

Study of the Teaching of Biodiversity as a General Undergraduate Course in a University of Taiwan

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Abstract—The development of biodiversity has great impact on human society and economical lives recently. It has become an important issue in the 21st century. Cooperating with biotechnology, they have become the strategy of national long term development. However, in Taiwan there are not many studies concerning the biodiversity curriculum, and most of the recent studies involved are of teachers of primary and secondary students for subject evaluation. It is important to promote the concept of biodiversity among the non-biological undergraduate students and provide enough information for them to understand the basic principle of biodiversity. It is also a challenge to develop the program for biodiversity course in university, and necessary to study the conceptual analysis and curriculum development in biodiversity course for the undergraduate students. In this study, biodiversity conceptual analysis for the reference of curriculum development and the tool of course evaluation in National Cheng Kung University were carried out in order to put the course into practice, design the teaching course and prepare the teaching strategy.

Index Terms—Biodiversity, conservation biology, general course, curriculum development.

I. INTRODUCTION

Ecological environmental protection and biodiversity species conservation are key factors for human survival and sustainable development, and they become important areas of global research for 21st century biological study. Biodiversity, also known as biological diversity, is an emerging science, and refers to an existence of different biological systems or similar characteristics of individuals.

Biodiversity is a biological characteristic of life changes in the group, such as genes, cells, individuals, groups, species or ecosystems [1]. Biodiversity is not just a biology topics and it arises out of its impact on every aspect of the global community such as aesthetics, ethics and morals, emotional and other factors. Biodiversity becomes a subject with cross-interdisciplinary concepts. However, most of the people do not really understand the meaning of biodiversity and confuse it with other words such as fine, natural or green [2]. Even biology research in the field of biodiversity also consists of different definitions and statistical meaning [3]. Scientists expected that because of environmental changes caused by human activities, and in the next 20 or 30 years more than 100,000 species of flora and fauna will disappear from the Earth. In 1992, 175

countries and areas signed an international treaty "Convention on Biodiversity" in Rio de Janeiro, Brazil. Biodiversity conservation becomes an important topic of environmental education and research [5]. In the year 2000, a number of scholars in Netherlands at the International Council of Association for Science Education (ICASE) recommended that biodiversity should be included in the formal and informal university curriculum. The purpose of this recommendation was, through the help of mass media and education programs, to let ordinary people understand: 1) the importance of biodiversity in human life and, 2) the basic needs for ecological conservation. Without the support of local people, the aims of biodiversity protection and ecological conservation could not be achieved. Therefore, through school and social education, the people will become more public aware and willing to participate in conservation and sustainable use of biodiversity. Department of Life Sciences of the National Cheng Kung University has been established for over 30 years. Cooperating with the Medical School, bio-medical field has become the main subject for the study of undergraduate students. However, in the last 10 years, influenced by the national environmental protection campaign, the department has also focused on the teaching of biodiversity in the undergraduate courses and established further study in biodiversity for local primary and secondary school teachers in order to promote the basic concept of ecological conservation.

In Taiwan there are not many studies concerning the biodiversity curriculum, and most of the recent studies involved are of teachers of primary and secondary students for subject evaluation. It is therefore important to promote the concept of biodiversity among the non-biological undergraduate students and provide enough information for them to understand the basic principle of biodiversity. It is also a challenge to develop the program for biodiversity course in university, and necessary to study the conceptual analysis and curriculum development in biodiversity course for the undergraduate students. In this study, biodiversity conceptual analysis for the reference of curriculum development and the tool of course evaluation in the National Cheng Kung University were carried out in order to put the course into practice, design the teaching course and prepare the teaching strategy.

II. METHODS

Ten different international and Taiwan domestic issues of biodiversity were designed for the evaluation (Table I) according to the reference of Caro, Mulder and Moore [6] and following the three main goals of the Convention of Biological Diversity (1992): 1) conservation of biodiversity, 2) sustainable use of its components and 3) fair and

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equitable sharing of benefits arising from genetic resources [7]. The various issues were focused on the integration of conservation and economic policies, emphasizing the diverse social participation and recognizing the value of indigenous culture. The statistic results of these issues were further integrated into three conceptual levels, practical, scientific and cultural respectively for biodiversity study. This study attempted to understand more about the non-biologically undergraduate students concerning their different views with various biodiversity issues. Each issue was evaluated by using seven grades as follows: absolutely disagree (1 point), disagree (2 points), partly disagree (3 points), no opinion (4 points), partly agree (5 points), agree (6 points) and absolutely agree (7 points). The higher the score shows the more preference to the particular point of view.

The study using undergraduate students was carried out from the year of 2006 to 2010 in the National Cheng Kung University (NCKU) which is situated at the southern part of Taiwan. Since its establishment in 1931, NCKU has developed into a comprehensive research-oriented university comprising 9 colleges: Liberal Arts, Sciences, Engineering, Electrical Engineering & Computer Science, Planning & Design, Management, Social Sciences, Medicine, and Bioscience & Biotechnology. Currently, there are more than one thousand faculty members and more than twenty thousand students at NCKU. The general course taught, namely "Introduction to Biodiversity" was elected by the undergraduate students, and after 16 weeks of general biodiversity teaching by experts from all relevant areas of biodiversity, only the non-biological undergraduate study students were subjected for the study. Lectures taught were not only based on professional knowledge, but through multimedia and animated pictures for course presentation. The questionnaires were carried out in the first week of the course, and the same questionnaires were also done after 16-week study. All lecturers who participated in this general course were not aware of the contents of the questionnaires, and the contents of their teaching would not touch on the issues of the questionnaires. After a five-year survey study, 1,400 valid questionnaires for students, of which 68% male and 32% female, were collected. The academic backgrounds of the students under study were shown in Table II.

III. RESULTS

The design of this research study was carried out by the evaluation methods of Caro, Mulder and Moore, 2003 [6] and Van Meel, 1997 [8]. By using 10 questions of different issues of biodiversity in 16 weeks of general biodiversity course, the students involved in this study were used for the tests of any changes on biodiversity conservation point of view. The ten different issues of biodiversity consisted of five various contents, namely human culture, education, pharmaceutical, scientific and human value. Results of these issues were categorized into three levels, practical, scientific and cultural.

Results between the preference for biodiversity and the three different levels are shown in Table III. The number of students changing their preference to conservation of

biodiversity is shown in Table IV.

TABLE I: ISSUES OF BIODIVERSITY

	International issues	Domestic issues
Practical	1. Hydro-electric power plant and species conservation 2. Establishing the Tibet National Park	3. Construction of the Hwushan reservoir conservation of the Blue-winged Pitta bird (Pitta brachyura Temminck & Schlegel) 4. Controversy over the import of pandas and Jinsihou monkey (rhinopithecus) to Taiwan
Scientific	5. Insect conservation and agricultural crisis 6. Research of pharmaceutical company in rainforest area	7. Prevention of invasion of bittervine (Mikania micrantha H. B. K.)
Cultural	8. Preservation of aboriginal heritage	9. Opening of experimental forest 10. Controversy over legalization of hunting by Aborigines

TABLE II: ACADEMIC BACKGROUNDS OF THE STUDENTS UNDER STUDY

Faculty	%
Engineering	65
Science	11
Business	14
Other (non-biological)	10

TABLE III: PREFERENCE FOR BIODIVERSITY RELATED TO THREE DIFFERENT LEVELS

	Not preferable to biodiversity view	Preferable to biodiversity view
Practical	35%	49%
Scientific	51%	39%
Cultural	24%	53%

From these results, the issues used for the study showed changes of preferences in practical, scientific and cultural level after the 16 weeks general course of biodiversity. In Table III, it was found that the performance of students in scientific level was poor compared to the other two different levels, practical and cultural, most probably because most of the students are from scientific and technological background (Table II).

According to the results of various issues, on issues 1, 3 and 4, students became more aware on the conservation of biodiversity. On issue 6, students acknowledged that science could help to reduce the damage of deforestation of tropical rainforests caused by agricultural development, and this result indicates less preference for biodiversity. Results changed on issues 1, 3, 4 and 6 might probably be due to the similar concepts taught in the course, and the student opted more for biodiversity. Issue 3 was an indigenous topic. It

was because that the construction of the reservoir might destroy the habitats of the endemic species, the Blue-winged Pitta bird (*Pitta brachyuran* Temminck & Schlegel). However, termination of the construction of the reservoir would finally result in shortage of local water supply in Yulin County. Results shown that more than 70% of the students under survey were more preferable for biodiversity, and this might be caused by the promotion of the concept of habitat conservation in the general course. Issue 4 was a controversial topic which consisted of the arguments between different political views (the pandas imported were from Peoples Republic of China) and conservation concepts. However, results of preferable for biodiversity were obtained from both questionnaires though panda was a kind of popular animal in this world. Issue 6 was a concern for permission to the establishment of pharmaceutical company in rainforest for research study. This issue was chosen and modified from the questionnaire of Caro, Mulder and Moore, 2003 [6]. Results showed that more than half of the students were found to recognize the fundamental function of rainforest related to conservation protection. Issue 1 was also adapted from the questionnaire of Caro, Mulder and Moore, 2003 [6], and illustrated the process of building hydroelectric plant might cause the extinction of rare species. Most students realized that the value of the conservation of rare species was more important than the construction of a hydroelectric plant even though the plant was mildly polluted and necessary for normal water supply in the country. Issues 5 and 7 belonged to domestic topics and their related news were frequently reported by mass media. Most students more and less knew the background of these issues and the survey was expected to be preference for biodiversity. Results found in both questionnaires were shown in favor of conservation protection.

TABLE IV: NUMBER OF STUDENTS PREFERENCE CHANGED TO CONSERVATION OF BIODIVERSITY

Issues	Number of student changed (%)
1	9.0
2	15.8
3	26.7
4	18.1
5	6.9
6	16.4
7	7.0
8	12.8
9	14.7
10	10.8

IV. CONCLUSION

A general education is a program that provides a wide range of courses in the arts and sciences to give the students a better educational experience. The courses, sometimes only basic or introductory, provide fundamental skills in areas such as Math, English, and the Social Sciences, and intend to develop students as personalities rather than trained specialists and to transmit a common cultural heritage. The general course of biodiversity is not just a biological subject. The various issues of biodiversity affect every aspect of the global community, in which thinking of

aesthetics, ethics and personal emotion are involved. Therefore, the current global ecological crisis as the central theme of eco-environmental education might become an important curriculum for modern general course study. The teaching of biodiversity is not only a course for the students to accept the basic professional theory. The main aim is, no matter which department students come from, to let them understand the application of ecological conservation. The implementation of today's higher education causes mutual differences between various disciplines such as humanity and science and technology, particularly in the concept of ecological conservation. Since the aim of the general course is to avoid the differences between various disciplines, biodiversity general course will play an important role for the promotion of ecological conservation concept among the university students. University students are future leaders of the world, and they also play important roles for the advancement of the progress of human society. Encouraging students to study biodiversity general course will provide more understanding of the global environmental crisis for the students, thus, the protection of the ecological world will become reality, and not only a slogan. Results of this study (Table III) indicate that undergraduate students in National Cheng Kung University are more preferable to biodiversity view in practical and cultural issues but not in scientific issues. All these results suggest that in spite of our university being a scientific and technological base institute, students are changing their biodiversity views in many general subjects after suitable teaching of biodiversity, and further study is necessary for the study of biodiversity related to scientific issues. Moreover, for better studying in biodiversity, implementation of outdoor education activities will allow students to appreciate and value the beauty of nature. With these activities, the general course would undoubtedly promote more understanding of the knowledge of ecological conservation, and therefore, better environmental attitude will be achieved. Finally, the world will become a better place for us to live in.

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