

# Integrating Climate Change and Environmental Education based on Themes into Biology Teaching and Learning in Vietnamese Secondary Schools

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**ABSTRACT----** *The implementation of Climate Change and Environmental Education (CCEE) each subject has been limited in education system of Vietnam. If CCEE separately in each subjects, it cannot reflect the “overall picture”, “systematic” and “extensiveness” of the environment and environmental issues. Hence, it is necessary to develop a system of integrated CCEE themes, including various disciplines’ contributions. Individual subjects are expected to play indispensable roles in the process of CCEE. Researching the theory and practice of the integrated pedagogical approach in order to compile a guide to integrate the CCEE based themes for biology teachers in secondary schools to achieve dual objectives, that are improving the quality of teaching and learning biology and integrating the CCEE effectively.*

**Keywords ----** Integrated, environment, education, climate, biology

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## 1. INTRODUCTION

The first reason emerging from the increasingly strong impact of human on environment having caused climate change consequences that directly threaten human lives; The second emerging from legal requirements such as the Law on Environmental Protection (LEP) approved by the National Assembly on 27 December, 1993 and became effective as from 10 January 1994; the documents, Directives, Resolutions, National Target Program to Response to Climate Change approved by Vietnamese Government and Ministry of Education & Training’s Documents on the practices of CCEE in schools; The third emerging from the disadvantages of CCEE practices including teachers’ awareness, contents and methods of CCEE, and students’ consciousness and habits on environmental protection. The fourth arising from the conflict between overloaded current curriculum and the information explosion, on the one hand, and the limitation of academic learning time, on the other hand; thus, it is impossible to add the subject of CCEE in schools and the last arising from Biology’s potential and advantages that facilitate CCEE for students.

The above mentioned reasons have strengthened the argument that is necessary to adopt the integrated approach in teaching separate subjects. The question is how to improve the quality of teaching and learning Biology subject as well as to implement the CCEE effectively. Integrating CCEE based on themes into Biology subject is a feasible approach to help students gain biological knowledge and to develop students’ knowledge, skills and attitudes relating to environmental issues and climate change without adding the subject of CCEE in high schools. However, the inclusion of CCEE in the secondary education level avoid widespread, arbitrary and overload and consistent with psychological and physical characteristics that has not been studied in a scientific way.

Currently, applying the CCEE in secondary schools as a part of compulsory education was approved by MOET. Biology curriculum and textbooks in high education contain environmental and climate change issues and it shows consequences by nature, but in the form of potential. This will provide opportunities to implement the CCEE in secondary schools through teaching and learning.

Thus, the study of “integrating the CCEE based on themes into Biology teaching and learning in Vietnamese secondary schools” is really necessary and feasible

In recent decades, the integrated approach in the curriculum development has become the global trend of educational development. In Vietnam, this approach has been used in the development of general educational curriculum since the third educational reform (1979). The idea of integrated teaching in subjects was then suggested by many educational researchers. However, it has not become popular yet, and it has still been tested at the lower levels of the integration. Much research on the theory and teaching-learning methods of each subject in Vietnam has been conducted with the aim of finding the best way to teach the knowledge of specific subjects. Such an approach has made these subjects isolated. In a high education level, the curriculum often prioritizes science over technology. The science separated from its application may reduce its effectiveness as an educational tool. This contrasts with developmental trends in science and social needs, which are integrated teaching into subjects in order to meet new educational requirements such as the CCEE, Population Education and Adolescent Reproductive and Sexual Health Education, Food safety and Nutrition Education, Social Evils Prevention in schools, Vocational Education, Life skills education.

It is obvious that the integrated approach used in the development of general education curriculum in Vietnam has been thoroughly grasped. This approach has been increasingly enhanced in teaching and learning process. It is the case for the CCEE, and it is realized that the CCEE's contents are found to scatter in all subjects, which results from the fact that the CCEE issues are diverse, complex, interdisciplinary. It is related to all aspects of social life, nature and human and it is also the research aim of many subjects in schools.

## **2. CONTENT**

### **2.1. Objectives**

The purpose of this research is study on the theory and practice of the integrated pedagogical approach in order to compile a guide to integrate the CCEE based on the themes for biology teachers in secondary schools. This study was carried out to (1) improve the quality of teaching and learning biology and (2) integrate the CCEE into biology subject effectively.

The trend of integrating sciences in the developmental process and the trend of integrating subjects in the teaching and learning process are not the same in the content as well as the cause. The former follows the rule of awareness which is the process of "General-Analysis-Synthesis". In essence, that is the awareness process based on holistic-partial model according to various spiral levels. In particular, the increasing emergence of interdisciplinary areas is a result of morphological changes in sciences that have occurred in the 21st century from analysis-structure to synthesis-system model. This means that the more science grows, the more deeply specialities are differentiated and the tighter interdisciplinary integration is. Meanwhile, the scientific development would be reflected through teaching and learning all the subjects in schools. This process takes place in a limited time hence, the shift from separate subject approach to integrated approach is indispensable. The focus is how to improve the quality of teaching biology as individual subject in schools and integrate the CCEE effectively, avoiding widespread, arbitrary and overload and consistent with psychological and physical characteristics at the same time

### **2.2. Time, place and method**

In this study, we used pretest-posttest designs to compare participant groups (teachers and students) and measure the degree of change occurring as a result of treatments or interventions. In this design, we used two classes; one class was given the treatment (applying the integrated teaching and learning in lessons) and the results were gathered at the end. The other class received no treatment, at the same and took the same tests. Statistical analysis can then determine if the intervention had a significant effect or not.

Firstly, we designed and pre-tested in our survey with the aim of obtaining the information to clarify the practice of (1) teachers' understandings of the objective, content, method and model of the integration of the CCEE into biology teaching and learning in secondary schools; (2) teachers' awareness of the integrated theory and integrated teaching; (3) teachers' capability of integrated instruction. This survey was implemented in the first semester of the academic year 2013-2014 through qualitative methods such as questionnaire, observation and interviewing, the number of participants was 40 teachers from 10 high schools in Hanoi. The results of this survey revealed limitations in teachers' understandings and abilities relating to the CCEE based on the integrated approach.

Secondly, we designed and pre-tested in our survey with the aim of obtaining the information to clarify the practice of (1) students' knowledge of environment and climate change in high schools; (2) students' attitudes and behavior trends relating to environmental protection and climate change responses in high schools. The survey was also implemented in the first semester of the academic year 2013-2014 through qualitative and quantitative methods such as questionnaire using Likert scale, and multiple choice questions. The number of participants was 960 students from 10 high schools in Hanoi.

Pedagogical experimental method was conducted to test the soundness and efficiency of the indicated scientific hypothesis of the study. The basis of the comparison of the pedagogical effectiveness between traditional teaching methods and teaching methods was integration of the CCEE based on themes in teaching and learning biology in high schools. The sampling of the experimental and control classes ensured the uniformity. Apart from that, we improved the

professional capability of teachers who would teach the experiment classes. The experimental teaching process was implemented in 10 high schools, two classes per school, four periods per class, then we scored the tests and collected data from the experiment.

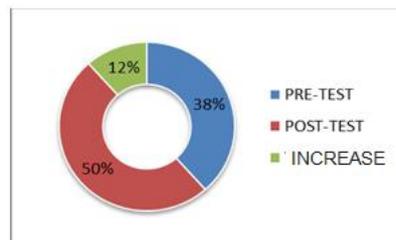
The statistical methods for analysis of pretest-posttest data were used in comparing groups with pretest and posttest data: (1) Analysis of variance (ANOVA) on the gain scores, (2) Analysis of covariance (ANCOVA), (3) ANOVA on residual scores, and (4) Repeated measures ANOVA. The change with pretest-posttest data was measured by the IRT methods, in which the Linear Logistic Model for Change was applied in measuring change in various pretest-posttest situations.

### 2.3. Findings

#### Results

##### *Comparison between teachers' cognition of the integrated approach and integrated teaching in pretest and posttest*

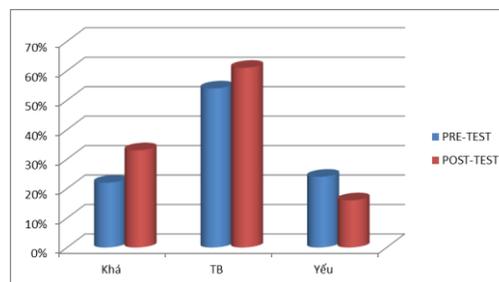
We used the same measuring tool to assess the teachers' cognition of the integrated approach and integrated teaching and learning pre-test and post- test. The result was shown in Figure 1:



**Figure 1:** Biology Teachers' Cognition of the Integrated approach and integrated teaching in pretest and posttest

##### *Comparison between biology teachers' ability of integration in high schools in pre-test and post-test*

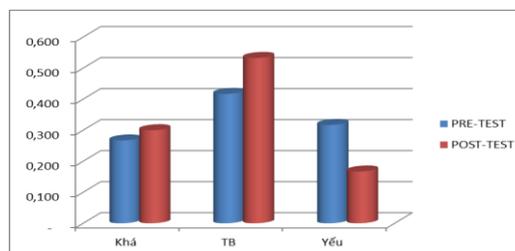
Figure 2 shows teachers' ability of intergration (general competence) pre-test and post-test



**Figure 2:** Biology Teachers' Ability of Integration in High Schools Pre and Posttest

##### *Comparison between biology teachers' ability of integrated teaching in high schools in pre-test and post-test*

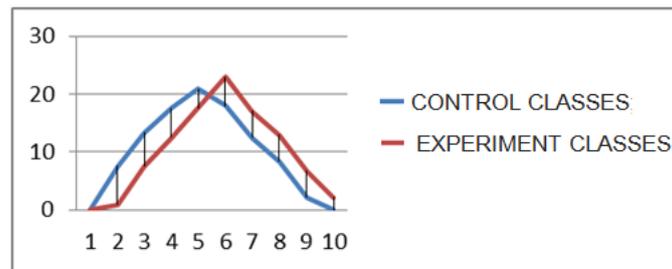
The following chart indicates biology teachers' ability of integrated teaching in high schools pre-test and post -test:



**Figure 3:** Biology Teachers' Ability of Integrated Teaching (professional ability) in High Schools Pre and Posttest

##### *Comparison between high school students' knowledge relating to environment and climate change pre and post test*

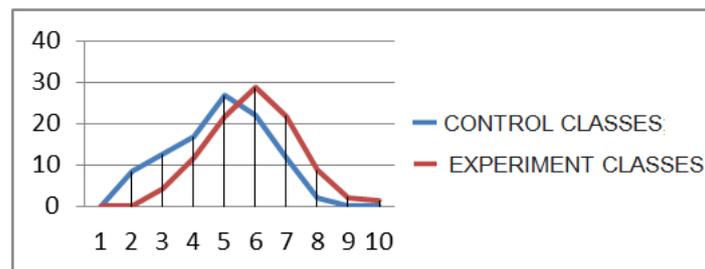
The following line chart shows the change in students' knowledge related to environment and climate change pre-test and post -test:



**Figure 4:** The students' knowledge of Environment and Climate Change Pre and Posttest

*Comparison between high school students' attitudes, behaviour trends relating to environmental protection and climate change responses pre-test and post- test*

The following chart shows the changes in high school students' attitudes and behaviour trends relating to environmental protection and climate change responses pre and post test:



**Figure 5:** The students' Attitudes, Behaviour Trends relating to Environmental Protection and Climate Change Responses pre and posttest

### Discussion

A system of integrated themes should include main contents related to environment and climate change. The issues concerned with environment and climate change in Vietnam and in the areas where schools are located should be added regularly in these contents. The CCEE integrated themes are developed systematically based on various areas reflecting the existence of material in the nature. It breaks down boundaries between separately traditional subjects and enable them to effectively integrated contents related to the CCEE in the teaching and learning process. These themes are expected to become the common core themes that provide opportunities for all subjects to deliver the CCEE. They are likely to be taught in classrooms and co-operation activities, and that is the case even when subject curriculum were based on the separate subject approach. The reason is that the core themes will control the levels of the integration and relationships between the subjects' knowledge components. Especially, the subjects of natural sciences (including biology, physics and chemistry) are most likely to provide opportunities to integrate the CCEE.

However, in order to develop core themes of subject areas and to be able to contribute to integrate appropriate educational aspects in those subjects' content in secondary schools, it is necessary to follow some principles. These principles include:

- (1) All established themes should be relying on the principles relating to the existence, movement and development of material world in the nature, which rules over the names of the core themes reflecting various existences of material in the nature.
- (2) The core themes should be systematically developed so that it is more likely to break down boundaries between separately traditional subjects, and allow all subjects to contribute to intergrate educational aspects.
- (3) It is necessary to establish the integrated links in each theme system based on the rules that express the relationships between structure and function, large and small systems, microscopic and macroscopic structure, organic and inorganic things and between various operation modes of a matter in theme systems.
- (4) Teaching and learning activites should be driven by each theme in the system at various levels of the integration and relationships between the subjects' knowledge components.
- (5) It is necessary to identify main contents of each theme in the system. Integrated contents of themes will be gradually expanded through regular updates of the practical issues in the area where the school is located. This is the basis that enables subjects to link with different domains (natural sciences, social sciences & humanities, science and technology).
- (6) Developing students' capabilities is the core principle of the post 2015 curriculum of general education in Vietnam. Students' competencies are able to develop only through organizing learning activities including the integration between the subject content and core themes. Science knowledge and ideas of vairous subjects should be selected according to the principle that aims at clarifying a certain issue in core themes.

The results of the comparison in biology teachers' awareness and ability of integrated teaching pre-test and post-test show that the progression of their awareness and capabilities in pre-test and post-test is clear.

Through analyzing the results of tests obtained from experimental classes and control classes, and the observation from students' attitudes during the experiment, we realized the followings points: (1) When learning in the classes with integrated the CCEE in the lesson (experiment classes), students were more interested in the content and environment and climate change issues than those of the control classes. (2) Students' skills of applying knowledge to solve the issues related to environment and climate change in experiment classes were enhanced more significantly than those of the control classes. (3) The results from comparing the progress of students' knowledge, attitudes and skills relating to environment and climate change between pre-test and post-test in experiment classes have been higher than those of the control classes.

#### 2.4. Conclusion

The existing Vietnam general curriculum and textbooks was developed based on the separate subject approach and it could make the possibility for integrating educational values into curriculum lowest. This possibility will be much greater if the integrated themes are developed so that all subjects can contribute to integrate various educational aspects.

The integrated approach is the underlying theory that helps teachers achieve dual goals and helps students gain biology knowledge as well as develops students' knowledge, skills and attitudes relating to environment and climate change issues without adding another subject of CCEE in schools. Thus, integrated teaching and learning aims not only to reduce the time for presenting various subjects' knowledge, but also to help students learn how to apply knowledge into practice in a synthetic manner.

Concerning the context of changing curriculum and textbooks, it is necessary to develop core themes as common points for designing the internal disciplinary, interdisciplinary, cross-subject and multi-disciplinary integrated learning and teaching activities in the areas of natural sciences (including biology), social sciences and humanities, science-technology.

Themes-based teaching and learning approach has a focus on students' awareness activities, providing opportunities for teachers, These help their students carry out learning activities both inside and outside the classroom such as entertainment, sightseeing, field survey, scientific seminar.

#### 2.5. Recommendations

In order to apply successfully the integrated pedagogical thinking into the teaching and learning process in schools, it is necessary to improve professional development for teachers and include the theory and methods relating to integrated teaching in training programs for teachers, master students and PhD students.

### 3. ACKNOWLEDGEMENT

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