dun sa group activity na kunin ang oras ng toy car to reach a distance. Medyo nahirapan lang po ako at aking kagrupo na ipakita through graph ang result nito… (During research class, there is no time that we are not noisy, we are noisy because we are busy performing an activity especially when we had the 'Timed-Car' activity. I and my groupmates enjoyed doing the group activity in recording the time it took for the car to reach a distance. Though, I and my groupmates find it slightly difficult in presenting the result using a graph)

It can be deduced that the 5E's Lesson Plan along with its different phases enable the teacher to guide the learners toward a deeper understanding of the concept through hands-on and minds-on activities. This is supported by the study of Zavesky (2022), in which he found out that his students got most from the engage and explore stages and his students did not feel dry or boring and quiet in their classes.

Furthermore, Table 4 shows that students' attitudes toward 5E's LP No. 6. Integrated Process Skills: Analyzing and Interpreting Data. It can be drawn from the table that one hundred percent (100%) of the learners agreed in the five statements out of 15. These implies that this specific topic is interesting and stimulating, helps develop the skills of thinking, excites questions, opinions and ideas, stimulates curiosity to learn more about it. They also agreed that the teacher is encouraging as well. As Manishimwe, Shivoga & Nsengimana (2022) confirmed in their study that inquiry-based learning was more efficient than the conventional teaching in promoting a positive attitude toward learning Biology.

Nevertheless, statements number 4 and 8 achieved a lowest percentage for 'Yes' response which were from fifty-three percent (53%) and fifty-seven percent (57%) of the learners respectively. These learners fail to agree that they love to recite in class and ask their teacher how the lessons are related to their daily life, and they are motivated to prepare assignments in research. When asked why not asked the teacher how the lesson is related in their lives the teacher, a student answered,

Bagan common sense naman po pan o, analyzing and interpreting data ang topic, magagamit po yan namo sa next or fourth quarter kasi maconduct kami simple investigatory project, kaya aram ko na an application niya, diri na kaipuhan ihapot (It's like common sense at all, the topic is analyzing and interpreting data, I/We

can use it when we do simple investigatory project, so we know its application, no need to ask for it).

This is the justification of the students who did not ask the teacher regarding the relatedness of the lesson in their daily life.

IV. CONCLUSION AND RECOMMENDATIONS

Based on the findings, this study concluded that the developed 5E's Lesson Plan were under the topics of experimenting, gathering data, organizing data and analyzing and interpreting data which are aligned to the K to 12 Grade 7 STE Learning Competencies and can be used as instructional material for Research teacher; The developed Prototype 5E's Lesson plan are valid and recommended for adoption in teaching as evaluated by the evaluators; The 5E's Lesson Plan is effective in improving the students' academic performance in Research I; Majority of the students had more positive attitudes compared to negative ones toward research after the implementation of each lesson. These positive attitudes were that they find research topics interesting and stimulating; Research excites questions, opinions and ideas; Research stimulates their curiosity to learn more about it and they find their Research teacher encouraging.

It was recommended that the developed lesson plans in this study may be adopted and improved by the teachers teaching Grade 7-Research in school offering STE Curriculum. It was also recommended that the teachers handling Research I or in other grade levels in STE Schools are encouraged to develop similar 5E's Lesson Plan for other topics. Another recommendation was that the developed 5E's Lesson Plan may be further validated using true experimental design. Moreover, it is further recommended that the teachers may develop other instructional materials to further encourage and sustain positive attitude towards the learning area. And lastly it is recommended that research on developing and validating instructional materials is encouraged to support teaching Research as learning area for Science, Technology and Engineering (STE) curriculum.

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