Integration of Climate Change Adaptation (CCA) and Disaster Risk Reduction (DRR) Concepts in Chemistry Teaching

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Abstract - The study explored the integration of Climate Change Adaptation and Disaster Risk Reduction Concepts in teaching chemistry. Power point presentations on Climate Change Adaptation and Disaster Risk Reduction concepts were integrated in selected topics in a General Chemistry course and student's conceptual understanding, thinking skills, environmental values development and awareness of CCA and DRR concepts were assessed.

Methodology was composed of three phases. Preparatory phase includes the identification of appropriate CCA and DRR presentations for selected topics in a 5 unit General Chemistry course, preparation of syllabus that served as guide in the final execution of the lessons, and development and validation of activity guide to be used during the lesson proper. Development and validation of teacher made achievement test was also done in this phase. Execution phase was the actual conduct of classes and integration of the CCA and DRR concepts via the identified presentations, this is the data gathering phase using validated teacher made achievement test. Evaluation phase was focused on the determination of the effects of the intervention particularly on the conceptual understanding, thinking skills, awareness of CCA and DRR concepts and environmental values development of the students.

Results of the study showed that the instructional procedures employed had improved the conceptual understanding and thinking skills of the students in chemistry. Integration of CCA and DRR concepts made the students aware of the problem and their environmental values were developed. The study proved that chemistry education can be an important tool in promoting climate change adaptation, disaster risk reduction and environmental advocacy.

Index Terms: chemistry education, climate change adaptation. environmental awareness, disaster risk reduction

1 INTRODUCTION

Education is an important sector in the society. It is through it that people are informed and made aware of the current and most pressing issues and concerns that need to be addressed. Through the school curriculum, societal concerns can very well be integrated in the learning process and capacitate learners with the necessary knowledge and skills for them to be aware of the realities in their immediate society. It is also a critical component for adaptive capacity: how people are educated and the content of education provides the knowledge and skills needed to make informed decisions on how to adapt individual lives, as well as ecological, social, and economic systems in a changing environment.

Chemistry is one subject that has a direct link with environmental science. Integrating climate change and disaster risk reduction in chemistry teaching is a good strategy in promoting environmental awareness and development of attitude towards environmental protection and conservation. Climate change education through chemistry teaching will not only empower citizens to tackle future challenges, including climate change adaptation and disaster risk reduction, but it will also ultimately empower citizens to achieve climate-resilient sustainable development.

Helping students understand climate change, its impacts and its solutions prepares them to take an active role in making good choices for

both society and the environment. Saving lives and properties are everyone's concern. So all together these should be given extra attention in the empowerment role of the education sector.

Making disaster risk reduction education part of the education curricula fosters awareness and better understanding of the immediate environment in which the students and their families live. Their awareness empowers the learners to take actions that reduce their vulnerability and turn them from disaster victims into agents of behavioral change. Mainstreaming Climate change Adaptation and Disaster Risk Reduction concepts in school is a great need, doing it in chemistry teaching is one good strategy.

The study explored the integration of Climate Change Adaptation and Disaster Risk Reduction Concepts in teaching chemistry. Power point presentations on Climate Change Adaptation and Disaster Risk Reduction concepts were integrated in selected topics in a General Chemistry course and student's conceptual understanding, thinking skills, environmental values development and awareness of CCA and DRR concepts were assessed. It worked on the following objectives:

1. Integrate CCA and DRR concepts in chemistry teaching.
2. Assess the effect of the integration to the academic performance of the students in the subject.
3. To determine the student's level of awareness on CCA and DRR concepts and development of attitudes before and after the integration.
4. Promote climate change adaptation and disaster risk reduction through chemistry instruction.

2 METHODOLOGY

Descriptive-evaluative method was used in the study. It involved description of the status of the respondents as regards to their awareness and attitude towards the current climate change concerns particularly on Climate Change Adaptation (CCA) and Disaster Risk Reduction (DRR) at the start of the study and evaluation of the effect of the integration to chemistry conceptual understanding of students as well as on their awareness of the CCA and DRR concepts and development of attitudes after the intervention. Methodology was composed of three phases, the preparatory phase, execution phase and evaluation phase.

Preparatory Phase

Preparatory phase includes the identification of appropriate CCA and DRR presentations for selected topics in a 5 unit General Chemistry course, preparation of syllabus that served as guide in the final execution of the lessons, and development and validation of activity guide to be used during the lesson proper. Development and validation of teacher made achievement test was also done in this phase. Orientation and profiling of the student respondents and preliminary assessment of their level of awareness on CCA and DRR were likewise conducted.

Teacher made achievement test intended to measure chemistry conceptual understanding (part A) of students and CCA, DRR concept awareness (part B) was developed through the standard procedure of test item construction and validation. It was submitted for face validation to selected chemistry teachers who were experts in the subject. Part A included only those that pertain to the topics where CCA and DRR concepts were integrated while part were items to measure CCA, DRR concept awareness.

Execution Phase

This phase was the actual conduct of classes and integration of the CCA and DRR concepts via the identified presentations which was adopted from the presentations obtained from the Regional Center for Initiatives and Research on Climate Change Adaptation (CIRCA). Interventions were conducted as indicated in the course syllabus at an integration time of not over one (1) hour per presentation and discussions on related topic in the General Chemistry. Pretest and posttest were administered using the teacher made achievement test focused on conceptual understanding and thinking skills to determine the effect of the instructional procedures to the achievement level of students in chemistry. Awareness of CCA and DRR concepts and environmental values development was

determined through the essays required to be written by the students.

Evaluation Phase

Evaluation phase was focused on the determination of the effects of the intervention particularly on the conceptual understanding, thinking skills, awareness of CCA and DRR concepts and environmental values development of the students.

Pretest and posttest results were evaluated to determine significant differences on the conceptual understanding and thinking skills of the respondents before and after the intervention. This is to find out if the instructional intervention does not affect the realization of objectives for the subject. Awareness of CCA and DRR concepts and environmental values development as a result of the integration was determined through the student essays which were evaluated using the Krathwohl's Taxonomy of Affective domains. The statistical methods used to analyze quantitative data gathered were the mean, standard deviation, and t-test for correlated samples.

3 RESULTS AND DISCUSSION

This section presents the discussions which were focused on a) the integration of CCA and DRR concepts in chemistry teaching; b) level of chemistry conceptual understanding, CCA and DRR concepts awareness of students and development of attitudes before and after the integration; and c) promotion of climate change adaptation and disaster risk reduction through chemistry instruction.

Integration of CCA and DRR concepts in Chemistry Teaching

Chemistry is a natural science prescribed as one of the General Education Courses in most programs. Students may not be able to finish a degree without passing a course in chemistry, As such it can be a vehicle for the integration of issues and concerns confronting the society because it is being taken by most students in the tertiary level.

Climate change is widely regarded as one of the most serious challenges the world faces. No country or individual will escape the effects the climate catastrophe. It was noted to get even worst as years progress, causing more severe effect to ecological components.

Schools through its curriculum can play a major role in the education of tomorrow's decision makers. The education sector is an opportunity and arm in solving societal problems like those that concerns the environment. It is a critical component for adaptive capacity. Climate change education will not only empower citizens to tackle future challenges, including climate change adaptation and disaster risk reduction, but it will also empower citizens to achieve climate-resilient sustainable development.

Helping students understand climate change, its impacts and its solutions through chemistry education is a promising initiative, as noted by this study. It was done through the use of power point presentations which were integrated at specific points in the discussion of chemistry topics in a General Chemistry Course. Points of integration on the presentations were reflected in appendix B.

It can be noted from the prepared syllabi for the subject that the integration is only a small part of the instructional procedure. It was done in the form of an into-drive after a chapter discussion that include related topics such as impact of chemistry to the society; changes in matter; measurement and conversion of units; writing and nomenclature of compounds; chemical reaction and gases. The presentation takes around twenty (20) to thirty (30) minutes, which was followed by a brainstorming exercise and sharing information related to the presentation. Reflective questions were given to cater into the affective domain of the learners.

The intervention was in the form of a power point presentations obtained from the Center of Initiatives and Research for Climate Change Adaptation.(CIRCA). It was a collection of talks by expert/authority in the topic catered. Presentations were in the form of an info-drive that included The Science of Climate Change; Sustainable Environment on Climate Change-DENR-EMB; Forest Restoration Using Native Trees; Water Resources/ Hydrology; Climate Change, CIVAR, Water and Food; and Acid Rain.

The mode of integration employed was noted to be effective based on student responses

after the info-drive. Their active participation in the discussion and sharing is an indicator of their awareness and concern towards the issue. This study had noted that chemistry teaching can be a vehicle in the dissemination and promotion of information on climate change adaptation and disaster risk reduction. Integration in the subject can effectively be done through power point presentations that were given as an additional learning activity in a chemistry class. It is recommended that matching of topic and presentation must be given due consideration to ensure that the main intention of chemistry instruction is still prioritized over the intervention.

Effect of the Integration to the Academic Performance of the Students

Instructional procedures in a subject are carried out to cater into the learning objectives. A chemistry class is primarily focused on the acquisition of chemistry concepts and principles as well as its applicability to the real life situations of the students. An intervention, like the integration of any concept is only an add on to the main objective of the course, thus should only form part of the instructional objective. To ensure that the integration of the CCA and DRR concepts in chemistry instruction is not neglected, this study looked into the academic performance of the students

Results showed an amazing increase in the achievement level of the learners. The mean score in the achievement test focused on conceptual understanding was increased from 4.20 in the pre-test to 50.0 in the posttest, at a perfect score of sixty (60). It indicated that the integration does not in any way affect the acquisition of chemistry concepts and principles. It further manifests the teacher's success in the conduct of academic instruction in the chemistry class. The foregoing results implied that Climate Change Adaptation and Disaster Risk Reduction concepts can be integrated in teaching chemistry without sacrificing the intent of instruction.

Statistical test of significant difference in the pre-test and posttest mean scores using t-test for correlated samples revealed that there is a significant difference in the mean scores before and after the instructional procedures. Findings implied that students learned the concepts in spite of the CCA and DRR concepts integration. Thus, the academic performance of the students is still developed even in the presence of the intervention.

Student's Level of Awareness on CCA and DRR Concepts and Development of Attitudes Before and After the Integration

A questionnaire on the level of awareness was administered to students before and after the instructional procedure with info-drive on CCA and DRR to assess their level of awareness. Overall results are given in table 1.

Table 1
Level of Awareness on CCA and DRR of the Students Before and After the Intervention

Ave. Level of Awareness Before	Description	Ave. Level of Awareness After	Description
1.71	Slightly Aware	3.62	Highly Aware

Legend: 0.51-1.5 not aware; 1.6-2.5 slightly aware; 2.6-3.5 moderately aware; 3.6-4.0 highly aware

Findings of the study indicated the positive effect of the info-drive to the CCA and DRR concept awareness of the respondents thus improving their level of knowledge on CCA and DRR. From slightly knowledgeable, they became highly knowledgeable after integrating the concepts in their chemistry class. The instructional activity implemented by the teacher to promote CCA and DRR concepts improves students' level of awareness.

The foregoing findings were found consistent with the learning theories. Blooms Teaching for Mastery Methods presents that students can master a subject matter if there is a proper design of materials. The power point presentations used in the integration in the form of info-drive promoted concept awareness and allows independent learning resulting into improved level of awareness.

To assess the development of attitudes on Climate Change Adaptation (CCA) and Disaster Risk Reduction (DRR), students' essays were evaluated in the light of the Krathwohl's Taxonomy of Affective Domains. Results in table 2

revealed development of positive attitude after the intervention.

Table 2
Evaluation of Student's Essay on Attitude
Towards CCA and DRR

Average Rating of Students' Essay	Attitude
2.1	Responding

Legend: 0.51-1.5 not aware; 1.6-2.5 slightly aware;
2.6-3.5 moderately aware; 3.6-4.0 highly aware

Noted as slightly aware at the start of the study, the respondents became highly aware after the intervention. Data in table 2 likewise presented that majority of them are already responding to the issue after being exposed to learning sessions with integration of CCA and DRR concepts. The results proved that integrating CCA and DRR concepts may be done in chemistry teaching through power point presentations that disseminate the concepts. Chemistry instruction therefore can be a vehicle in the promotion of climate change adaptation and disaster risk reduction among students. The essays made by the students reflected concern over the environment; some of them also include plans on what they will do in response to the problem. It was amazing to note that at their young age, they are already developing an advocacy towards the environment.

4 CONCLUSION

Results of the study showed greater potential of chemistry instruction as a means of promoting climate change adaptation and disaster risk reduction concepts. It can be effectively done through power point presentations that were integrated in the discussions of related topics in the subject as noted in this study. The study likewise noted that the integration made does not affect the realization of the objectives of instruction as proven by the significant difference between the pre-test and posttest mean scores of the students in the test for conceptual understanding, with the mean of the posttest higher than the pre-test mean score.

The study likewise revealed favorable results of the intervention in promoting CCA and DRR concepts awareness as well as in developing attitudes towards climate change adaptation and disaster risk reduction. The noted responding attitudes of the students after the intervention makes it a promising means of solving the climate change problems being faced by the world today. As such, integrating CCA and DRR concepts in teaching chemistry may be recommended to teachers who wants to take part in the climate change issue. Integration of the CCA and DRR concepts through power point presentations in one strategy that they can adopt, or they can try other means like doing it through modular instruction or the use of other IEC materials.

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REFERENCES

[1] Anderson, Allison (2011). Climate change education can reduce disaster risk and ensure sustainable development. Retrieved from http://www.educationforallblog.org/issues/education-and-climate-change/climate-change-education-can-reduce-disaster-risk-and-ensure-sustainable-development

[2] Holbrook J. And Rannikmae, M (2005). Supplementary Teaching Materials-Promoting Scientific and Technological Literacy. Taru, Estonia: ICASE.

[3] Lombardi, M (2007). Authentic Learning for the 21st century: An overview. Educause Learning Initiative (ELI), paper 1.

[4] Flores, Zonia Luz R. (2006). International strategy for disaster reduction. Retrieved from http://www.eird.org/eng/revista/no-13-2006/art22.htm

[5] Ramirez, Ramona Isabel (2012). Resource-Based Course guide in Teaching General Inorganic Chemistry Integrated with Environmental Concepts. Unpublished Dissertation.

[6] Power point presentations from CIRCA (2010). Presented during the "Trainor's Training for Mainstreaming Climate Change Adaptation and Disaster Risk Reduction Concepts in School Curriculum".