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Activity - Based Learning in Teaching Earth Science

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Abstract — The study aims to evaluate the performance of the students using Activity- based Learning in teaching Earth Science. It was conducted in Aurora National High School during the First Semester of school year 2019-2020. Forty respondents from the TVL sections were being tested, treated and validated during the conduct of the study. To determine the significant difference between the use of Activity- based Learning and Conventional Method in teaching Earth Science, pretest and posttest of the first and second trial runs were administered. The conceptual framework of the study was anchored by the Student Centered Learning. Two teaching methods were conducted, namely; the use of Activity- based Learning, and the use of Conventional way of teaching. The performance of the students were evaluated using the Activity- based Learning with the lesson on Weathering on the first topic and Mass Movement on the second topic, respectively. It utilized the homogenous, random sampling technique. The students were chosen homogenously from the population of each section. Draw lots were made and they picked one rolled paper. The findings revealed that there was an increase in the level of performance of the students using the Activity-based Learning method. It shows that there was an increase in the level of achievement in the first and second trial runs which is 73.89 and 75.88, respectively. The result indicates that Activity-based Learning is an effective method in teaching science. It was found to be appropriate for improving the performance of the learners. It was also revealed that there was a decrease in the level of performance of the students using the conventional method. There was a decrease in the level of achievement in the first and second trial runs which is from 45.40% to 29.71%. The result indicates that the conventional method is ineffective way of teaching science concepts. Results implied that Activity-based Learning has proven to be highly effective in enhancing student engagement and comprehension. It far outweighs traditional teaching methods, making it a valuable tool in modern education.

Keywords — Activity-Based Learning, Conventional, Experiential, Hands-on, Weathering, Mass movement

I. Introduction

The field of science is commonly acknowledged as one of the most challenging areas of study. The intimidating nature of science courses deters many students from pursuing them. Those who decide to enroll often encounter academic struggles or make the choice to change majors in their early academic journey.

Science students often encounter various challenges that make their courses challenging, resulting in decreased participation in the science classroom and increased drop-out rates. One of these problems includes difficulty in understanding abstract concepts and lack of hands-on experience. To confront this distressing issue, engaging the students into hands-on activities helps them to get motivated and engage in the learning process.

One effective way in introducing this method is through Activity-based Learning strategy. Activity-Based Learning involves teaching the students how to observe everything around them. However, this does not imply that we should do away with textbooks. Activity-Based Learning and text-based instruction can be successfully combined (Protein Man, 2015).

Activity- based teaching enhances student motivation and improves academic achievement in education at higher secondary level. Teaching styles attract students and play a positive role in student motivation and improve academic achievement for better results in learning (Anwer, 2019).

Activity-based learning is essential in science education because it allows students to engage in hands-on, real-world applications of scientific concepts, fostering a deeper understanding and retention of complex ideas. By participating in experiments, simulations, and projects, students can develop essential skills such as critical thinking, problem-solving, and collaboration, while also developing a sense of curiosity and inquiry-based learning. This approach helps to break down abstract concepts into tangible and relatable experiences, making science more accessible and enjoyable for students of all learning styles.

Conceptual Framework

The conceptual framework of the study was anchored by the Student Centered Learning. Student-centered learning gives students the opportunity to decide two things: what material they learn and how they learn it. It helps high schools prepare students not only with academic knowledge, but also with the skills of self-direction, curiosity, creativity, and collaboration they'll need for future success (Sudderth, 2019).

This study assessed the levels of achievement of students exposed to two different variables manifested in the experimental and control groups. The experimental group and control group employed the use of Activity- based Learning and Conventional Method of teaching, respectively.

The study has conducted two teaching methods, namely; the use of activity- based learning, and the use of conventional way of teaching. The task of the researcher in this study was to evaluate the performance of the students via activity- based learning using the lesson on Weathering on the first topic and Mass Movement on the second topic, respectively.

Before and after taking up each topic of the two trial runs, pretest and posttest were conducted to assess the students' learning about the lessons which shall be conducted in the experimental and control groups. The results of each group were then evaluated and the significant difference of the level of performance between the pretest and posttest, and between two groups, the conventional and the experimental method was treated, tested and compared.

Statement of the Problem

This study aimed to evaluate the performance of the students using Activity- based Learning in teaching Earth Science among Grade 11 TVL Students of Aurora National High School during the first semester of S.Y. 2019-2020.

Specifically, it sought to answer the following queries:

1. To what level is the students' performance of the experimental group (using Activity – based Learning) in the pretest and posttest results during the first and second runs?
2. Is there any significant difference of the students' performance in the experimental group (using Activity- based Learning) in the pretest and posttest results during the first and second trial runs?
3. To what level is the students' performance of the control group (using conventional method) in the pretest and posttest results during the first and second trial runs?
4. Is there a significant difference of the students' performance in the control group (using conventional method) in the pretest and posttest results during the first and second trial runs?
5. What is the percent of increase of students' performance in the experimental group and control group during the first and second trial runs?
6. Is there any significant difference of the students' performance of the pretest results between the experimental group (using Activity- based Learning) and control group (using conventional method) in the first and second trial runs?
7. Is there any significant difference of the students' performance of the posttest results between the experimental group (using Activity- based Learning) and control group (using conventional method) in the first and second trial runs?
8. Based on the findings, what implications can be drawn to improve the learning in science concepts of the students?

Hypotheses

The following hypotheses were tested using the 0.05 level of significance:

1. There is a significant difference of the students' performance in the experimental group (using Activity- based Learning) as revealed in the pretest and posttest results during the first and second trial runs.

2. There is a significant difference of the students' performance in the control group (using conventional method) as revealed in the pretest and posttest results during the first and second trial runs.

3. There is a significant difference of the students' performance of the pretest results between the experimental group (using Activity- based Learning) and control group (using conventional method) in the first and second trial runs.

4. There is a significant difference of the students' performance of the posttest results between the experimental group (using Activity- based Learning) and control group (using conventional method) in the first and second trial runs.

Scope and Limitations of the Study

This study evaluates the effects of Activity- based Learning in teaching Earth Science for TVL students. It was focused in the Aurora National High School, Aurora, Zamboanga del Sur during the school year 2019-2020. The research participants of the study were the two sections of the Grade 11 Technical Vocational Livelihood Students. This study has utilized the experimental method of research. Experimental group was used by using the activity- based learning to meet the individual needs of the learners. To determine the significant difference between the uses of activity- based learning and conventional method in teaching Earth Science, pretest and posttest of the first and second trial runs were administered.

Literature Review

Activity- based Learning

Albadi and David (2019) conducted a study to determine the influence of activity based learning on students' achievement in comparison to passive learning and detect students' views towards activities. For this purpose, mixed research method was utilized, gathering data from a public school in Oman. Quasi-experimental research design with pre-test and post-test was used in the research with a sample of 24 male students from 12th grade. The result of the study indicated that activity based learning had a positive effect on students' achievement. Students believe that activity based learning enhance understanding, increase a sense of responsibility, create attractive learning environment and increase achievement. The study therefore contents that activity based learning has significant impact on student's academic achievement.

Sarpong, et al (2020) investigated the impact of activity-based teaching method used in teaching social studies on students' retention and academic performance within the Sekyere South District of Ashanti Region. The study adopted the quasi-experimental research design, using both questionnaire and 40-multiple choice tests items in its investigation. The study found that activity-based teaching method was beneficial to students learning social studies in junior high school in many ways. They include: students develop high-order thinking skills, retain social studies'

concepts more easily, become active in class, interests are sustained, maximize potential in performing well in class.

Furthermore, Mustapha et al (2020) revealed that Activity-Based learning has improved the students` outcomes in English language and Basic Science. The study examines how the use of the activity-based learning strategy enhances students` outcomes in the two core subjects taught in the upper basic levels in Nigeria. The study's findings indicated that activity-based learning significantly affects the students` outcomes in English language and Basic science subjects. Therefore, it is recommended that teachers should promote active learning through the use of hands-on activities.

A study was conducted to determine the effects of place-based and activity-based learning approaches on students' achievement, interest and retention in technical education. The study constituted a total number of 122 subjects, 63 for the place-based education, while 59 for the activity-based learning. The instruments used for data collection were Technical Education Cognitive Achievement Test (TECAT), Technical Education Psychomotor Achievement Test (TEPAT) and Technical Education Interest Inventory (TEII). The reliability coefficient obtained was 0.78. Mean was used to answer the research questions; while ANCOVA was employed to test the hypotheses. The study revealed that students taught Technical education using the place-based education instructional approach had a higher mean score than students taught using the activity-based learning teaching method in cognitive achievement test, psychomotor achievement test and test for retention of learning. (Usman, et al, 2020).

Anjur (2015) conducted a study on students in the course Physiology and Disease are exposed to basic physiological concepts using novel hands on methods to help them understand the material better. In order to observe the effect of hands on activities on student understanding, students made heart models to study the anatomy and physiology of the heart. Their scores on the heart unit assessment were evaluated for understanding by correlating their scores on heart model building with specific transfer questions on the heart unit. It was observed that students who spent more time on building their heart models also seemed to be better equipped to answer transfer questions on the heart unit test.

Conventional Teaching Method

The conventional teaching methodology has severally been condemned as inefficient, rigid and outdated by scholars and researchers who are intent on furthering the course of new instructional approaches. Often, educationists evade the simple confrontation of what the supposed duty of a good teacher is. This discourse took on the issues surrounding conventional mathematics teaching with a focus on the adaptability of the instructional approach to encompass present-day technology and cultural augmentation. The conventional job of the teacher was considered in detail as a task of society building, a mission of re-invention, and a position of accountability. The

submission of this appeal was that the current global best practice in the field of mathematics education should dictate what amounts to conventional teaching. (Abah, 2020).

A case study was conducted at INTI International University, Malaysia where it realized the limitations of conventional teaching and had taken initiatives to encourage lecturers to adopt a more learner-centred teaching approach. This study compared the conventional teaching with the multimedia learning and also the online learning in terms of their implications on learner understanding and learner motivation through the use of pre-test/ post-test, surveys and students' comments. The study found out that students performed better in the web learning environment. Students accepted the use of multimedia learning module in the multimedia learning environment and also in the web learning environment. The interactivity provided in the multimedia learning module helped students to achieve better understanding and motivation. (Li, 2016).

A study was conducted on the use of lecture capture, which allows a live lecture to be recorded and packaged with classroom media and delivered online to many more students than a traditional face-to-face class. This article studies the selection process and educational outcome differences between students enrolled in a lecture capture and a face-to-face course in economic principles. Students could select either course format, both with the same instructor and course requirements, without capacity restrictions. It was found out that students' attitudes toward online learning are the chief determinant of their choice of class over demographics, opportunity cost measures, or past online experiences. Findings suggest that lecture capture students perform as well as those who take a face-to-face course when not accounting for self-selection. When selection is taken into account, lecture capture is not significantly worse than face-to-face. (Bosshardt & Chiang, 2016).

II. Methodology

Research Design

The study used the experimental research design in obtaining the necessary data. Experimental design allows researchers to control for extraneous variables that might affect the outcome, ensuring that any changes observed are due to the activity-based learning intervention. Randomizing participants to either an experimental or control group helps to minimize confounding variables and ensures that both groups are equivalent at the beginning of the study. Activity-based learning is a specific intervention that can be implemented and manipulated in an experimental design, allowing researchers to isolate its effects. It enables researchers to measure the outcome variable (e.g., student achievement, attitudes, or behaviors) with precision and accuracy. It also allows for a direct comparison between the activity-based learning group and a control group, providing a clear understanding of the effectiveness of the intervention.

Research Environment

The study was conducted in Aurora National High School located in the district of Aurora, Division of Zamboanga del Sur.

For the 2019-2020 school year, Aurora National High School had 2,304 students enrolled. This makes the school a big school, with 761 more students than the average school and 843 more students than the average school in Aurora.

Research Participants

The research participants of this study were the Grade 11 TVL Students of the subject school. As shown in the table 1, there are two sections in the 11th grade of Aurora National High School, Aurora, Zamboanga del Sur, School Year 2019-2020. They were homogenously chosen with population of 41 and 40 students for the TVL- ICT and TVL- HE.

Table 1. The Research Participants Grade 11	Population	Sample Size
TVL- ICT	41	20
TVL- HE	40	20
Total	81	40

Sampling Techniques

The study utilized the homogenous, random sampling technique. Before the actual conduct of the study, the students were chosen homogenously from the population of each section. Draw lots were made and they picked one rolled paper. Inside the rolled are numbered by even and odd numbers. Whoever picks the even number was chosen as the control group, while those with the odd numbers were not included since 50% only were the research participants. The same procedure was made for the other section to be chosen as the experimental group. When conducting an activity-based learning study, a homogenous sampling technique is crucial to ensure that the participants are similar in certain characteristics, which helps to minimize potential biases and improve the validity of the results. Randomly selecting participants from a population ensures that the sample is a representative of the population.

Research Instruments

The study used two sets of lesson plan in the utilization of the two teaching approaches in the two trial runs. The first set of lesson plan constituted the first topic (Weathering) for the first trial run and second set of lesson plan constituted the second topic (Mass Movement) as the second trial run. Pretest and Posttest was used as measuring tools in the experiment. Pretest and Posttest was used as measuring tools in the experiment. Both groups were given pretest at the beginning, and posttest after each trial run. The instruments were carefully developed by the researcher and utilized the gain score validity index, which is calculated by subtracting the pretest score from the

posttest score and dividing by the standard deviation of the pretest scores. This index measures the change in scores from pretest to posttest and provides a sense of how much students have learned.

Data Gathering Techniques

The researcher has obtained permission to conduct a study from the Office of the Schools Division Superintendent of the Division of Zamboanga del Sur and from the Office of the School Principal of Aurora National High School. On the day of first trial run of the experimental and control groups, the researcher has explained to the respondents the purpose of the test and its directions. It was begun with the administration of the pretest and to be checked afterwards. At the end of the discussion, the posttest was administered. The answers of the students were checked and the result was analyzed and interpreted. The results of the pretest and posttest was validated through the Mean Percentage Score from each group then tested using the t- test. To make the results more reliable, an SPSS was used to validate.

Statistical Treatment

The mean percentage score (MPS) of the respondents in the pretests and posttests was interpreted in order to determine the effectiveness of the activity- based learning. The T- test was used to assess whether the means of two groups are statistically different from each other. The processing of data was done using the Software Statistical Package for the Social Science (SPSS) for more accurate and dependable results.

III. Results and Discussion

Level of Students' Performance Using Activity- Based Learning

Table 2 presents the data on the level of students' performance using activity- based learning of the experimental group as revealed in the pretest and posttest during the first and second trial runs.

Table 2 Level of Students' Performance Using Activity- based Learning (Experimental)

Runs	Pretest		Posttest		% Increase
	(MPS)	Descriptive Equivalent	(MPS)	Descriptive Equivalent	
1. First Trial	45.00	Very Poor	78.25	Good	73.89
2. Second Trial	42.50	Very Poor	74.75	Good	75.88

Hypothetical Mean Range:

90.0 – 100 - Excellent
80.0 -- 89.9 - Very Good
70.0 - 79.9 - Good
60.0 - 69.9 - Fair
50.0– 59.9 - Poor
Below 50 - Very Poor

As shown in the table, the findings revealed that there was an increase in the level of performance of the students from pretest to posttest in the two trial runs using the experimental method. The table shows that there is an increase in the level of achievement in the first and second trial runs which is 73.89 and 75.88 respectively. The result indicates that the experimental method is an effective method in teaching science. Activity-based teaching found to be appropriate for improving the performance of the learners. Use of activities supplements the study material. Use of activities helps the teachers to explain the subject-matter easily. It is also more effective for the development of higher order thinking skills in the students. (Noreen, 2020).

Level of Students' Performance Using the Conventional Method

Table 3 presents the data on the level of students' performance using the conventional method as revealed in the pretest and posttest results during the first and second trial runs.

Table 3 Level of Students' Performance Using Conventional Method (Control)

Runs	Pretest		Posttest		% Increase
	(MPS)	Descriptive Equivalent	(MPS)	Descriptive Equivalent	
1. First Trial	43.50	Very Poor	63.25	Fair	45.40
2. Second Trial	43.75	Very Poor	56.75	Poor	29.71

Hypothetical Mean Range:

90.0 – 100 - Excellent
80.0 -- 89.9 - Very Good
70.0 - 79.9 - Good
60.0 - 69.9 - Fair
50.0– 59.9 - Poor
Below 50 - Very Poor

As shown in the table, there is a decrease in the level of achievement in the first and second trial runs which is from 45.40% to 29.71%. The findings revealed that there is a decrease in the level of performance of the students from pretest to posttest in the two trial runs using the conventional method. The result indicates that the conventional method is ineffective way of teaching science concepts. Traditional teaching methods in science education did not lead to significant improvements in students' learning outcomes. (Ozdemir & Demirel, 2015).

Summary Data

Table 4 shows the percentage increase of students' performance as revealed by the results of the two trial runs.

Table 4 Summary Data of the Percentage Increase of Students' Achievement

Trial Runs	Percent Increase of the Students' Performance from the Pretest to Posttest	
	Experimental	Control
First Trial Run Second Trial Run	73.89 75.88	45.40 29.71
Overall Average Percent Increase of Students' Performance	74.88	37.55

As shown in the table, the overall average percent increase of students' performance in the experimental group using the activity- based learning is 74.88 and 37.55 for the control group that employed the conventional method of learning. Results implied that the use of activity- based learning is an effective strategy of teaching science to Grade 11 students. In a research published in the Journal of Chemical Education found that students who designed and conducted their own experiments showed a deeper understanding of chemical reactions compared to those who received lectured instruction (Lazonder & Swaak, 2015).

Testing of Hypothesis

Four hypotheses were proposed for testing in this study using the 0.05 level of significance.

Hypothesis No. 1. There is a significant difference of the students' performance in the experimental group (using the Activity- based Learning) as revealed in the pretest and posttest results during the first and second trial runs.

The above hypothesis was tested using the t- test, with results shown in table 5.

Table 5 Test of Significant Difference in the Students' Performance Using Activity- based Learning (Experimental) between Pretest and Posttest

Trials	T-Test Value	df	Probability Value	Decision of the Hypothesis	Interpretation
1. First Trial Run	8.729	38	0.000	Accept	Significant
2. Second Trial Run	9.220	38	0.000	Accept	Significant

In the first trial run, the T- test value is 8.729, the df is 38, and the probability value is 0.000. A significant difference was established hence, the *hypothesis* was accepted. In the second trial run, the T- test value is 9.220, the df is 38, and the probability value is 0.000, which established a significant difference and accepted the hypothesis.

The results of the tests indicated that a significant difference in the level of performance was established between the pretest and posttest in the two trial runs.

Hypothesis No. 2. There is a significant difference of the students' performance in the control group (using conventional method) as revealed in the pretest and posttest results during the first and second trial runs.

The above hypothesis was tested using the t- test, with results shown in table 6.

Table 6 Test of Significant Difference in the Students' Performance Using Conventional Method (Control) between Pretest and Posttest

Trials	T-Test Value	df	Probability Value	Decision of the Hypothesis	Interpretation
1. First Trial Run	5.927	38	0.000	Accept	Significant
2. Second Trial Run	4.310	38	0.000	Accept	Significant

In the first trial run, the T- test value is 5.927, the df is 38, and the probability value is 0.000. A significant difference was established and hypothesis was accepted. In the second trial run, the T- test value is 4.310, the df is 38, and the probability value is 0.000. A significant difference was established and hypothesis was accepted.

The results of the test indicated that a significant difference in the students' performance using conventional method was established between the pretest and posttest in the two trial runs.

Hypothesis No. 3. There is a significant difference of the students' performance of the pretest results between the experimental group (using Activity- based Learning) and control group (using conventional method) as revealed in the pretest results of the two trial runs.

The above hypothesis was tested using the t- test, with results shown in table 7.

Table 7 Test of Significant Difference on the Students' Performance as Revealed in the Pretest Results between Activity- based Learning and Conventional Method of the First and Second Trial Runs

Trial Runs	T-Test Value	df	Probability Value	Decision of the Hypothesis	Interpretation
1. First Trial	0.433	38	0.667	Reject	Not Significant
2. Second Trial	0.402	38	0.004	Reject	Not Significant

In the first trial run, the T- test value is 0.433, the df is 38, and the probability value is 0.667. The *hypothesis* was rejected and significant difference was not established. In the third trial run, the T- test value is 0.402, the df is 38, and the probability value is 0.690. The hypothesis was rejected and no significant difference was established.

Hypothesis No. 4. There is a significant difference of the students' performance of the posttest results between the experimental group (using Activity- based Learning) and the control group (using conventional method) in the threetrial runs.

This hypothesis was tested using the t- test, with results shown in table 8.

Table 8 Test of Significant Difference on the Students' Performance as Revealed in the Posttest Result between the Activity- based Learning and Conventional Method of the First and Second Trial Runs

Trial Runs	T-Test Value	Df	Probability Value	Decision of the Hypothesis	Interpretation
1. First Trial	4.064	38	0.000	Accept	Significant
2. Second Trial	5.267	38	0.000	Accept	Significant

As shown in the table above, T- test values of the first and second trial runs are 4.064 and 5.267 respectively with a df of 38 and probability values of 0.000 which is less than the 0.05 level of significance, hence the hypothesis was accepted.

The result of the test indicated that a significant difference on the students' performance using the Activity- based Learning and conventional method was established during the posttest in the two trial runs.

IV. Conclusion

The use of activity- based learning greatly helped to improve the level of performance of the students in the field of science. On the other hand, the use of conventional method was still found to be an effective method in teaching science. However, the use of activity- based learning was proven to be more effective than utilizing the traditional way of teaching. Activity-based learning has proven to be highly effective in enhancing student engagement and comprehension. By actively participating in hands-on activities, students are able to apply theoretical knowledge to real-life situations, fostering a deeper understanding of the subject matter. This approach also promotes critical thinking skills and encourages creativity. Overall, the benefits of activity-based learning far outweigh traditional teaching methods, making it a valuable tool in modern education.

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