ON-BOARDING PROJECT LAYAG (LABORATORY AT YOUR ACTUAL GROUND) IN ENHANCING STUDENTS' ACADEMIC ACHIEVEMENT AND ENGAGEMENT IN SCIENCE

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Abstract

This study investigated the effectiveness of the program of the Science Department of Sindangan National High School's Project LAYAG *(Laboratory at Your Actual Ground).* This one-group pretest-posttest experimental research design was applied to thirty (30) Grade-9 students during the second semester of the School Year 2021-2022. The ADDIE Instructional Design Model was employed in the study to carry out the systematic approach of implementing the action research process. A 30-item researcher-made test was validated at 0.74 Cronbach Alpha and was employed to measure students' achievement levels. Students' engagement was measured using an adapted Student Science Engagement Scale (SSES). Mean, standard deviation, t-test for dependent sample, and focus group discussion were used to treat the data. Results showed that the utilization of students' laboratory works outside the school had significantly increased students' level of achievement. Moreover, positive students' attitude and engagement were enhanced with the application of laboratory teaching approaches. It is highly recommended to encourage teachers to adapt innovative science activities through laboratory manipulation even away from the unstructured instructional delivery.

Keywords: *achievement; engagement; laboratory; Project LAYAG*

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Context and Rationale

One of the most fascinating parts of learning science has been conducting laboratory experiments. With science lab experiments, students can ask questions, seek answers, carry out research, and gather data. Additionally, it enables students to participate in the investigative style of scientific learning. Students really perform and execute science in science laboratories as an alternative to studying science in the classroom using textbooks or modules in an alternative mode of learning.

In the laboratory, learning can occur in a number of ways, usually through trial observation, practical training, or observation of a case or phenomenon. Often in their field of specialization, the primary objective of laboratory learning for students is to assist them in gaining practical competency. Laboratory learning also gives students the chance to connect with and reinforce the theoretical concepts they are learning in class (Chan 2012, 1). Additionally, it strives to accomplish a range of educational goals, including experiential learning.

Laboratory-based classroom activities can inspire all learners to succeed and build confidence in an activity-based classroom, regardless of their aptitude for reading, mathematics, or learning challenges (Townsend 2012, 28). Aside from the interest of the students, laboratory-based experiments have also been used to enhance their academic performance. According to Shana and Abulibdeh's study (2020, 13), there is a link between achievement in school and real-world experience of the majority of science students. They also suggested that in secondary schools, students should participate in practical lessons.

Due to the limitations set forth by the Inter-Agency Task Force for the Management of Emerging Infectious Diseases, the actual learning experience has been compromised with the spread of the pandemic. In the new normal education setup, most schools do not have the face-to-face class. In the Schools Division of Zamboanga del Norte, printed modular distance learning is being utilized to continue to deliver learning to students despite the threat of COVID-19. However, modules only provide readable text and visual illustrations, which could somehow compromise the learning of the students since they only remember 10% of what they read and 30% of what they see, which is just in the abstract learning stage. While using printed self-learning modules for modular distance education, students are expected to learn independently, but they are unable to do so. During the COVID-19 pandemic, students had trouble learning using printed self-learning modules (Meniano and Tan 2022, 5-6).

Recalling the concept of the Cone of Experience by Edgar Dale, students learn best through direct experience rather than reading text alone because they are bound to remember 90% of what they do. Direct task experience fosters greater levels of team innovation and more diverse products than indirect task experience. Furthermore, teams that acquired task experience directly are more creative than teams that acquired task experience indirectly since they have better transactive memory systems (Gino et al. 2009, 1). The result of their study concurs with the theory of learning by John Dewey, which states that students learn better through a hands-on approach. Direct experience could provide more interesting and exciting learning compared to just listening to lectures or reading modules specifically for kinesthetic learners.

In this study, the researchers allowed learners to directly experience laboratory activities that helped them get engaged through hands-on science activities and be able to improve their learning towards certain science concepts even in the new normal setup. During this pandemic, students were not yet allowed to go to school due to the health protocols provided by the IATF. Luckily, printed modules were still provided to allow the learners to still continue to learn and perform science activities at their own pace at home. However, science activities provided in learning activity sheets are just limited to the available materials that the students can easily find at home or in their surroundings and the degree of safety measures to be considered while performing such activities. This led to a compromised learning experience for the students since some science concepts would be best understood if they were performed through certain laboratory activities that would really require assistance by the teacher and would need laboratory apparatus that is only found in the school laboratory. To overcome such limitations of conducting laboratory experiments during this pandemic, the Sindangan National High School Science Department actively proposed the implementation of Project LAYAG, which stands for Laboratory At Your Actual Ground.

Project LAYAG is an outreach program within the satellite barangays of Sindangan. It aims to provide engaging workshops, live stage performances, mobile exhibit sets, and instructive workshops and programs to boost student engagement and pique their interest in the fascinating world of science. Bringing laboratory experiments in a field that is more accessible to learners is something that is not new. In fact, many mobile laboratories have been used operating in the Philippines in order to continue to deliver instruction to students. The Schools Division of Antique established mobile laboratories to help guarantee that pupils will learn through appropriate modalities. The purpose of these mobile labs was to give students access to modules for learning and followed by “first-hand” experiences in the laboratory (Malipot 2021, 1).

Thus, this is the school's response to the need to continue learning despite the constraints put in place by the COVID-19 crisis. This study is hoped to be of great assistance in filling the gaps in learning science through the implementation of Project LAYAG alongside the printed modular distance learning modality.

Innovation, Intervention, and Strategy

Project LAYAG (*Laboratory at Your Actual Ground)* is an outreach program of the Sindangan National High School’s Science Department traveling within the satellite coastal barangays of Sindangan. Students' enthusiasm for science was increased by teachers' interactive workshops, live stage performances, and portable exhibit sets. Science teachers facilitated engaging and educational workshops and programs to strengthen students’ engagement and ignite curiosity and excitement for the captivating world of Science (Bolliger and Martin 2018, 1). The program ran last second semester of the previous school year, starting February to June, 2022.

The conceptualization of this project was aligned with the Division of Zamboanga del Norte maiden project in Science – WAIS (Where Am I in Science), which is anchored on inquiry-based instruction. Students were exposed to applications of the concepts in Science through real-life situations such as but not limited to friendly competitions, trainings, and workshops.

LAYAG is the Filipino counterpart of ‘sail’ which signifies moving forward. DepEd reiterates UNESCO's stance that there can be no compromises on access, quality, or system strengthening in education, so education must go on (DO 012 s. 2020, 1). While waiting for the face-to-face school opening, alternative options of supplementary activities will be provided to the students. Activity-packed experiences were exposed to the students along the identified coastal barangays of Sindangan to engage themselves in workshops designed to enrich their alternative learning modality with fun, innovative experiments right at the students’ facility.

Science activities in the modules need adult supervision in performing them. Moreover, materials are not readily available for the students to perform the experiment. Hence, teachers tend to let them skip to perform for their safety. Having seen these scenarios, it is deemed necessary to provide supplementary activities to enrich students’ science experience. This project provided an extended classroom where they can practice laboratory works and allowed students to see science in application instead of just reading about in in their modules.

Science teachers of this school engaged students in their respective community with different activities ranging from 40-minute science shows to a multi-day whole school experience. Each Barangay's covered courts served as exhibit sets for the science center. Limited number of students at a given time was recommended, Among these activities were as follows: live shows were brought to group of students in the community following the proper health protocol; a captivating, interactive, and entertaining presentation was used to present science content and methods; hands-on exhibit sets were intended to be an entertaining "science playground" for all participants; and workshops – content-rich, hands-on Science exploration were delivered by the facilitators in each Satellite Barangays. This out-of-school workshop accommodated up to 30-40 participants.

Teachers initiated interactive Science activities aligned with the competency in the MELCs in a weekly basis- twice every month. Prepared activities were brought to the receiver barangays to conduct sessions, classes, and tutorials. Donations from the external stakeholders were used as funds for preparing the materials of the out-of-school workshops to accommodate the participants.

Action Research Questions

Project LAYAG (Laboratory at Your Actual Ground), an initiative of Sindangan National High School, was put into practice, and its effectiveness was tested in this study. This intervention was a community learning initiative of Sindangan National High School's science department. In order to supplement students' understanding and give them the opportunity to engage directly with laboratory activities and experiments that were otherwise restricted by the current learning modality, this brought science learning programs to the community. This learning advocacy provided varied activities to students such as hands-on, minds-on Science, video clips, and fun game-based activities to enhance students' engagement in Science lessons.

To test its effectiveness, this advocacy program was implemented between February and June 2022 last school year. Generally, this research sought to answer the following questions:

1. What is the mean score of the students in the pretest (before the intervention) and the posttest (after the intervention)?
2. How engaged are the students towards the intervention of Project LAYAG?
3. Is there a significant difference of the pretest (before the intervention) and posttest (after the intervention – Project LAYAG) mean score of the students?

Alternative Hypothesis

Ho: There is no significant difference of the pretest (before the intervention) and posttest mean score of the students (after the intervention-Project LAYAG)?

Action Research Methods

Research Design

The researcher of the study employed a quasi-experimental one-group pretest-post-test design. In this study, single group of participants before the intervention of Project LAYAG (pretest) and after the intervention (posttest) was applied. Then students' engagement was measured using an adopted scale.

Participants and Other Sources of Data Information

Five (5) coastal barangays were recipients of the Project LAYAG. This dramatically complemented the word LAYAG since most of the students were densely distributed from these areas. Conversely, the Sindangan National High School in which it is located is part of Sindangan Central I District, which covers the five (5) neighboring elementary schools located in these coastal barangays. Among these five (5) identified barangays, Barangay Calatunan was chosen as the research locale since this was the place where the proponents were randomly assigned. All students were given a generic type of MELCs-based interactive Science activities which covered the third grading period. Grade 9 students were randomly selected by cluster from among the participants.

The ADDIE Instructional Design (ID) Model by Dick and Carey (1985) was employed in implementing the instructional design process. Effective learning instructions were created using this instructional design framework, which consists of five (5) phases: examining a learning scenario, creating goals and guiding principles to handle its problems, creating resources that satisfy these requirements, putting the learning resources into practice in the learning circumstances, and assessing how well the resources met the needs of the instruction (Branch 2009, 1).

Research Instrument

Both the lesson exemplars and the achievement test were validated prior to the conduct of the study. Activity sheets and test questionnaires were quality assured by the Science Department's Master Teachers who specialized in Chemistry and Biology. In establishing the reliability of the achievement test, this was pilot tested to fifteen (15) Grade 10 students who were randomly selected as was computed using Microsoft Excel. The 30-item researcher-made test has established an acceptable value of Cronbach Alpha of 0.74 reliability. Students' engagement was tested using adapted students' engagement inventory scale (Baraquia 2019, 6).

Data Gathering Procedure

The proponents prepared validated lessons with activity sheets and researcher-made achievement tests. Before the pilot implementation of the Project LAYAG, series of planning was conducted in the Science Department. The lessons with activity sheets were prepared before-hand and will be subjected to the scrutiny of the subject experts for the content and content clarity, appropriateness, and language. The researcher-made achievement test, on the other hand, was created and put through both validity and reliability tests. When these instruments had passed its validity and reliability, these were implemented in the recipient barangays for its test of effectiveness. Pretest was administered to thirty (30) students before the conduct of the intervention. Five (5) lessons were piloted for the saturation of the application of the intervention. The same group of students were then given a posttest to gauge their level of achievement.

After the administration of the achievement level of the students, validated students' engagement inventory scale (Baraquia 2019, 6) was given to the participants to test their engagement towards the implementation of the intervention program.

The program lasted for five (5) months at Barangay Calatunan, Sindangan, Zamboanga del Norte. To ensure the participants' and teachers' safety, a health protocol was first obtained from the Rural Health office. Permission was granted from the respective barangays where the program was piloted. The activities were conducted among the participants from Grades 7-12 bona fide students of the school. Grade 9 participants were selected sfor the data gathering since the topics were obtained from their MELCs. Pretest and engagement inventory were given to thirty (30) Grade 9 participants before the intervention and the same research instruments were given to the students as posttest. Thus, one-group pretest-posttest designed was implemented in the study.

Data Analysis

Both the lesson exemplars and the achievement test were validated prior to the conduct of the study. Activity sheets and test questionnaires were quality assured by the Science Department's Master Teachers who specialized in Chemistry and Biology. In establishing the reliability of the achievement test, this was pilot tested to fifteen (15) Grade 10 students who were randomly selected as was computed using the Microsoft Excel. The 30-item researcher-made test has established an acceptable value of Cronbach Alpha of 0.74 reliability.

Data that were gathered and subjected to statistical treatment tools. The mean scores of the students' pretest (before the intervention) and posttest (after the intervention) were obtained using descriptive statistics to address research question 1; adapted students' engagement inventory scale was used to gauge student engagement in order to investigate question number 2 (Baraquia 2019, 6). Inferential statistics were lastly used to address research question number 3. Since two mean scores from one group were compared, a t-test of the dependent sample was appropriately employed. The Shapiro-Wilk test for normality was used to check the distribution's normality prior to this statistical treatment's data processing. All data were presented in tables, and the proponents' insights and interpretation were used to significantly treat the data.

The hypothetical mean range of 1.00 - 1.75 = Very Low, 1.76 - 2.50 = Low, 2.51 - 3.25 = High, and 3.26 - 4.00 = Very High was used to describe students' level of engagement in the learning process. Following that, to ascertain the degree of students' achievement, the Mean Percentage Score (MPS) and its descriptive equivalent below, taken from DepEd Memo No. 160, s. The following scale was used: 96- 100% = Mastered, 86- 95% = Closely Approximating Mastery, 66- 85% = Moving Toward Mastery, 35- 65% = Average, 15- 34% = Low, 5-14% = Very Low, and 0- 4% = Absolutely No Mastery.

Results and Discussion

Students' Achievement Level Before and After the Intervention. Data were obtained before and after the implementation of the Project LAYAG. The participants' pretest and posttest results were compiled using the validated test questionnaire created by the researcher. The achievement levels of the students are described statistically in Table 1. Data show that prior to the application of the intervention, students' achievement level was more on the average level as shown in their pretest's mean scores. Conversely, students' performance has increased after the implementation of the intervention as what has been reflected in the students' posttest results.

Table1: Descriptive Statistics of the Students' Achievement Level

Parameter	N	X	sd	Achievement Level
Before the Intervention (Pre-test)	30	47.22	10.90	Average
After the Intervention (Posttest)	30	61.67	10.09	Moving Towards Mastery

MPS: 96 – 100% = Mastered; 86 – 95% = Closely Approximating Mastery; 66 – 85% = Moving Towards Mastery; 35 – 65% = Average; 15 – 34% = Low; 5 – 14% = Very Low; 0 – 14% = Absolutely No Mastery

This result demonstrated that hands-on learning experiences, such as working in a laboratory and engaging in science activities, were more effective than other teaching strategies at fostering an understanding and appreciation of scientific ideas. Inquiry-centered laboratories, in particular, possess the ability to enhance students' comprehension of science's nature, conceptual grasp, and meaningful learning when they are properly developed (Hofstein 2017, 359). This further affirmed that learners greatly profited from the activity-oriented, laboratory-based learning approach, which involved them in deep critical thinking and process skills (Ezeano and Ugwu 2010, 1).

It is the goal of learning science that all students must have improved mastery of the science material, developed conceptual scientific reasoning abilities, increased understanding of some abstract concepts, developed practical skills, improved comprehension of the nature of science, encouraged curiosity in science, and improved teamwork skills (Singer, Hilton, and Schweingruber 2005, 3).

Understanding Science concepts cannot truly take place without some degree of engagement among students. This motivates students to learn; thus, it is a prerequisite for understanding and long-term learning.

Level of Students' Engagement Before and After the Intervention. Table 2 displays the level of students' engagement before and after the intervention of Project LAYAG.

Table 2. Level of Students' Engagement Before and After the Intervention

Indicators	Before the Intervention			After the Implementation		
	Mean	SD	Description	Mean	SD	Description
A. Engagement on Science Lessons and Tasks						
1. My Science lessons and performance tasks are important and relevant to my life.	3.10	0.40	High	3.63	0.49	Very high
2. My Science lessons and performance tasks are interesting and meaningful	2.93	0.37	High	3.50	0.57	Very high
3. My Science lessons and performance tasks are realistic and contextualized.	2.87	0.35	High	3.30	0.53	Very high
4. I am inspired to learn new things in Science class.	3.00	0.45	High	3.63	0.49	Very high
5. My Science lessons and performance tasks stimulate my curiosity.	2.80	0.61	High	3.23	0.63	High
6. I feel encouraged and interested to work on something in Science class.	2.83	0.59	High	3.33	0.61	Very high
7. I am inspired and prepared to come to Science class every day.	2.80	0.66	High	3.13	0.73	High
B. Science Learning Involvement						
8. I am having fun during collaborative learning activities in Science	3.03	0.49	High	3.40	0.62	Very high
9. I want to ask my Science teacher or classmates personally or through social media if I have a trouble understanding a lesson	2.77	0.57	High	2.87	0.78	High
10. I want to investigate and understand the societal and environmental impacts and implications from science and technology.	2.93	0.58	High	3.20	0.66	High
11. I participate and interact during small-group discussion in Science.	2.73	0.52	High	3.20	0.55	High
12. I appreciate the scientific method or process.	2.70	0.65	High	3.27	0.74	Very high
13. I consult and share my views and knowledge with my classmates and Science teacher	2.57	0.63	High	2.87	0.68	High
14. I use my creativity and inventiveness in doing my Science work.	3.07	0.64	High	3.30	0.65	Very high
C. Science Effect and Preparation						
15. I do and finish my Science tasks on time.	2.97	0.61	High	3.13	0.73	High
16. I raise my hand to participate in Science class discussion.	2.83	0.65	High	3.03	0.76	High
17. I read and review my class notes, handouts, and textbooks between classes to make sure that I learn from these Science learning materials.	2.73	0.52	High	3.17	0.59	High
18. I prepare thoroughly before the summative test or exam in Science.	2.57	0.63	High	3.13	0.78	High
19. I give maximum effort to my Science class.	2.73	0.45	High	3.07	0.64	High
20. I always pay attention to my teacher and classmates who communicate during Science class.	2.80	0.48	High	3.30	0.75	Very high
21. I feel supported by my classmates and Science eacher.	2.90	0.55	High	3.50	0.68	Very high
22. I follow the instruction closely in doing my Science work.	2.97	0.56	High	3.43	0.68	Very high
Weighted Mean	**2.85**	**0.65**	**High**	**3.26**	**0.54**	**Very high**

Mean Range: 1.00 - 1.75 = Very Low, 1.76 - 2.50 = Low, 2.51 - 3.25 = High, and 3.26 - 4.00 = Very High

Before the conduct of the intervention, students were asked about their engagement in their science classes before the pandemic. They exemplified a high level (M=2.85, SD=0.65) of engagement in their laboratory classes. When the school year halted due to the threat of COVID-19, students were pressed to perform science experiments at home. Thus, this intervention allowed them to perform first-hand selected Science engagements at their respective barangays.

After being exposed to science laboratory activities through the intervention conducted, students' engagement has meaningfully increased. This demonstrated a very high level (M=3.26, SD= 0.54) of engagement in Science laboratory experiments. This was validated by the responses among students that they liked doing science experiments. Doing hands-on activities has resulted in a positive attitude of the students towards the science laboratory. Further, laboratory practices have improved students' problem-solving skills, gained scientific perspectives, and enabled effective, permanent, and enjoyable learning [Duban, Aydoğdu, and Yüksel 2019, 7). This was affirmed by the participants' responses.

> "Yes, I liked Project LAYAG because we only have limited face-to-face, 30-minute class, I liked Project LAYAG because we only have limited face-to-face, 30-minute class, and I find it hard to learn from the discussion of our teachers."
> *Yes po. Giganahan ko sa pagconduct sa Project LAYAG kay bisan nag-limited face to face gamay ra ang nahibal-an gihapon sa mga estudyante agi anang 30 minutes ra ang discussion sa mga teachers.*
>
> "I like the activity because the activities we performed were done outside the school. I also liked the activity because the teachers explained it to us well."
> *Ug mao pung giganahan ko sa maong kalihukan kay naa poy mga activities nga dili na nahimo sa eskwelahan. Giganahan pod ko sa Project LAYAG kay ang mga teachers nga mag lecture sa amoa mayo motudlo or maayo mo explain.*
>
> "Yes, because I have learned many things from Project LAYAG and I have many learnings that I was not able to learn in school."
> *Oo, kay daghan man ko ug makat-unan sa Project LAYAG ug daghan pud ug masabtan nga wala nako nasabtan sa school.*
>
> "What I like most in Project LAYAG was of the experiements we performed, the quizzes and the group work."
> *Ang usa pud sa ganahan nako aning Project LAYAG kay nay mga experiment nga buhaton, ug naa puy mga quiz nga answeran, naa puy grupo-grupo nga buhaton.*

The current study verified that exposure to hands-on laboratory activities increases students' interest and attitudes toward science, promotes critical thinking, and provides opportunity to perform real-world activities (Baraquia 2018, 54; Adkins 2020, 1). Learning increased as a result of the engagement and interest. Exposing students to science laboratory-based activities gave a discernible improvement in attitude toward science in terms of the final topic of choice and level of scientific comprehension.

Students' attitudes toward learning science are important predictors of their attitude towards the classroom and level of motivation (Chua and Karpudewan 2017, 1-2). These were carried out based on the teacher's designing teaching strategies thus, teaching has the potential to influence students' attitudes toward learning science by influencing their motivation and learning environment.

Significant Difference in Students' Achievement Before and After the Intervention. Before and after the intervention, there was a (14.45%) difference in the students' mean scores. To test its significant difference, t-test of dependent samples was used. One group was tested where pretest and posttest scores were obtained. The mean scores showed a significant difference at the 0.05 level of uncertainty. Thus, the alternative hypothesis was accepted. The researchers could safely report that the mean scores of the students receiving interventions and those who did not differ significantly.

Table 3: Dependent t-Test on Students' Achievement

Parameters	Mean	sd	df	t-value	p-value	Remarks
Before the Intervention	47.22	10.90	29	2.04	0.000000000578	Significant
After the Intervention	61.67	10.09				

**Significant at the 0.05 level*

Parallel to this research findings, when science outreach laboratory work is provided, students' achievement was achieved combined with classroom learning (Itzek-Greulich, et al. 2015, 1). This is also in consonance with the claim that in conducting science experience among students, achievement was higher when exposed with laboratory work that the usual traditional method (El-Rabadi 2013, 1). Laboratory experiments in teaching science was necessary to use the laboratory. Frequent utilization of these tools in experiments greatly enhanced students' achievement in class. Students' achievement significantly increased when students were taught with laboratory work related than the traditional method. Furthermore, students' attitudes showed positive and increased significantly in their mean scores utilizing laboratory environment and equipment and working collaboratively with other students (Tarhan and Sesen 2010, 5-6).

Students can connect and reinforce the theoretical concepts addressed in the lab during class instruction. Additionally, it gives the students the abilities they need in the areas of manipulation, inquiry, investigation, organization, and communication. Laboratory work helps students develop cognitive abilities such as application, analysis, synthesis, problem solving, and critical thinking.

Conclusion and Recommendations

Project LAYAG *(Laboratory at Your Actual Ground)* is the Sindangan National High School's advocacy plan for learning continuity amidst the threat of the pandemic. They say that learning doesn't stop; so, education must continue. The study concluded that exposing students with laboratory works significantly enhanced students' achievement and engagement. The level of students' achievement has reached from average to moving towards mastery level. Students were meaningfully engaged themselves to Science laboratory experiences, thus developing positive students' attitude towards learning Science concepts. The study found that students' achievement scores significantly differed when exposed to laboratory work. The recent findings signified that the use of laboratory teaching suggestively developed students' achievement and engagement in Science. It is recommended that laboratories in the heart of every Science teaching and learning and so, this must not be taken for granted. Doing laboratory manipulatives must be strengthened and established in every Science teaching in the school. Science laboratories must be institutionalized since it is where students develop the necessary scientific skills and attitudes. Reinforce teachers through Learning Action Cells (LAC) meetings for the utilization of Science equipment thus, updating them to the trends of laboratory works. Encourage them to adapt the innovative science activities even away from the unstructured instructional delivery.

Action Plan

ACTIVITY	OBJECTIVES	STRATEGY/ IES	PERSONS RESPONSIBLE	TIMELINE	RESOURCES	SUCCESS INDICATORS
Information Dissemination	To inform and disseminate the result of the action research (AR) in the District Research Congress and Division Research Congress	Present results to the District and Division Research Committees as well as during school LAC	District Research Committee Division Research Committee	December 2022	Completed AR Research Output PowerPoint	Informed and disseminated the result of the action research
Mentoring	To capacitate science teachers in crafting and validating laboratory activities and utilizing them to their respective classes	Conduct a capacity-building on the creation, validation, and utilization of the science activities during the LAC session and In-service Training (INSET).	Researcher Teachers	February 2023 onward	Project LAYAG activities PowerPoint Validation Tool compliant with DepEd standards	Utilization of the Project LAYAG activites
Evaluation	To evaluate the outcome of the activities in Project LAYAG	Gather the needed data for the evaluation	Researcher Administrators Teachers	April 2023	Evaluation Sheet Student's Scores	Sustainability Plan and Re-adoption of the Materials

References

Adkins, Donna G. 2020. “Effects of hands-on experiences on student achievement, interest, and attitude in chemistry. *Electronic Theses and Dissertations*. 343. https://scholarworks.sfasu.edu/etds/343.

Baraquia, Lee G. 2018. “Interdisciplinary Contextualization and Inquiry-Based Learning: How Engaging Can It Be?” *International Journal of Science and Engineering Investigations* Volume 7, No. 81, pp. 54-58.

Baraquia, Lee G. 2019. “Students’ Science Engagement Scale (SSES): Developing the Constructs to Measure Science Engagement. *PANAGDAIT Multidisciplinary Research Journal*. Volume 1, No. 1, pp. 99-110.

Bolliger, Dorris U. and Martin Florence. 2018. “Engagement matters: Student perceptions on the importance of engagement strategies in the online learning environment.” *Online Learning* 22(1), 205-222. doi:10.24059/olj.v22i1.1092.

Branch, Robert M. 2010. “Instructional design: The ADDIE approach.” *Springer New York* Dordrecht Heidelberg London ISBN 978-0-387-09505-9. DOI 10.1007/978-0-387-09506-6.

Chan, Cecilia K.Y. 2012. “Laboratory learning”. In: *Seel N.M. (eds) Encyclopedia of the Sciences of Learning*. Springer, Boston, MA. https://doi.org/10.1007/978-1-4419-1428-6_966.

Chua, Kah-Eng and Karpudewan, Mageswary, 2017. “The role of motivation and perceptions about science laboratory environment on lower secondary students’ attitude towards science”. Asia-Pacific Forum on Science Learning and Teaching, Volume 18, Issue 2, Article 8, p.1 https://files.eric.ed.gov/fulltext/EJ1207702.pdf.

DepEd Order No. 012, s. 2020. *Adoption of the basic education learning continuity plan for school year 2020-2021 in light of the COVID-19 public health emergency*. https://authdocs.deped.gov.ph/deped- order/do_s2020_012-adoption-of-the-be-lcp-sy-2020-2021/.

Duban, Nil, Aydoğdu, Bülent , and Yüksel, Aslı. 2019. “Classroom teachers' opinions on science laboratory practices”. *Universal Journal of Educational Research* 7(3): 772-780. DOI: 10.13189/ujer.2019.070317.

El-Rabadi, Ensaf George S. 2013. “The effect of laboratory experiments on the upper basic stage students achievement in physics”. *Journal of Education and Practice*. www.iiste.org ISSN 2222-1735 (Paper) ISSN 2222-288X (Online) Vol.4, No.8, 2013.https://www.iiste.org/Journals/index.php/JEP/article/viewFile/518 8/5306.

Ezeano, C. A., and Mary I. Ugwu. 2010. "The Effect of Laboratory Teaching Method on Senior Secondary School Students’ Academic Achievement in Inorganic Chemistry." *International journal of arts and sciences (IJOTAS)* 3.5.

Gino, Francesca, Argote, Linda, Spektor, Ella M, and Todorova, Gergana. 2010. First, get your feet wet: The effects of learning from direct and indirect experience on team creativity. *Organizational Behavior and Human Decision Processes* 111; 102–115. doi:10.1016/j.obhdp.2009.11.002.

Hosftein, Avi 2017. “The role of laboratory in science teaching and learning.” *Science Education An International Course Companion*. https://cloudflare-ipfs.com/ipfs/bafykbzaced2fj4mvqeg5ddcv4lwdmsg2k23f7coaxd4ngy2umsgq2oucx7ara?filename=%28New%20Directions%20in%20Mathematics%20and%20Science%20Education%29%20Keith%20S.%20Taber%2C%20Ben%20Akpan%20%28eds.%29%20%20Science%20Education_%20An%20International%20Course%20Companion-SensePublishers%20%282017%29.pdf.

Itzek-Greulich, Heike, Flunger, Barbara, Vollmer, Christian, Nagengast, Benjamin Rehm, Markus, and Trautwein, Ulrich. 2015. "Effects of a science center outreach lab on school students' achievement – Are student lab visits needed when they teach what students can learn at school?" *Learning and Instruction*, 38, 43–52. doi:10.1016/j.learninstruc.2015.03.00310.1016/j.learninstruc. 2015.03.003.

Malipot, Merlinda H. 2021. *This mobile lab in Antique provides 'authentic learning' to students amidst the pandemic*. Manila Bulletin. mb.com.ph/2021/10/23/this-mobile-lab-in-antique-provides-authentic-learning-to-students-amidst-the-pandemic/?amp.

Meniano, Ken Rozen C. and Tan, Rosie G. 2022. "Challenges in studying mathematics using self-learning module during COVID-19 pandemic." *American Journal of Educational Research,* Vol. 10, No. 4, 182-187. DOI:10.12691/education-10-4-4.

Singer, Susan R, Hilton, Margaret L., and Schweingruber, Heide A. 2005. *America's lab report: Investigations in school science*. https://books.google.com.ph/books?hl=tl&lr=&id=tKFVAgAAQBAJ&oi=fnd&pg=PA1&dq=+America%27s+Lab+Report:+Investigations+in+High+School+Science+(2006)&ots=NWMgtZvrQs&sig=z4IyWSUmqNqfvzKEg-yCv7FPhWs&redir_esc=y#v=onepage&q=America's%20Lab%20Report%3A%20Investigations%20in%20High%20School%20Science%20(2006)&f=false.

Shana, Zuhrieh and Abulibdeh, Enas S. 2020. "Science practical work and its impact on students' science achievement. *Journal of Technology and Science Education*, 10(2),199-215. https;//doi.org/10.3926/jotse.888.

Tarhana, Leman, and Burcin Acar Sesenb, Burcin, A. 2010. "Investigation the effectiveness of laboratory works related to "acids and bases" on learning achievements and attitudes toward laboratory." *Science Direct Procedia Social and Behavioral Sciences* 2; 2631–2636. doi:10.1016/j.sbspro.2010.03.385. https://pdf.sciencedirectassets.com.

Townsend, Lizabeth A. 2012. "Effects of laboratory-based activities on student attitudes towards science." *Masteral Thesis, Montana State University*. https://scholarworks.montana.edu/xmlui/bitstream/handle/1/2435/TownsendL0812.pdf?sequence=1&isAllowed=y.

Financial Report

ACTIVITIES	RESOURCE NEEDED	AMOUNT
Preparation and printing of research proposal	Bond paper Internet connection Materials for laboratory activity Prices	1, 200.00 500.00 1,500.00 500.00
Printing of the reading materials and other related documents	Reproduction	1,000.00
Printing and binding of completion result	Printing and binding fee	1,000.00
Snacks during the activity	Food	1,000.00
Travel Expenses	Tricycle fare Motorcycle gasoline	500.00 2,400.00
Publication of research result	Journal Publication fee	3,500.00
TOTAL		13,100.00

Appendix

Assent Form

I ____, of ______________________
(Name of Participant & Year Level) (Name of School)

hereby agree to participate in the research project entitled
____
____

I will also religiously and voluntarily attend the classes Project LAYAG. This project has been explained to me and all my queries have been catered of by the researchers.

______________________________ ________________________
Signature of Participant Date

Research Instrument

ACHIEVEMENT TEST IN GRADE 9-SCIENCE

Name: ______________________________ Score:______________
Year Level: _________________________ Date:______________

DIRECTIONS: Read and answer the following questions. Encircle the correct answer.

1. What is the most famous among the Philippine volcanoes because of its almost perfect cone-shape?

   A. Mt. Hibok-hibok B. Mayon Volcano
   C. Mt. Apo D. Mt. Province

2. What is the name of the volcano which is located on the small island of Camiguin?

3. The following are volcanic hazards directly associated with eruption EXCEPT ONE _______.

   A. lava flow B. ashfall
   C. global warming D. volcanic gas

4. A volcano that is no longer erupting but is likely to erupt again in the future is ______

   A. extinct. B. dormant.
   C. active. D. quite

5. When a volcano erupts quietly, what kind of mountain forms?

   A. shield volcano B. cinder cone
   C. composite volcano D. covered volcano

6. A reference to the process by which materials such as magma and gases from inside the Earth are forced onto the Earth's surface is ________

   A. eruption. B. lava.
   C. volcanism. D. earthquake.

7. It is a natural opening in the surface of the Earth where molten rocks, hot gases, smoke, and ash are ejected.

   A. cave B. mountain
   C. tunnel D. volcano

8. Which of the following is associated with geothermal energy?

A. Wind
B. Magma
C. Rivers
D. Ocean tides and waves

9. How can energy from volcanoes be tapped for human use?

A. People can harness geothermal energy through hydroelectric power plants.
B. People can harness geothermal energy through geothermal power plants.
C. People can harness geothermal energy through solar panels.
D. People can harness geothermal energy through plants.

10. In which direction do stars appear to move in the night sky?

A. From East to West
B. From West to East
C. From North to South
D. From South to North

11. Why do stars have color?

A. It is because of the presence of oxygen.
B. It is because of the presence of carbon dioxide.
C. It is because of temperature variation.
D. It is because of the different locations.

12. Stars appear to move in the sky because ________.

A. the Earth is rotating on its axis.
B. the universe is expanding.
C. the night sky is rotating.
D. new galaxies are formed.

13. The North Star or Polaris is located in what constellations?

A. Ursa Minor
B. Crux
C. Ursa Major
D. Cygnus

14. What are group of stars in the sky that form an imaginary picture

A. Galaxy
B. Constellation
C. Moon
D. Solar system

15. Which stars are classified as first magnitude stars?

A. bluish stars
B. faintest stars
C. brightest stars
D. yellow stars

16.What does the color of stars reveal?

A. composition
B. mass
C. diameter
D. surface temperature

17. Which of the following is a constellation?

A. Betelgeuse
B. Sirius
C. Polaris
D. Orion

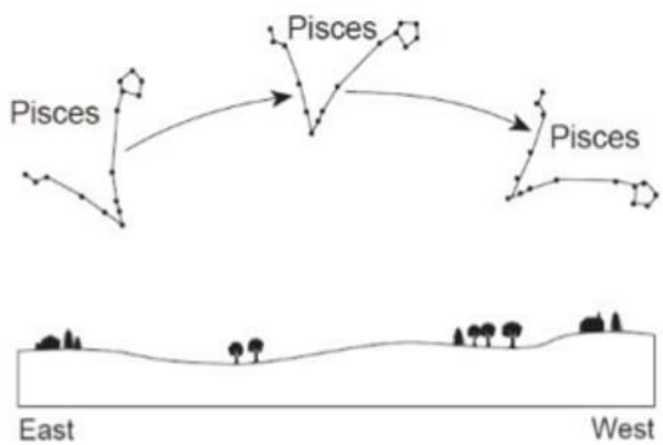
18. The Big Dipper is an asterism of what constellation?

A. Cassiopeia
B. Pegasus
C. Centaurus
D. Ursa Major

19. The North Star or Polaris is located in the constellation.

A. Crux
B. Ursa Minor
C. Cygnus
D. Ursa Major

The constellation Pisces changes position during a night, as shown in the given diagram.



Science 9 Learner's Material. First Edition. Department of Education-Bureau of Learning Resources

20. Which motion is mainly responsible for this change in position?

A. Revolution of Earth around the Sun.
B. Rotation of Earth on its axis.
C. Revolution of Pisces around the Sun.
D. Rotation of Pisces on its axis.

21. If you are located at the North Pole, where will you see the Polaris?

A. Overhead
B. Just above the horizon
C. Around 45° from the horizon
D. Polaris will not be seen in the North Pole

22. A rubber ball and a lump of clay have equal mass. They are thrown with equal speed against a wall. The ball bounces back with nearly the same speed with which it hit. The clay sticks to the wall. Which one of these objects experience the greater momentum change?

A. the clay
B. the ball
C. Both of them experience the same non-zero momentum change.
D. Both of them experience zero momentum change.

23. The impulse experienced by a body is equal to the change in its __________.

A. velocity
B. kinetic energy
C. momentum
D. potential energy

24. Which has more momentum, a heavy truck moving at 30 km/h or a light truck moving at 30 km/h?

A. Heavy truck
C. Both have the same momentum
B. Light truck
D. Cannot be determined

25. Two objects having equal masses and velocities collide with each other and come to a rest. What type of a collision is this and why?

A. Elastic collision, because internal kinetic energy is conserved
B. Inelastic collision, because internal kinetic energy is not conserved
C. Elastic collision, because internal kinetic energy is not conserved
D. Inelastic collision, because internal kinetic energy is conserved

26. If an object's velocity is constant, what is its momentum proportional to?

A. Its shape
B. Its mass
C. Its length
D. Its breadth

27. What is the difference between momentum and impulse?

A. Momentum is the sum of mass and velocity. Impulse is the change in momentum.
B. Momentum is the sum of mass and velocity. Impulse is the rate of change in momentum.
C. Momentum is the product of mass and velocity. Impulse is the change in momentum.
D. Momentum is the product of mass and velocity. Impulse is the rate of change in momentum.

28. What is projectile motion?

A. Projectile motion is the motion of an object projected into the air and moving under the influence of gravity.
B. Projectile motion is the motion of an object projected into the air and moving independently of gravity.
C. Projectile motion is the motion of an object projected vertically upward into the air and moving under the influence of gravity.
D. Projectile motion is the motion of an object projected horizontally into the air and moving independently of gravity.

29. Which illustrates projectile motion?

A. Running
B. Driving a car
C. Kicking a soccer ball
D. Dropping a stone from the top of the building

30. An object is launched at an angle. How does the final velocity compare to the initial velocity if it lands at the same horizontal level?

A. Opposite B. Unable to determine
C. Equal and Opposite D. Equal

God Bless You!

Name: ___________________________________ **Year Level:** ___________

Directions: The following items describe students' engagement in Science class.
Please encircle the number that best represents your response as to:
4 – Very True to Me; 2 – Not True to Me;
3 – True To Me; 1 – Very Not True to Me.

A. Engagement on Science Lessons and Tasks	**4**	**3**	**2**	**1**
1. My Science lessons and performance tasks are important and relevant to my life.				
2. My Science lessons and performance tasks are interesting and meaningful.				
3. My Science lessons and performance tasks are realistic and contextualized.				
4. I am inspired to learn new things in Science class.				
5. My Science lessons and performance tasks stimulate my curiosity.				
6. I feel encouraged and interested to work on something in Science class.				
7. I am inspired and prepared to come to Science class every day.				
B. Science Learning Involvement	**4**	**3**	**2**	**1**
8. I am having fun during collaborative learning activities in Science.				
9. I want to ask my Science teacher or classmates personally or through social media if I have a trouble understanding a lesson.				
10. I want to investigate and understand the societal and environmental impacts and implications from science and technology.				
11. I participate and interact during small-group discussions in Science.				
12. I appreciate the nature of the scientific method or process.				
13. I consult and share my views and knowledge with my classmates and Science teacher.				
14. I use my creativity and inventiveness in doing my Science work.				
C. Science Effort and Preparation	**4**	**3**	**2**	**1**
15. I do and finish my Science tasks on time.				
16. I raise my hand to participate in Science class discussions.				
17. I read and review my class notes, handouts, and textbook between classes to make sure that I learn from these Science learning materials. 18. I prepare thoroughly before the summative test or exam in Science.				
19. I give maximum effort to my Science class.				
20. I always pay attention to my teacher and classmates who communicate during Science class.				
21. I feel supported by my classmates and Science teacher.				
22. I follow the instructions closely in doing my Science work.				

Baraquia, L. (2019). Students' Science Engagement Scale (SSES): Developing the Constructs to Measure Science Engagement. PANAGDAIT Multidisciplinary Research Journal, 1(1), 99-110