Integrating Climate Change Lessons in Grades 7 and 8 Science

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Abstract

This study designed, developed, validated and tested the effectiveness of the climate change lessons integrated into Grades 7 and 8 Science concepts of population, pollution, biodiversity, environmental factors and environmental phenomena. The study was conducted in Bukidnon State University-Secondary School Laboratory (SSL) during the school year 2013-2014. Three stages followed in the preparation of the lessons: pre-development, development, and post-development stages. The criteria of the Department of Education (DepEd) were used by the five experts and ten pre-service teachers in evaluating the lesson plans. Grades 7 and 8 students also evaluated the lessons. Findings showed that the climate change lessons met the criteria for validity, specifically on functionality and usability. The developed lessons were appropriate, appealing and exciting, challenging, easy to understand, and enjoyable to the students. The result showed that both Grades 7 and 8 students from the experimental groups obtained the level Approaching Proficiency (AP). This indicates that the students have developed the basic knowledge and skills but cannot transfer learning independently. The performance of the control groups for both Grades 7 and 8 falls below the level Developing (D) which means possessing minimum knowledge, skills and understanding but needs help throughout the performance of authentic tasks. Competence levels along the five climate change concepts were also determined. Data suggest that students show great difficulty in understanding or learning creatively in producing products or performance especially in the concepts of biodiversity and population for Grades 7 and biodiversity for Grades 8.

Keywords: Climate change, integration, population, pollution, biodiversity, environmental factors, environmental phenomena

Introduction

Climate change as a global issue is affecting everyone. Everybody is feeling the disturbing weather conditions. Calamities strike many countries around the world like earthquakes, tsunamis, flash floods and landslide. Floods are devastating the different communities, strong waves are washing out communities, and heavy downfalls together with unpredictable weather conditions are ever present.

It is a distress call to save ourselves from our worsening climate conditions. It is the most urgent message we can deliver to our friends, leaders, and to the rest of the world (Grundmann, 2010). Our climate crisis is a threat to anyone, everywhere.

The earth's temperature is rising. Our water and food sources are becoming scarce, and oceans, coastal cities and island countries are endangered. Its magnitude means that only a real global response can address it.

The United Nations Educational, Scientific, and Cultural Organization (UNESCO, 1993) had established the goal of environmental education. The aim of the organization is to develop a world population that is aware of and concerned about the environment and

its associated problems and which has the knowledge, skills, attitude, drive towards having solutions of the existing problems, and prevention of new ones. UNESCO has explained that these qualities begin with an experience of the environment. An environmentally literate individual should possess the following characteristics: relevant and adequate environmental knowledge, environmental sensitivity, and problem-solving skills.

ASEAN 2014-2018 Integration has challenged scientists, researchers, and other experts to mitigate climate change and its impacts. In addition, Intergovernmental Program for Climate Change (IPCC, 2007, 2011) has given serious attention to the environment, economy and community in such issues as development assistance, poverty reduction, and disaster and risk management.

Literatures currently used are the Kyoto Protocol which published the Climate Change on Focus which listed topics such as coastal zone, agriculture, forestry, human health, and flora and fauna. Another reference titled Romancing Science (Reading in Science and Society) contains a historical background of the industrial revolution as the beginning of climate change. The advent of technology gave rise to powerful machines that made humans consume resources at an accelerated pace. There are studies which were able to group certain climate change concepts. A recent research published recurring concepts such as pollution, population, overpopulation with too many people reproducing too quickly and hazardous solid wastes as common to climate change which are taken up in schools (Valdez et al., 2010).

Climate change phenomenon has affected the earth in terms of air and water pollution destroying freshwater and the marine environment. Added to this are mountains of toxic wastes, and acid deposition that have spoiled land and water, and destruction of the remaining scattered habitats. These have brought near to total deforestation, rampant overfishing, depletion of agricultural land, and conspicuous consumption of highly endangered species (Harris, 2006).

From the perspective of the Philippines, education plays a vital role in combating the adverse effects of climate change. One of the ways in which schools approach the topic of climate change is through integration. Integration is an approach to teaching and learning where many areas of the curriculum are connected (Lawrence-Brown, 2007). Integrating the content enables learners to explore boundaries and connections across disciplines (EBEC, 2013).

K to 12 Core Science Standard envisioned that students demonstrate an understanding of basic science concepts, apply science process skill and exhibit scientific attitudes and values to solve problems critically. Furthermore, the learners should innovate on beneficial products, protect the environment, and conserve resources for sustainability. The understanding will lead to manifestations of the respect for life and environment bearing in mind that the earth is our only home. In line with this, teachers are encouraged to integrate climate change concepts in science. Climate change has become a crucial issue on the global environmental agenda since 1990. It is not only affecting human beings but all living species.

The Environmental Law of the Philippines (1994) emphasizes the value of environmental education to both the young generation and adults. There is education in environment matters for the younger generation as well as the various adults in protecting and improving the environment in its human dimension. In recognition of the above law, Presidential Decree No. 1152 or the Philippine Environment Code mandates the Department of Education to integrate subjects in environmental education in the school curricula at all levels. All levels and forms of existing educational and teaching and learning programs need to be reviewed and reoriented to address the cause and consequences of climate change (UNESCO, 2009).

R.A. 9512 is one of the Philippines' concrete expressions of support to the United Nations Decade of Education for Sustainable

Development (2014-18) and the ASEAN Environmental Education Action Plan (AEEAP). Republic Act (RA) 9512 or the Environmental Awareness and Education Act of 2008 mandates the integration of environmental education in school curricula at all levels whether private or public and the implementation of awareness program on environmental protection and conservation in the context of sustainable development. The Climate Change Commission (CCC) of Republic Act No. 9729 or the Climate Change Act of 2009 is the policy making body tasked to coordinate, monitor and evaluate its program and action plans regarding climate change.

The Philippines as an archipelagic developing country is along the ring of fire which increases the frequency and intensity of waves, floods, drought, and typhoons (Pulhin et al., 2008). Tropical cyclones happen from time to time resulting in the loss of many lives, infrastructure destruction, and displacement of families which curtail livelihood activities as evidenced in the footprints of Bagyong Sendong, Pablo, and Yolanda. Man is indeed responsible for climate variability and the changing climate. Human activities such as logging, mining, housing projects, pollution and other causes continue to rise alarming, and hence there is the urgent call for mitigation activities and adaptation measures.

C. Institutional Perspective on Climate Change

The Philippines being in the typhoon belt area is regularly hit by typhoons. The country is experiencing 2°c - 3°c increase in temperature including Mindanao. Bukidnon is one of the food baskets of the region producing high-value crops like vegetables, fruits, bananas, pineapple and livestocks. It is known for its high mountain ranges with Mount Kitanglad Range Natural Park (MKRNP) towering over the province which is considered as the homeland of the Indigenous Peoples (IPs), high biodiversity conservation value, tourism potentials, and headwater of the three major river basins.

At present, Sawaga River is observed to have deteriorating resources including water quality, flora and fauna, and vegetation. This river is one of the major river basins in the province. An urgent call to recover the river is a great challenge before it dies. Different communities, IPs, the churches and religious organizations, and government and non-government organizations could work hand in hand not only to save Sawaga River but also sustain its remaining resources.

The above scenario is a great challenge to Bukidnon State University (BukSU), an institution of higher learning in Bukidnon, Mindanao. The College of Education has two (2) laboratories for research and innovations, the Elementary School Laboratory and the Secondary School Laboratory (SSL). One of the goals is to train pre-service teachers for content, pedagogy and classroom management. So far, there are no studies about climate change integration conducted in the province.

Each of us can take actions. We have a role to play essentially where schools are efficient vehicles to draw the curiosity of young minds. Integrating CC lessons in Grades 7 and 8 sciences will not only provide students with the technical knowledge of climate change but also develop positive attitude and values towards the environment. This research is conducted to Grades 7 and 8 students by empowering pre-service teachers as facilitators of learning. Integration of climate change lessons within this study includes the five concepts, namely population, pollution, biodiversity, environmental factors and phenomena.

D. Climate Change and Climate Change Concepts

Climate change according to Ekpoh (2009) is any long-term change in the patterns of average weather of a specific region on the earth as a whole. Valdez et al. (2010) identified five major concepts with the topics listed in Box 1. A population is a group of the same kind of organism living in the same habitat, and pollution as the adding of any substance to the environment in harmful amount (Bierer &

Lien, 1985). The term biodiversity encompasses a broad spectrum of biotic scales, from genetic variation within species to biome distribution on the planet (Wilson, 1992; Gaston, 1996; Purvis & Hector 2000; Mooney, 2002). In the absence of theoretical definitions of environmental factors and ecological phenomena Rabanal (2011) defined the two terms operationally.

Box 1. Categorization of Climate Change Concepts

Categories	Concepts
Population	Densities, trends, food shortage
Pollution	Air, water, land, solid waste management, etc.
Biodiversity	Forest, aquatic (fresh/ marine), brackish water, marsh, estuaries, agricultural, pond, etc.
Environmental Factors	Rainfall, wet and dry seasons, monsoons-amihan, habagat, etc.
Environmental Phenomena	Flood, landslide, earthquakes, cyclone, typhoon, El Niño, La Niña, etc.

Statement of Purpose

This study designed, developed, validated, and tested the effectiveness of CC lessons integrated in Grades 7 and 8 Science. Specifically, it:

1. Designed and developed lessons along the five concepts of climate change: a) population, b) pollution, c) biodiversity, d) environmental factors and environmental phenomena,
2. Validated the lessons on its acceptability, applicability, and usefulness, and revised them based on the results of the validation and feedback from a panel of experts and pre-service teachers and students,
3. Determined the students' level of proficiency and competence along the five CC concepts integrated in Grades 7 and 8 Science lessons, and
4. Tested the effectiveness of the CC lessons integrated in Grades 7 and 8 Science.

This study is delimited to the design, development, validation, revision, and testing of the effectiveness of CC lessons along the five climate change concepts integrated into Grades 7 and 8 Science in BSU-SSL in SY 2013-2014. CC concepts included were population, pollution, biodiversity, environmental factors and phenomena. The research followed the stages in the preparation of instructional materials adopted from Simbulan (2006). The stages were: a) Pre-development, b) Development, and c) Post-development Stages. The null hypothesis of the study states that there are no significant differences in the academic achievement level of Grades 7 and 8 students taught science lessons with an integration of CC concepts from those students taught without the integration of CC concepts.

Methodology

Research Design

The research methodology is adopted from Simbulan (2006). The stages were a) Pre-development Stage, b) Development, and c) Post-development. This study also determined students' level of competence along five CC concepts, embedded in CC lessons: population, pollution, biodiversity, environmental factors and phenomena using DepEd order No. 73 s. 2012, K-12 guidelines for the assessment, and rating of learning outcomes.

This study also employed quasi-experimental design, using four whole classes: two whole classes for Grade 7 and two whole classes for Grade 8 which consisted of the experimental groups and the control groups. The experimental groups were taught integrating CC lessons while the control groups

used the conventional teaching approach, the usual chalk and talk lecture-discussion method. There were 30 students from each cluster, given pre-test and post-test to both groups, but the treatment Y, had the CC lessons introduced in the experimental groups. The broken line indicates the use of whole classes.

Experimental Group

Y_1 X Y_2

Y_3 Y_4

Control Group

Where; Y_1 **Experimental Pre-Test**

Y_2 **Experimental Post Test**

Y_3 **Control Pre-Test**

Y_4 **Control Post-Test**

X Treatment (CC Lessons)

This treatment was done separately for Grades 7 and 8. The CC concepts were the same for Grades 7 and 8, but the different subject matters were introduced following the K to 12 curricula. Objectives, and activities were different. BSU-SSL is a laboratory school which could be a venue for research or innovation. Pre-service teachers and Grades 7 and 8 students signed the consent to participate in the study. There were two sections in each grade level. There were about 50 to 60 students in every section heterogeneously grouped based on average.

Methods of Data Collection

Pre-development Stage

Based on the table of specification (TOS), items were categorized according to the level of knowledge, process, understanding, and performance or product. Topics in the lessons on climate change included concepts of population, pollution, biodiversity, environmental factors, and phenomena. A 30-item pre-post tests were prepared by the researcher in SY 2012-2013 for Grades 7 and 8 students. The pre-post tests were patterned from Reeder and Raven et al. (2001). Some items were from the textbooks and test banks. These books were recommended for use

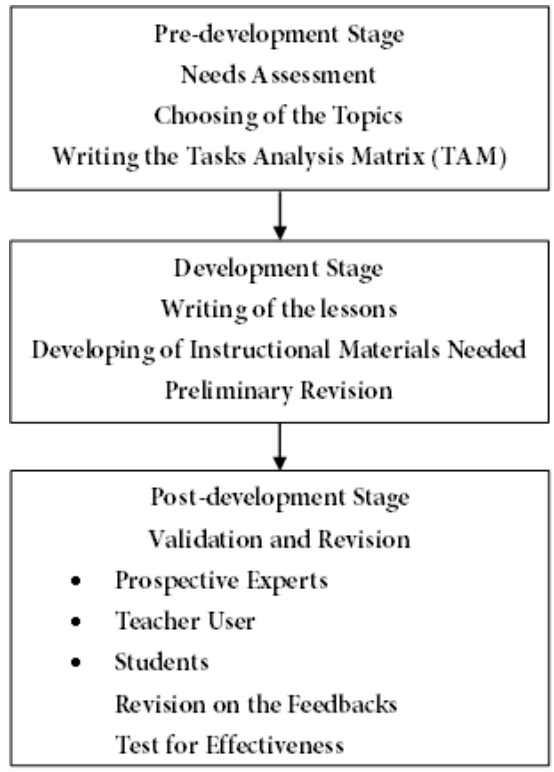

Figure 1. Flowchart of the present study.

by the Department of Education. DepEd Order No. 73 s. 2012 K-12 guidelines were used as assessment. The pre-post tests were subjected to analysis, obtaining a reliability index of 0.801 for Grade 7 and 0.820 for Grade 8, categorized as very good for classroom test.

Development Stage

The five climate change concepts were identified by Valdez et al. (2010). The researcher added sub-concepts in environmental factors e.g., monsoons based on the different textbooks for K to12 in Grades 7 and 8. The sets of lessons and activities were developed based on the content standards introduced in Grades 7 and 8 Science in Biology, Chemistry and Earth Science. Some lessons were from Micayabas (2010). Five lessons for Grade 7 integrating CC concepts lessons were on environmental pollution, ecosystem, biodiversity terrarium and aquarium. Five lessons for Grade 8 include photosynthesis, biogeochemical cycles,

interaction typhoons and earthquake, El Niño and La Niña. For the experimental group, the integration was modified using CC lessons. The integration of the CC concepts introduced to both experimental and control groups was the same. However, the control groups were taught with the conventional approach while the experimental groups were taught integrating CC lessons in the five climate change concepts.

Post-development Stage

Box 2 presents the feedback on the CC lessons by the panel of experts, pre-service teachers and students. The panel of experts validated the climate change lessons. The experts consisted of K to 12 Grades 7 and 8 science trainers who attended the Trainers' Training for Grade 8 Science at UPNISMED in April 2013. Trainers represented Luzon (1), Visayas (2), and Mindanao (3). The panel of experts suggested the addition of rubrics in every lesson. Twelve pre-service teachers conducted the lessons under the supervision of the researcher. Box 3 presents the pre-service teachers' suggestions for the improvement. Both the panel of experts and pre-service teachers suggested SMART in lesson planning using appropriate and well-prepared IMs.

Evaluation criteria set by DepEd (2005) on acceptability, applicability and usefulness were also utilized. Based on the result, the panel of experts assessed the CC lessons as functional and useful. Pre-service teachers found the developed lessons as appropriate and appealing. An opinionnaire which was recommended by DepEd (2005) for students' feedback was administered and collected after each lesson. Results indicated that the lessons were challenging, easy to understand and the activities were enjoyable, according to the students during the focus group discussion (FGD). It was fun especially during the outdoor activities. Students find the pre-service teachers approachable and they mastered their craft. Both pre-service and students realized they had to move now to save the environment.

Box 2. Feedback on the CC Lessons by Panel of Experts, Pre-Service Teachers, and Students

Feedback from the Panel of Experts

1. Monitoring and feedbacking of students progress not found/stipulated within the lesson
2. Use of 4 A's in the procedure might be of great help.
3. Improve template, adjust color highlighting the text

Feedback from the Pre-Service Teachers

1. I have realized from this class that learning will take place when the examples are based on real life situations.
2. The more attractive and realistic your visuals are the better the learning will take place.
3. The more interesting the questions you give, the more interactive they (students) become.
4. Helps us explore teaching strategies in integrating climate change.
5. I was fulfilled and successful in teaching climate change.

Feedback from Students about the CC Lessons

1. The lessons were interesting, challenging and it was fun especially the outdoor activities.
2. Instructions of the teachers in the activities were clear.
3. Enough time was given to us students for the activities.
4. We were able to clarify some terms; we got it right and then participated well during the discussion.
5. The lessons helped us internalize CC concepts, improved and enhanced scientific and technical knowledge, e.g., carbon footprints.

Box 3. Suggestions from Pre-Service Teachers on the CC Lessons

1. Objectives must be clear and should follow SMART

2. Objectives of the lesson should be made clear to students.
3. Write instruction on a manila paper and state it clearly.
4. Have students engage themselves during the discussion
5. Give more seatwork and board work to engage more students in the discussion.

Feedback from pre-service teachers during the conferences include: "The greatest sign of success for a teacher is to be able to see- the students are now working as if I did not exist and the experience I had teaching CC lessons helped me a lot in delivering the next lessons and interacting with the students. I enjoyed every learning opportunity with nature." Moreover, the panel of experts recommended the CC lessons be integrated: "it's very timely to address the climate change crises."

The Analysis of Covariance (ANCOVA) at 0.05 level of significance was used to determine whether there was a significant difference in the academic achievement of the integration of climate change lessons. Those taught with the conventional method, ANCOVA was used to determine which of the two groups obtained greater gains in the post test using the pretest as the covariance to equalize the nature of the two whole classes.

Results and Discussion

This study designed, developed and validated lessons using climate change concepts. The panel of experts unanimously agreed that the CC lessons met the criteria set by DepEd (2005) for instructional materials. Based on the feedback of experts, the CC lessons were acceptable, applicable and useful, which is similar to the finding of Hermocilla (2013) and Dedace (2014) whose developed SIMs were found functional and usable. The activities deepened the understanding of the students.

The CC lessons were acceptable, applicable and useful. Furthermore, the CC lessons were appropriate, appealing, exciting, challenging, easy to understand and enjoyable to the students based on the evaluation of the 12 pre-service teachers. Among the climate change lessons in Grade 7, students enjoyed the lesson on environmental pollution the most. They were able to count vehicles without smoke belchers passing the highway in front of BSU. Students tested the presence of pollutants using an improvised current detector as the tester in the science laboratory. Also, they found the lesson in ecosystem interesting because it was conducted outside the classroom for two hours. They monitored the activities of organisms in the three ecosystems: pond, stream and the forest at the Kaamulan Grounds. Grade 8 students found the aquarium-making so challenging. They learned that it needs a lot of patience and perseverance. They found that observing plants interacting with animals in the aquarium is interesting.

Climate change lessons as an instructional material provide a variety to the presentation of concepts (Simbulan, 2011). It can eliminate the monotony of teaching and learning through localization or bringing the students to the real environment. From the student's feedback, the CC lessons were interesting, challenging, especially the field trips, and it was fun specifically the outdoor activities. Grade 7 students traced photosynthesis in their terrarium as their project. They studied their terrarium carefully for a week and determined causes of the improvement of growth of the plants. Their patience was tested in monitoring the environmental factors, e.g., sunlight, H_20, and other factors needed for photosynthesis. One of their feedbacks includes "It was a wonderful experience caring for endangered species of plants like Nepenthis neprolepis (pitcher plant)", as the centerpiece of the terrarium. Both Grades 7 and 8 students appreciated the co-existence of plants, animals and other environmental factors in the terrarium and aquarium and the interplay of CO_2 and O_2. Bandura (1997) posited that students learn by modeling. The above ecosystems mimic the big world. Students developed a caring attitude and learned to appreciate and value other organisms.

Table 1
Post-test Achievement Scores of the Experimental Group and of the Control Groups of Grades 7 and 8

Level of Proficiency	Score Range	Experimental N=30		Control N=30	
		Grade 7	Grade 8	Grade 7	Grade 8
Advance (A)	28-34	1	0	0	0
Proficient (P)	25-27	15	8	0	0
Approaching Proficient (AP)	22-24	7	10	0	7
Developing (D)	19-21	4	10	22	18
Beginning (B)	0-18	3	2	8	5
	Mean	23.00	21.52	18.08	19.36
	SD	2.83	2.97	2.38	1.98

Table 1 presents the mean score, standard deviation and students' proficiency level in the five CC lessons. Data showed both Grades 7 and 8 in the experimental groups, obtained the level of Approaching Proficiency (AP). This indicates students have developed the basic knowledge and skills but cannot transfer learning independently. The performance of the control groups for both Grades 7 and 8 belong to the level of developing (D) possessing a minimum knowledge, skills and understanding but needs help throughout the performance of authentic tasks.

It can also be gleaned from the table that the standard deviation of the experimental groups is slightly higher to that of the control groups for both Grades 7 and 8. This indicates that the scores of the experimental group are widely dispersed compared to the control groups. Therefore, students in the experimental groups had varied responses than the control groups.

Data showed that the experimental groups both in Grades 7 and 8 performed better than that of the control groups. Therefore, integration of CC lessons facilitated learning contrary to the conventional teaching of integrating climate change without the CC lessons.

Competence levels along the five climate change concepts were determined as presented in Figure 2. Data suggest students show great difficulty in understanding or learning creatively in producing products or doing performance tasks especially in the concepts of biodiversity and population for Grade 7. The competency level of students in the five (CC) concepts is low except for pollution.

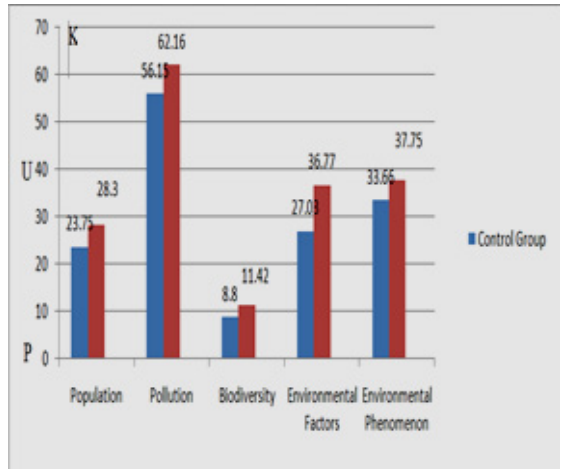

Figure 2. Graph of competence level of Grade 7 students where the CC concepts were embedded in the CC lessons.

This may be attributed to students being familiar with the effects of pollution to human health and the problem of safe potable water which is a primary need. The prices of bottled water are more expensive than soft drinks which decrease their "baon" (daily allowance). Teenagers are usually assigned in their households to segregate solid wastes as biodegradable and non-biodegradable. They are aware that when this is not done, garbage collectors do not collect this, as provided by the city ordinance.

Media contribute a lot to fostering environmental awareness; for example, advertisements like "smoking is bad to the health", "it's more fun in the Philippines" and many more. When students' competence level is on understanding, the assessment is drawn from the students. These meanings are made from their own understanding expressed using any facet of knowledge or any other appropriate manifestation of understanding. For example,

school administrators and teachers work hand in hand implementing the Solid Waste Management Act of 2001, segregation and recycling of garbage is done in school, at home and in the community. DepEd Order no. 33 s. 2008 encourages schools to have annual tree planting activities. Students are not aware that they have participated in reducing carbon dioxide present in the atmosphere with the teachers as mediators between the school and community.

Competence Levels of Grade 8 Students in the Five Climate Change Concepts

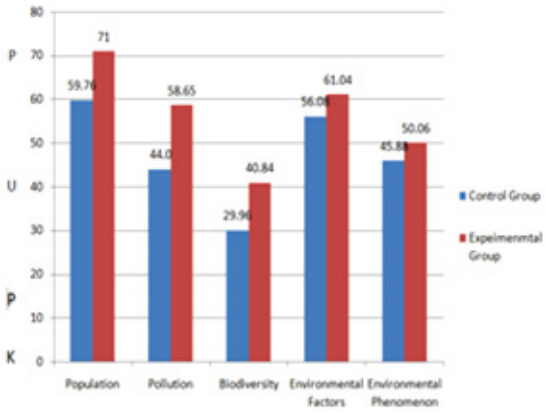

Figure 3. Graph of the competence level of Grade 8 students where the five climate change concepts were embedded in the CC lessons.

Figure 3 shows that students show difficulty in understanding and learning creatively in producing products or performance especially in the concept of biodiversity. In the lesson on interaction, students find difficulty explaining the idea of interrelatedness and interdependence of organism, considering the role and function of each of the organism in this world. Further, students find it difficult to accept why the Philippine government spends millions of pesos in saving the last Philippine eagle.

Concepts of genetics can hardly be understood by students until they reach Grade 10. The found the concept of genetic material being vital to the next generation difficult. Here they have to trace the concept through congestion of population caused by migration. Students can observe this scenario as they travel, the migration of people to places where centers of trade and commerce are found. This is where people look for greener pastures and livelihood resulting in the increase of population, food shortage and uncontrollable garbage. All of these events cause changes in climate or global warming (Perez, 2007) resulting to Accelerated Sea-Level Rise (ASLR) as an effect of global warming.

Grade 8 students were exposed to the five concepts in their Grade 7 Science. A substantial improvement in the competence levels is observed especially with the experimental group. Concepts of population, pollution, environmental phenomena, and factors which are inherent to climate change were learned. As manifested in students' responses they were reflective of their experiences. However, they must link this reflection to real life situations. Grade 8 students do not fully understand the interconnectedness, interrelatedness and interdependence of each of the species in this world to understand biodiversity.

To test the significant differences on the post-test scores of the experimental and control groups, the data were subjected to Analysis of Covariance (ANCOVA) which is shown in Tables 2 and 3.

Table 2
Comparison of Achievement Test Scores between the Experimental Group and the Control Group Using ANCOVA for Grade 7

Source	Type 111 Sum of squares	df	Mean Square	F	Sig.
Corrected Model	518.207a	2	259.104	108.5	0
Intercept	580.821	1	580.821	243.3	0
Pretest	215.627	1	215.627	90.32	0
Group	255.269	1	255.269	106.9	0
Error	112.213	57	2.388		
Total	21725	60			
Corrected Total	630.42	59			

Significant at 0.05 level of significance

Table 3

Source	Type 111 Sum of squares	df	Mean Square	F	Sig.
Corrected Model	123,696a	2	61.848	12.081	0
Intercept	177.286	1	177.286	34.629	0
Pretest	65.376	1	65.376	12.77	0
Group	78.607	1	78.607	15.354	0
Error	240.624	57	5.12		
Total	21254	60			
Corrected Total	364.32	59			

Significant at 0.05 level of significance

Tables 2 and 3 show the comparison of the achievement test scores of Grades 7 and 8 students between those who were taught integrating climate change with the CC lessons and those who were taught using the conventional method. The result showed that the use of CC lessons in integrating climate change in teaching the experimental group significantly improved the students' academic proficiency level.

Furthermore, the ANCOVA summary of the achievement test results of Grades 7 and 8 showed that the p-values of 0.000 is significant because it is below the alpha level which was set at 0.05 level of significance. It means that there is a significant difference in the mean gain scores of the achievement test between the experimental and control groups.

Based on the findings the null hypothesis which states that there is no significant difference between the academic proficiency level of Grades 7 and 8 students who were taught using the integration of CC lessons and the students who were taught using the conventional method is rejected.

There is a statistically significant difference between the academic proficiency level of Grades 7 and 8 students in the experimental group (AP) and the academic proficiency (D) of the control group. The higher academic proficiency level of the students in the experimental group can be attributed to the use of CC lessons in integrating climate change. Higher proficiency levels of the experimental groups in Grades 7 and 8 students can be credited to students' active participation in various CC lessons.

The study of Ledres (2014) integrating computer technology in teaching physics improved students' academic achievement. Likewise Ezeudu and Ezinwanne (2013) found that simulation increased students' achievement in chemistry. Teacher support materials with technology integration can be used and can enhance traditional teaching. Typhoons, earthquakes, and other calamities can be effectively taught using multimedia incorporated in CC lessons (Rutten, Van Joolinger, & Van der Veen, 2011). Students interact and learn better with multimedia explanation of the content (Van Joolingen, de Jong, Lazonder, Savelsbergh, & Manlove, 2004). Documentary files can be accessed from TV programs (Rieber, Tseng, & Tribble, 2004).

Gistarea (2013) claimed that the success of any learning process depends largely on the instructional procedure. Encouraging teachers to bring students to the real environment, and analyzing problems of depleting resources would enhance awareness of students and challenge them to respond accordingly.

Conclusions and Recommendations

The CC lessons were appropriate, appealing, exciting, challenging, easy to understand, and enjoyable to the students. It can be recommended for use among Grades 7 and 8 Science teachers.

The experimental groups both in Grades 7 and 8 obtained the level of achievement as Approaching Proficiency (AP) compared to Developing (D) among control groups. ANCOVA result showed significant differences between experimental and control groups. Therefore, the null hypothesis stating that there are no significant differences in the academic proficiency levels of Grades 7 and 8 students taught by integrating CC concepts in the lessons and those using the conventional method is rejected.

Students show great difficulty in understanding or learning creatively in producing products or performance especially

on the concepts of biodiversity and population for Grade 7 and biodiversity for Grade 8. The above result could be attributed to the transition from basic education curriculum to K to 12. Spiraling of different concepts (Physics, Chemistry, Earth Science and Biology) starts at Grade 3 so there are learning gaps in the elementary graduates because the full implementation of K to 12 Science curriculum will be by 2018-19. Grade 7 students need more exposure to content particularly in the concept of population where students cannot relate the idea of law of supply and demand to population e.g., food shortage as a result of population explosion to pollution, other results like more garbage and its consequences to human health. These concepts were taught in Grade 8 but these were also taken up as concepts of CC in grade 7.

It is also further recommended that future curriculum developers consider the weakness in the gaps in the level of knowledge and understanding on population and biodiversity for Grade 7 and biodiversity for Grade 8. Furthermore, Teacher Education Institutions (TEI) consider the teaching of population and biodiversity by enhancing the pre-service teachers' skills in integrating CC concepts. Also, it is recommended that Science teachers give more emphasis on these concepts in integrating climate change. It is highly recommended that teachers introduce teaching-learning activities that would provide the connection between theories and practices related to climate change.

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