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Grade - 8 Students' Knowledge on the Impact of Human Activities on an Ecosystem Using Aftermath Wheel

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Abstract This study determined the Grade 8 students' knowledge on the impact of human activities on an ecosystem using teacher-made educational hands-on activity in the form of *Aftermath Wheel*. A pretest-posttest quasi-experimental design was conducted using an achievement test. Population sampling method was employed to choose the subjects of the study. There were 53 Grade 8 students form two classes of Burgos National High School in Cabarroguis, Quirino, Philippines. For the treatment, 23 students belongs to the control group *(K to 12 module based lesson)* and 30 students served as experimental group *(Utilization of Aftermath Wheel).* Data revealed that the mean scores of the control group in the pre-test was 11.91/30 (39.7%), and in the post-test was 12.74/30 (42.47%) while the mean scores of the experimental group in the pre-test was 12.8/30 (42.7%) and in the post-test was 14.07/30 (46.9%). Apparently, there is no significant difference in the pre-test and post-test scores in the control group while the post-test scores of the experimental group revealed significantly greater than their pre-test scores with a p-value of 0.013. It was found also that the post-test scores of the experimental group significantly greater than the post-test scores of the control group in the subtopic on *ways of minimizing human impact*, with a p-value of 0.028. And in the overall, data analysis revealed that there is no significant difference in the over-all post-test scores between the control group. Relatively, this study has demonstrated that the aftermath wheel can help in enhancing the knowledge of the grade 8 students on the impact of human activities on an ecosystem. Hence, the researcher recommended to use of the Aftermath Wheel as an alternative method to enhance the knowledge of the students on the impact of human activities in the ecosystem.

Keywords: *aftermath wheel, ecosystem, human activities, quasi-experimental*

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1. Introduction

Enhancing students' knowledge on the impact of human activities in the ecosystem is very significant. The students' participation is a great help to restore the worsening status of the ecosystems. Enhancing students' knowledge on the impact of anthropogenic activities in the ecosystem may guide the youth to a more positive response in addressing the problems in the ecosystems [1]. The promotion of environmental awareness is mandated in school curricula across levels, be it public or private [2]. Specifically in Section 6 of RA 9512 which emphasized that the Department of Education, Commission on Higher Education, Technical Education and Skills Development Authority, Department of environment and Natural Resources, Department of Science and Technology and other relevant agencies are mandated to lead in the implementation of public education and awareness programs on environmental protection and conservation [3].

In addition, the Department of Education in the Philippines urges all public and private schools to lead the role on the environmental awareness by enhancing environmental education and pursuing effective school-based activities seeking to preserve and protect the environment. It is stated that trainings from different activities like YES-O Camp and Science fairs shall be used as tools for classroom drills, discussion and activities. Moreover, these shall be taught and integrated in the related learning areas of ecology and ecosystem [4].

In this regard, Science as a core subject across disciplines has vital role of producing science literate individuals who can think and react to things in the environment objectively and scientifically. Besides, the science teaching should seek to achieve proper knowledge, skills and understanding of students about the impact of human activities to the ecosystem. Effective science teaching consists of processes that enable students gain scientific inquiry process, display critical thinking skills and internalize scientific concepts and principles [5].

Ecosystem topics are embedded in K to 12 curriculum which is found in quarter four (4 topics), module four

(4 topics) for the Curriculum guide and quarter four (4 topics), module two (2 topics) for the Science Learner's module. The subtopics included are; Transfer of energy in Trophic Levels, Cycling of materials in the ecosystem and the Impact of human activities in an ecosystem. In this K-12 curriculum guide, specific activities such as "How do you identify the components of a food chain in an ecosystem", "Making food webs", and, "Meat eaters vs. plant eaters "are provided for certain topics. Unfortunately, some topics like the impact of human activities in an ecosystem were not provided with any activity. In this case, this particular topic has always been taught using the traditional lecture method. Having earlier emphasized the imperative of educating the youth about the environment, it is deemed necessary to provide this particular topic an appropriate classroom activity that will boost the learning experiences of the students about taking care of the environment, [6] stated, if effective learning is to take place it is important to gain students' interest through instructional materials. Hence, this study aimed to enhance the knowledge of Grade 8 students in Burgos National High School on the impact of human activities in the ecosystem. Specifically, sought to determine the level of knowledge of the grade 8 students of BNHS on the Impact of Human Activities on an Ecosystem as reflected in their Pre-test scores. Also, this study deemed of determining the level of knowledge of the grade 8 students of BNHS on the Impact of Human Activities as reflected in their Post test scores when grouped according Control group (K to 12 module based lesson) and Experimental group (Utilization of Aftermath Wheel). In the study, it also determined the significant difference between the pretest scores and post test scores of the of the control group and of the experimental group and significant difference in the post test scores of the control and experimental group.

2. Methodology

This study utilized a pretest-posttest quasi-experimental method. Two sections of grade 8 students at Burgos National High School of comparable academic standing were selected as the respondents. One section served as the control group taught under the K to 12 module based lesson on the Impact of Human Activities in an Ecosystem, which is an identified topic in their curriculum that integrates environmental concerns. The other group was taught with the same topic but using the Aftermath Wheel as the main tool of delivering the lesson. Both groups were given a pre-test and a post-test through a 30-item achievement test which was initially tested for its reliability using Quest Rasch model giving an internal consistency of 0.87. Data gathered were analyzed using Statistical Packages for Social Sciences v.21 software. The profile of the respondents were determined by frequency counts. Means and standard deviations were used to describe the test scores of the respondents. Paired t-test was used to compare the difference between the pre-test scores and post-test scores of the control and experimental groups. Independent Sample T-test was used to compare the pre-test and post-test scores between the control group and the experimental group.

3. Findings

Table 1. Descriptive Statistics for the Pre-Test Scores of the Control and Experimental Groups

Groups	N	Mean	Std. Deviation
Control	23	11.9130	3.72843
Experimental	30	12.8000	3.41801

Table 1 shows that the mean scores of the control and experimental groups are 11.913 and 12.8 respectively. The maximum score that can be obtained from the pre-test is 30, which means that the students have scored below 50%. With not so deviating values for the standard deviation and a very slight difference in the mean score, the pre-test scores of the control and experimental group should be considered the same. A t-test however is performed to establish the equality of means.

Table 2. Independent Samples T-Test between the Pre-Test Scores for both Control and Experimental Group

	Levene's Test for Equality of Variances		t-test for Equality of Means		
	F	Sig.	t	df	Sig. (2-tailed)
Equal variances assumed	0.046	0.832	-.900	51	**0.372**

Table 2 showed that the computed p-value is 0.372, which is much higher than the α-value of 0.05. This accepts the null hypothesis that there is no significant difference in the mean scores of the control and experimental group during their pre-test. This also establishes that before the conduct of the experiment, the two sections have the same academic attributes. Three days after the administration of the pre-test, the control group received a K-12 modular-based lesson on the *human impact on an environment* using lecture method, while the experimental group received the same lesson but with the use of aftermath wheel as the instructional material/strategy. The post-test, which is the same as the pre-test, was administered to both groups one day after the classroom delivery of the lesson.

Table 3. Descriptive statistics for the pre-test sand post test scores of both the control and experimental groups

Groups		Mean	N	Standard Deviation
Control	Post test	12.739	23	3.658
	Pre-test	11.913	23	3.728
Experimental	Post test	14.066	30	3.095
	Pre-test	12.800	30	3.418

It is shown in Table 3 that there is an observable increase in the mean scores of the control and experimental groups when their pretest and post test scores are compared. This slight difference is considered negligible and it could be said that the pre-test and post-test scores of the control group are the same. Paired t-test is performed to further confirm this equality in scores.

Table 4. Paired Samples T-Test for the Pre-Test and Post Test Scores of both the Control and Experimental Groups

Groups	Paired Differences			t	df	Sig. (2-tailed)
	Mean	SD	SEM			
Control Post-test - pre-test	0.826	3.142	0.655	1.261	22	0.221
Experimental Post-test - pre-test	1.266	2.625	0.479	2.643	29	**0.013**

Table 4 shows that the p-value of the control group was 0.221 revealed higher than the α-value which is 0.05. This indicates that the mean scores of the control group in their pre-test and post-test are statistically the same. It is unfortunate that after the delivery of the module-based lesson on the "human impact on the environment", the students did not show improvement in their scores on the same test that they were already given a week earlier. For the experimental group, the computed p-value for the two-tailed test, which is 0.013, is lesser than the α-value which is 0.05. This rejects the null hypothesis that there is no significant difference in the post test and pretest scores of the experimental group. This indicates further that there is a significant improvement in the learning outcomes of the students who were delivered with the lesson on the impact of "human activities on the ecosystem" using the aftermath wheel as the teaching strategy. This could be a classic illustration of the difference between a lecture method that is normally teacher-centered and a teaching strategy where the students do some hands-on activities, such as the case of the aftermath wheel, where the students were drawn to establish the cause and effect relationships between human activities and some environmental phenomena through a type of a consequence map, that is, the aftermath wheel. It is unfortunate however that despite the said significant increase, the mean post-test scores of the experimental group, which is 14.07 out of 30, it is still below 50% which is to be considered as low. This low score could be attributed to the low IQ category of the students and to the fact that Burgos National High School's performance on National Achievement Test (NAT) in science has always been very low. The 30-item test questionnaire was split into three sub-topics, namely: (1) Anthropogenic Activities, (2) Changes in the ecosystem and, (3) Ways of minimizing human impact. Table 4.6 present the pre-test and post-test scores of the respondents on these particular sub-topics.

Table 5. Descriptive Statistics on the Pretest and Post-Test Scores of the Control Group on Specific Sub-Topics

Control Group				
Sub-Topics	*Questionnaire*	Mean	N	SD
Anthropogenic Activities	Post test	5.304	23	1.690
	Pre-test	5.043	23	2.163
Changes in the Ecosystem	Post test	3.565	23	1.779
	Pre-test	3.130	23	1.324
Ways of minimizing human impact	Post test	3.869	23	1.289
	Pre-test	3.739	23	1.251

Table 6. Descriptive statistics on the pretest and post-test scores of the experimental group on specific topics

Experimental Group				
Sub-topics	*Questionnaire*	Mean	N	SD
Anthropogenic Activities	Post test	5.5667	30	1.63335
	Pre-test	5.3667	30	1.84733
Changes in the Ecosystem	Post test	3.8667	30	1.96053
	Pre-test	3.7000	30	1.82228
Ways of minimizing human impact	Post test	4.6333	30	1.15917
	Pre-test	3.7333	30	1.01483

Table 5 and Table 6 show that on all the three sub-topics and on both control and experimental groups, there is an increase in the mean scores from pre-test to post-test. The highest score for the sub-topic on *anthropogenic activities* is 8 points, 12 points for the sub-topic *changes in the ecosystem* and 10 points for *ways of minimizing human impact*. It is very noticeable that for the sub-topic on changes in the ecosystem, both the control and experimental groups have scored below 35 percent (e.i. 3.8/12) while they scored higher percentage on the sub-topics on anthropogenic activities and ways of minimizing human impact. It seems that the students have higher comprehension of environmental topics when it involves the actual human experience than of the environmental topics that involves ecological processes in the ecosystem. The 12 items under the sub-topic *changes in the ecosystem* do not describe human activities but rather describe the ecosystem as being shaped by various ecological phenomena. The 10 items under the sub-topic *ways of minimizing human impact* and the 8 items under the sub-topic *anthropogenic activities* made an emphasis on the direct actions of humankind towards the environment.

Table 7. Paired T-Test on the Post-Test and Pretest Scores of Both Control and Experimental Groups According to Specific Sub-Topics

TOPICS		Paired Differences		t	df	Sig. (2-tailed)
		Mean	SD			
Control	Anthropogenic Activities	0.260	2.434	0.514	22	0.613
	Changes in the Ecosystem	0.434	1.700	1.226	22	0.233
	Ways of minimizing human impact	0.130	1.358	0.460	22	0.650
Experimental	Anthropogenic Activities	0.200	1.562	0.701	29	0.489
	Changes in the Ecosystem	0.166	2.229	0.409	29	0.685
	Ways of minimizing human impact	0.900	1.241	3.97	29	**0.0001**

The paired difference in the mean scores as shown in the third column reveals a difference of 0.9 under the topic *ways of minimizing human impact* in the experimental group, which is determined by the two-tailed test to be significant with a p-value of 0.0001. Apparently, this is the particular topic where the experimental group have exceeded the control group in terms of post-test score. A comparison in the post-test scores between the control group and the experimental group is presented in the next table.

The topic on ways of minimizing human impact falls under experiences or day-to-day experiences of students reflects the idea of [7] wherein learning is the process of creating knowledge through the transformation of experiences. Moreover, the researcher stated that learning involves the acquisition of abstract concepts that can be applied flexibly in a range of situations. Further explained that different people naturally prefer a certain single different learning style which includes social environment, educational experiences, or the basic cognitive structure of the individual. In addition, [8] emphasized experiential learning as process that provides the conditions for optimally supporting student learning. Moreover, when students are engaged in learning experiences, they can see the relevance of the subject matter because they have increased motivation to learn. Aside from, students are also motivated when they are provided opportunities for practice and feedback.

Table 8. Descriptive Statistics on the Post-Test Scores of the Control Group and the Experimental Group

Groups		N	Mean	Std. Deviation
Post-test	control	23	12.739	3.658
	experimental	30	14.066	3.095

Table 9. Independent Samples T-Test on the Post-Test Scores between the Control Group and the Experimental Group

	Levene's Test for Equality of Variances		t-test for Equality of Means		
	F	Sig.	t	df	Sig. (2-tailed)
Equal variances assumed	0.173	0.680	-1.430	51	**0.159**
Equal variances not assumed			-1.398	42.96	0.169

Table 9 shows the computed p-value of 0.150 which indicates that there is no significant difference in the post-test scores of the two groups under study. However, the post-test scores presented per sub-topic show a variation from this result.

Table 10. Descriptive Statistics on the Post-Test Scores of Control and Experimental Groups on Specific Sub-Topics in the Questionnaire

	groups	N	Mean	SD
Anthropogenic Activities	Control	23	5.304	1.690
	Experimental	30	5.566	1.633
Changes in the Ecosystem	Control	23	3.565	1.779
	Experimental	30	3.866	1.960
Ways of minimizing human impact	Control	23	3.869	1.289
	Experimental	30	4.633	1.159

It is shown in Table 10 that there are observable differences in the mean post-test scores of the control and experimental group when grouped according to the three sub-topics in the questionnaire. These differences however seem to be negligible except for the scores under the topic *ways of minimizing human impact*, which is noticeably much greater than the paired mean differences on the other two sub-topics. Independent samples t-test was carried out to determine if this paired difference is significant or not.

Table 11 revealed that under the topic *ways of minimizing human impact*, the mean post-test score of the experimental group is significantly higher than the mean post-test score of the control group. This is shown by the highlighted p-value of 0.028, which is lesser than the α-value of 0.05. Though only one sub-topic showed significant difference, still it implies learning of the students. On the other hand, the results of the study supports the work of [9] wherein incorporating experiential learning are found to be more effective ways of teaching than pure lecture. The ten items in the questionnaire for the subtopic on ways of minimizing human impact include the following concepts: preservation of nature, maintaining clean environment, kaingin system, reduce, reuse and recycling of plastic bags, protecting trees, advising grocery owners to use paper bags instead of plastic, maintaining water quality, demolishing breeding sites of mosquito, and planting trees to cure the ozone layer malady. All of these are actual human interactions with the environment, which apparently, are easier learned by students when they are given a hand-on learning experience such as the aftermath wheel.

Table 11. Independent Samples T-Test between the Post-Test Scores of Control and Experimental Groups on Specific Sub-Topics

TOPICS		Levene's Test		t-test for Equality of Means		
		F	Sig.	t	df	Sig. (2-tailed)
Anthropogenic Activities	Equal variances assumed	0.069	0.793	-0.571	51	0.571
	Equal variances not assumed			-0.568	46.64	0.573
Changes in the Ecosystem	Equal variances assumed	0.674	0.415	-0.577	51	0.566
	Equal variances not assumed			-0.585	49.49	0.561
Ways of minimizing human impact	Equal variances assumed	0.001	0.971	-2.264	51	**0.028**
	Equal variances not assumed			-2.232	44.68	0.031

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