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IMPROVING STUDENTS' PARTICIPATION AND ACHIEVEMENT IN SCIENCE THROUGH HOME-BASED ACTIVE LEARNING ACTIVITIES

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ABSTRACT

This study aimed to address the challenges encountered during online distance learning where several hands-on and active learning activities were not experienced by the students in school due to the pandemic and other unforeseen calamities. This study carried out home-based active learning activities using the ADDIE model. The study utilized the pre-experimental research design, specifically a one-group pretest-posttest design, to collect information about the participation and achievement of Grade 11 students section Integrity in Earth and Life Science class in the Senior High School Program of Gingoog City Comprehensive National High School. The students' participation was measured regarding their output submission using pictures or video as specified in the active learning activities. The students' engagement and motivation were measured using a survey questionnaire containing 10 Likert-type items developed by the researcher and validated by experts. A researcher-made pretest consisting of 30 multiple-choice science questions was administered to determine the student's achievement. Data shows that students' participation has increased from 50 % to 80 %, as reflected in their prompt submission of outputs. It is perceived to be very effective in engaging students to participate in both online and face-to-face learning. The achievement level of students before the intervention significantly varies from that in the posttest ($p<0.05$). The result implies that the home-based active learning activities significantly improved the students' performance in Earth and Life subjects, where 61 % of the class obtained an outstanding proficiency level (90 and above) of their grade.

Keywords: *Home-based activities, active learning, Earth & Life Science, participation, achievement in science*

INTRODUCTION

Science content and science processes are intertwined in the K to 12 Curriculum. Learners will have difficulty utilizing science process skills without the content since these processes are best learned in context. Organizing the curriculum around situations and problems that challenge and arouse learners' curiosity motivates them to learn and appreciate science as relevant and valuable. Teaching science entails going beyond the content to help students understand how they know and what they know and give them the tools they need to think scientifically. Most importantly, it allows students time to reflect on their participation in the process (Schwartz et al., 2004). Rather than relying solely on textbooks, varied hands-on, minds-on, and hearts-on activities will be used to develop learners' interest and let them become active learners (K to 12 Science Curriculum Guide, 2016). Active learning can optimize the learning process in science (Pratiwi et al., 2015).

Active learning is one of the teaching methods used in science teaching that focuses on student engagement and interaction (Nguyen et al., 2016). Active learning is the concept of instruction that focuses on using student-centric, instructor-led activities and instructional methods (Hartikainen et al., 2019). It is also known as a learner-centered approach, encompassing teaching methods that shift focus from teachers to students. It allows students to take their education into their own hands and enables them to "learn how to learn" (Akinoglu & Tandogan, 2006).

Several studies have pointed out active learning increases student performance and engagement in science, engineering, and mathematics (Freeman et al., 2014; Nurbavliyev, 2022; Munna and Kalam, 2021). An active learning environment can also foster many positive effects for students, such as an increase in students' attitude towards science and finding more enjoyment in the subject.

However, teaching science has been challenging when students do not experience several hands-on and active learning activities in school because these are crucial to scientific learning. During most challenging and uncertain times due to the pandemic and other unforeseen calamities, home-based learning using several multimedia platforms has been introduced in all schools to make learning possible at home, without physical interaction near other students and teachers. Hands-on activities in the school setting, like laboratory experimentation, field investigation, group or collaborative work, and other related work, are put on hold.

This year, 2022, Gingoog City Comprehensive National High School has recommended limited face-to-face classes. However, it is still integrating online

distance learning for all tracks and strands of the Senior High School program due to the COVID-19 incidence. Some problems encountered for the first few weeks were around students' engagement and active involvement aside from difficulties with internet access, intermittent connection, and absence of gadgets. More than 50% of the students were less engaged in the lesson topics, as evidenced by their low scores in formative tests and submission of outputs. These pose imminent problems because the concepts and in-depth understanding of the learning competencies might not be achieved.

On this ground, the researcher has developed an innovative strategy to design home-based active learning activities that will engage students to watch video lessons and actively accomplish the tasks at home. These are simple, safe, and doable activities that will allow them to make the process of experimentation, physical experience, practicing a skill/procedure, data collection or analysis, and even working collaboratively with people at home. These likely encourage students' participation and active knowledge checking to ensure that key concepts are meaningfully understood.

FRAMEWORK

Science education is primarily the teaching and learning of science for all learners across ages within the public. It encompasses science content, science inquiry & process, social science, and teaching pedagogy. Active learning is one of the teaching methods used in science teaching that emphasizes student engagement and interaction (Nguyen et al., 2016).

Active learning, in which students become active participants in the learning process, is imperative for developing student skills. In active learning, students shift from being passive recipients of knowledge to being active participants in activities that include analysis, synthesis, evaluation, and developing skills, values, and attitudes (Shivan et al., 2000). Active learning builds on constructivist learning theory, which suggests that people learn by connecting new ideas and experiences to what they already know. Active learning is the concept of instruction that focuses on using student-centric, instructor-led activities and instructional methods (Hartikainen et al., 2019). Active learning increases student performance in science, engineering, and mathematics, where examination scores improved by about 6% in active learning sections compared to students in classes with traditional lecturing (Freeman et al., 2014).

The study of Munna and Kalam (2021) in 50 higher education levels has shown that active learning activities such as gamification, collaboration, and peer learning improved students' cognitive, learning, and emotional behavior, thus

boosting their engagement. Furthermore, Matthias (2014) focused on active learning and how it affects student attitude and achievement in biology class. A Biology Attitude Survey was administered at the beginning and middle of the semester to determine if student's attitudes towards biology improved from the active learning setting. The ANOVA revealed that students with high achievement in the course had a higher attitude towards biology. In addition, Zhao et al. (2022) determined the impact of the home-based learning experience during COVID-19 on future intentions to study online in Chinese universities. The results indicate that the experience of home-based learning significantly influenced Chinese university students' attitudes, which positively influenced their intention to continue online learning.

In the Philippines, Villanueva and Campos (2022) conducted a study to determine home-based learning activities about the academic achievement of Grade 6 learners in Plaridel North District, Municipality of Plaridel, Misamis Occidental. The descriptive-correlational design was used in the study. The researcher-made Home-Based Learning Activities Questionnaire was used as a research instrument in determining the learners' learning activities at home. Results revealed that the respondents had a very high engagement in home-based learning activities, and their academic achievement was generally very satisfactory. The level of engagement in home-based learning activities was highly influential to the learners' academic achievement. The efforts extended for modular distance learning can determine what learners can achieve academically.

MATERIALS AND METHODS

The study utilized the pre-experimental research design, specifically the one-group pretest-posttest design. This study was designed to collect information about the participation/ involvement and achievement of Grade 11 students in the section Integrity (SY 2021-2022) in the Earth and Life Science class in the Senior High School Program of Gingoog City Comprehensive National High School.

The researcher sent a letter of request for the approval of the conduct of the study to the School Principal and the Schools Division Superintendent through the office of the SEPS Planning & Research. The primary objectives were clearly stated to ensure the welfare of the students and the researcher. Ethical considerations were carefully observed in this study. The researcher ensured that the participants were not harmed in any way. Full consent and respect of research participants were also taken into full consideration.

The students' participation was measured regarding their output submission using pictures or video as specified in the active learning activities. The

students' engagement and motivation were measured using a survey questionnaire containing 10 Likert-type items developed by the researcher and validated by a group of experts. The researcher made a pretest consisting of 30 multiple-choice items to determine the student's achievement. The same set of questions was given as a posttest.

The researcher designed and implemented home-based active learning activities using the ADDIE model to determine the student's involvement in science class. It involved five stages: Stage 1- Analysis; Stage II- Design; Stage III- Development; Stage IV- Implement; and Stage V- Evaluation.

Analysis Phase

A 30-item multiple choice test was constructed containing Earth & Life Science questions subject for validation and item analysis. This was given as a pretest. The same set of questions was provided as a posttest. This aimed to determine the instructional problem, the instructional goals or objectives, and the learner's existing knowledge and skills. The questions were modified from the multiple-choice test developed by Campbell and Reece et al. (2010).

Design and Development Phase

The design stage involved focus group discussions with teachers to design home-based active learning activities to actively engage Grade 11 students in watching the Earth and Life Science video lesson and accomplishing the tasks.

Science experts were asked to assess and validate the different home-based activities in the development stage. The objectives and content of the activities were based on the learning competencies found in MELCs. Final revisions followed to incorporate the comments and suggestions made during the validation.

Implementation Phase

In the utilization and implementation of the materials crafted during the intervention, the following mechanics were followed:

a. *Schedule.* Home-based active learning activities were integrated into the video lesson and streamed via the Facebook page every Monday from 7:50 to 8:50 in the morning. These were part of the performance tasks for the week. The students watched the video for instructions and were given enough time to perform the activities with the rubrics for the scoring guide.
b. *Duration of the intervention.* This intervention was done for the two quarters of the current school year.
c. *Learning Instruction.* The teacher utilized the developed home-based active learning activities which were based on the identified students' learning needs and anchored on these elements: Learning objectives, Learning instructions & procedure, observation and analysis, and conclusion/generalizations.

d. Timeliness. All lessons conducted or discussed during the intervention /remediation, as contained in the learning materials, had specific dates and timelines.

e. Monitoring. A weekly monitoring for submission was conducted to measure the effectiveness of the intervention. A video or pictures were the primary evidence for an accomplishment report based on the rubrics.

Evaluation Phase

The students' participation was measured regarding their output submission using pictures or video as specified in the active learning activities. The students' engagement and motivation were measured using a survey questionnaire containing 10 Likert-type items. To determine the student's achievement in terms of proficiency level, a researcher-made pretest consisted of 30 items of multiple-choice containing science questions. The same set of questions was given as a posttest.

All instruments underwent validation and reliability tests. The items were presented to experts in science and thoroughly reviewed. Then, the comments and suggestions were integrated after that. Then, these were further piloted to 20 students and subjected to a reliability test.

The data obtained from the survey were analyzed by utilizing both descriptive and inferential data analysis procedures. The percentage was used to determine the students' participation in different home-based active learning activities. In contrast, the weighted mean was used to assess the effectiveness of the other interactive activities in improving the students' engagement/motivation in online distance learning as perceived by the students. To test if there is a significant difference in the pre/post-test mean gain of students, the t-test for dependent samples was computed.

RESULTS AND DISCUSSION

On the Percentage of students' Participation in Different Home-Based Active Learning Activities

Table 1 shows the percentage of students' participation in different home-based active learning activities per week and the average % for the two quarters. A total of fifteen (15) active learning activities were given in the two quarters for Earth and Life Science.

As presented in Table 1, 80 % of the students are compliant and prompt in submitting outputs as specified in the active learning activities. This indicates that students' participation in Online Distance Learning via FB video lesson presentation

has improved compared to the preliminary observation that less than 50 % are in attendance.

Table 1. *Percentage of Students' Participation in Different Home-Based Active Learning Activities*

Act. No.	Active Learning Activities	Output Submission (%)
1	Rock samples at home	85.25
2	Uses of rocks at home	83.61
3	Rock formations in the community	86.89
4	Different hazards at home/community/country	91.80
5	Areas prone to hazards in the community	78.69
6	Activities to slow it down /prevent some hazards	77.05
7	Activities to prevent/mitigate destructions on control coastal processes	77.05
8	Threats and Risks to living organisms at home/community	90.00
9	Taking care of the environment	77.50
10	Plant propagation at home	92.50
11	Biotic/environmental resistance	80.00
12	Best Practices in taking good care of one's body	72.50
13	How an organism maintains homeostasis	60.00
14	Taxonomic classification	65.00
15	Human activities and the natural environment	75.00
	Mean	**79.52 or 80**

The students are motivated to watch all the elements of the video lessons apart from answering the module. Activity on plant propagation at home obtained the highest percentage (92. 50 %) of submissions. In this task, the students were asked to select and propagate a plant at home. It is followed by identifying hazards in the community (91.80 %).

In contrast, activities on taxonomic classification (65 %) and homeostasis (60 %) obtained the lowest submission percentage. Viewing the video lesson and participating in the activities are imperative to meaningfully understanding the

lesson topics. With active learning activities, the students are stimulated to watch the video to perform the tasks and activities at their respective homes.

The students are given a venue for hands-on and proactive learning experiences based on their pace and capability. This strategy also fosters students' creativity and ingenuity in designing their outputs through video, pictures, infographics, songs, etc. It promotes active learning even in the absence of face-to-face interactions.

On the Level of Effectiveness of the Home-Based Active Learning Activities in Improving the Students' Engagement and Motivation in Online Distance Learning as Perceived by the Students

Table 2 shows the effectiveness of the different interactive activities in improving the students' engagement/motivation in online distance learning as perceived by the students. It presents the indicators, weighted mean, verbal description, and interpretation.

Table 2. *Level of the Effectiveness of the Different Interactive Activities in Improving the Students' Engagement/Motivation in Online Distance Learning as Perceived by the Students*

Indicators Home-based active learning activities:	**Mean**	**Desc**	**QI**
1. motivate you to watch the video lesson discussion.	3.70	Strongly Agree	Very Effective
2. are effective strategies for stimulating your interest in doing performance tasks.	3. 80	Strongly Agree	Very Effective
3. engage you to participate in class/online distance learning.	3. 82	Strongly Agree	Very Effective
4. help you display creativity, resourcefulness, and inventiveness.	3.72	Strongly Agree	Very Effective
5. help you develop scientific skills and attitudes.	3.68	Strongly Agree	Very Effective
6. help you connect with the environment and improve self-awareness about things that	3.85	Strongly Agree	Very Effective

affect our daily activities and living			
7. stimulate critical thinking and problem-solving skills.	3.60	Strongly Agree	Very Effective
8. enhance ICT skills/digital literacy.	3.62	Strongly Agree	Very Effective
9. promote active learning and be experientially involved in the learning process.	3.80	Strongly Agree	Very Effective
10. provide you clearer idea and understanding of the lesson topic.	3.65	Strongly Agree	Very Effective
Overall Mean	**3.70**	**Strongly Agree**	**Very Effective**

Table 2 shows that students generally believe that home-based active learning activities help them connect with the environment and improve self-awareness about things that affect their daily activities and living, with the highest mean value of 3.85. Then, it was followed by engaging them to participate in online distance learning, an effective strategy in stimulating their interest in doing performance tasks, promoting active learning, and being experientially involved in the learning process, with a mean value of 3.82 and 3.80, respectively. The item on stimulating critical thinking and problem-solving skills obtained the lowest mean value but was rated very effective.

Overall, the home-based active learning activities are perceived to be very effective in motivating students to watch the video lesson discussion and engaging them to participate in online distance learning with a mean value of 3.70. The result conforms to the study of Martin-Chang & Levesque (2017) as cited in Cook (2020), which shows the key benefits of HBL: it promotes independent, self-directed learning because students can learn and review materials at their own pace.

On the Achievement Level of Students Before and After the Intervention Strategy

Table 3 reveals that the pre-test mean score is 18. 33 while the post-test score is 25.51, which indicates an increase in performance. Hence, the achievement level of students before the intervention significantly varies from that in the posttest (t=-14.790; p=0.000).

Table 3. *Dependent Samples T-Test for the Differences in Students' Achievement Level*

Comparison	Mean	Percent score	T-Value	Sig
Pre-Test	18.3279	61 %	-14.790	.000
Post-Test	25.5082	85 %		

The result implies that the home-based active learning activities significantly contributed to improving the student's performance in the subject of Earth and Life. The result of the study is similar to the study of Aji and Khan (2019), which determines the impact of active learning on the academic achievement of students from groups underrepresented in STEM in introductory mathematics and aerospace engineering courses. The results indicated that the performance of students who took the courses with active learning has significantly improved.

On the Level of Proficiency of Students' Grades in Earth & Life Science

Table 4 presents students' proficiency level in Earth and life Science. Data shows that 61 % of the class obtained an outstanding proficiency level, followed by a very satisfactory level of 31 %.

Table 4. *Level of proficiency of students in Earth & Life Science*

Grade Range	No. of Students	%	Proficiency Level
90-100	37	61	Outstanding
85-89	19	31	Very satisfactory
80-84	2	3	Satisfactory
75-79	3	5	Fairly satisfactory
60-74	0	0	Did not meet expectations
Total	**61**	**100**	

This suggests that most of the students showed remarkable accomplishments, consistent work quality, and timeliness in their tasks.

CONCLUSIONS

This study concluded that while limited face-to-face classes and online distance learning via video presentation have been a great challenge, especially for science teachers, innovative strategies in teaching science through integrating active learning processes are still possible. Incorporating home-based active learning activities in the video lesson has increased students' participation from 50 % to 80 %, as reflected in their prompt submission of outputs. Most of the students found

the activities very interesting and engaging, which is perceived to be an important causative factor in the success of the performance tasks. The result further implies that the home-based active learning activities have significantly improved students' achievement level and performance in Earth and Life subject. However, some difficulties were observed with time management and lack of creativity.

Integrating active learning activities fosters meaningful learning despite the difficult circumstances brought on by the pandemic. In one way or another, the intervention strategy has improved students' engagement and achievement since all of them could pass the subject.

It is recommended that further enhancements to the design and selection of activities must be carefully made to sustain the implementation of the activity and achieve the learning goals. As a teacher and researcher, it is deemed essential to improve all facets of teaching with a commitment to the success of learners and the curriculum.

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