Education for Sustainable Development
Biodiversity Education Project

Case Study of Integration of “Learning about Biodiversity: Multiple-Perspective Approaches” into Teaching and Learning at Tonle Sap Biosphere Reserve

Prepared by:
CHOU Phanith and NOP Sothun
Abstract
Cambodia has diverse forest types including evergreen, deciduous, mixed and mangrove. Presently, the natural resources including habitats for biodiversity, non-timber forest resources, and marine and fresh water resources in Cambodia have been degraded significantly in recent years. Wildlife hunting, habitat destruction and human disturbance by local people and outsiders have been considered as the main threats to biodiversity in Cambodia. Besides, low education and public awareness on education are the main challenges for biodiversity conservation, according to Clements and his colleagues, 2009. In order to assist in preserving biodiversity, UNESCO has cooperated with multi-stakeholders to implement the project called “Biodiversity Education Project”. The project focused on improving capacity of teachers, students, community members, media professionals and decision makers to better understand on biodiversity in Cambodia, particularly in Tonle Sap Biosphere Reserve. The project has been implemented through two important phases. The 1st phase included the process of translating toolkits into Khmer, reviewing the meaning and, introducing tool of “Learning about Biodiversity”. The 2nd phase was the training workshops, which focused on the dissemination of how to use the toolkit and how to integrate the biodiversity perspectives into teaching and learning at lower secondary school. The first section of this case study report elucidated the real situation of biodiversity in Tonle Sap Biosphere Reserve, where many of Cambodian people depend on. The second part included the way in which biodiversity approaches have been integrated into formal education program. Main opportunities and barriers for integrating biodiversity perspectives into teaching and learning activities and possible way forward of relevant institutions have been explored.

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<tr>
<td>ACCB</td>
<td>Angkor Center for Conservation of Biodiversity</td>
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<td>ADB</td>
<td>Asian Development Bank</td>
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<td>CEAT</td>
<td>Community Environment Action Team</td>
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<td>DEEC</td>
<td>Department of Environmental Education and Communication</td>
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<td>DoE-India</td>
<td>Department of Environment, Delhi, India.</td>
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<td>DoEYS</td>
<td>District of Education Youth and Sport</td>
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<td>FACT</td>
<td>Fisheries Action Coalition Team</td>
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<td>FAO</td>
<td>Food and Agriculture Organization</td>
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<td>MAFF</td>
<td>Ministry of Agriculture, Fishery and Forestry</td>
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<td>MoE</td>
<td>Ministry of Environment</td>
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<td>MoEYS</td>
<td>Ministry of Education Youth and Sport</td>
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<td>MRC</td>
<td>Mekong River Commission</td>
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<td>NIE</td>
<td>National Institute of Education</td>
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<td>PoEYS</td>
<td>Provincial of Education Youth and Sport</td>
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<td>SECs</td>
<td>School Eco-Clubs</td>
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<td>UNDP</td>
<td>United Nation Development Program</td>
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<td>UNEP</td>
<td>United Nations Environment Programme</td>
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<td>UNESCO</td>
<td>United Nation Education Scientific Cultural Organization</td>
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<td>WCS</td>
<td>Wildlife Conservation Society</td>
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<td>WD</td>
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I. Project Background

UNESCO has initiated pilot projects in 8 countries to strengthen existing education and outreach programmes on biodiversity in UNESCO Biosphere Reserves. The focus is on school programmes (primary to secondary) that teach the conservation and sustainable use of biodiversity. Actions have also included capacity building workshops to support teachers, students, community members, media, professionals and decision makers, as well as the development of resource packages for teachers and trainers. A special focus was on how formal education and learning can mutually support each other, as well as how to better integrate biodiversity and cultural diversity issues in educational programmes. Cambodia was selected as one among them to pilot the project by introducing “Learning about Biodiversity: Multiple-perspective Approaches” toolkit to teachers in lower secondary schools located in Tonle Sap Biosphere Reserve, particularly in three provinces—Kompong Thom, Siem Reap, and Battambang. Case Study of Integration of “Learning about Biodiversity: Multiple-Perspective Approaches” into Teaching and Learning at Tonle Sap Biosphere Reserve is a part of learning toolkit and could be used as supporting document in the process of teaching and learning in order to sharpen understanding on biodiversity which is beneficial for people livelihoods and global aspect.

The case study is written about overview and current aspects of biodiversity in Tonle Sap Biosphere Reserve, which is considered as the important natural resources benefiting many people in Cambodia. This report is also the supporting document, which can be used to provide the ideal knowledge for sustainable natural resources management in order to support community livelihoods and human well-being. In addition, the content of this case study mainly included how biodiversity approaches have been integrated into formal education program. The reflection from stakeholders especially from teachers at lower secondary schools, representative of university, Ministry of Education, Youth and Sport (MoEYS) and Ministry of Environment (MoE) were the main data sources for this case study. Moreover, opportunities, challenges and way forward for relevant stakeholders have been also explored.

This case study was shaped and structured based on the three following questions:

1. What is the overview of Biodiversity in Tonle Sap Biosphere reserve?
2. How can teachers plan to integrate the eight approaches of biodiversity into their teaching at lower secondary school?
3. What are the challenges and possible way-forwards for improving teaching and learning about biodiversity?

II. Methodology of Case Study

There were four main methodologies to support this case study writing including literature/secondary data review, reflection from group discussions, key informants interviews, and field observation. The primary data was mainly collected from all training workshops, which were organized in Kampong
Thom, Siem Reap and Battambang. These three provinces are the core zones of the Tonle Sap Biosphere Reserve, and where field works have been conducted.

- Literature Review: Relevant documents have been collected from various sources. Scientific information related to biodiversity in Tonle Sap biosphere reserve was mainly gathered from journal articles, books, and research papers. These papers were used to discuss the current overview of the key important perspective of biodiversity in Tonle Sap Biosphere Reserve. In addition, the reports from government and non-government organizations were also reviewed to examine on how development activities have impacted on biodiversity in Tonle Sap. The key integration between biodiversity and education was also collected to compare and discuss with the information gathered from fieldwork and during the trainings. The reports were mainly collected from various national and international institutions, including MoE, Ministry of Agriculture, Fishery and Forestry (MAFF), UNESCO, Wildlife Conservation Society (WCS), Asian Development Bank (ADB), United Nation Development Program (UNDP), Fisheries Action Coalition Team (FACT), Mekong Region Committee (MRC), Food and Agriculture Organization (FAO), etc. This methodology was mainly used to response to the first research question focusing on overview of the biodiversity at Tonle Sap. It was also used to answer the second research question focusing on giving explanation on each perspective of biodiversity.

- Reflections from group discussions during the training workshops: This was done during the technical trainings in the three provinces. The training was conducted within two days in each province including Kampong Thom, Siem Reap and Battambang. During the training, resource persons who are from various institutions including MoE, NIE, and RUPP organized the group discussion among participants to reflect what they have learnt based on those 8 perspectives. Participants were asked to share their experiences and knowledge of how to integrate biodiversity into their current teaching subjects and lessons. Through this process, the useful information of how to bring biodiversity perspective into teaching and sharing at school was captured. During the reflection session, the participants were asked with additional questions relevant to the research questions in case the information were missing. Then, all information was compiled, structured and synthesized to ensure a good flow of information to support the 2nd research question.

- Key informants Interviews: The resource persons of the training and toolkit reviewers of the project were interviewed to get the overall perspective of the projects and learning toolkit. They were asked to provide overview of project and training workshops, which support to the 2nd research question. Besides, they were requested to share main difficulties in relation to toolkits translation and in the process of training workshops. In addition, the feeling of participants and possible way forward of all relevant institutions has been collected. This primary data were mainly used to support the 3rd research questions, which focused on challenges, opportunities and way-forward for improving teaching and learning about biodiversity using multiple perspectives approach.

- Field Observations: One lower secondary school that is located nearest to Tonle Sap in each province was selected. This was done to get overall reflection from teachers and students after
trainings and sharing knowledge regarding to toolkits and biodiversity. The group discussions in each school were done with all the teachers, who were participated in the training workshop. The discussions were conducted to assess how teachers have integrated biodiversity approaches into their teaching lessons. The key challenges and opportunities of this integration were also collected. In addition, group discussion with students in each school was also done in order to reflect how biodiversity perspectives have been applying in the classes. This means that it was the process to reassure whether teachers used to teach or showed about biodiversity in the class. The information from this observation strongly supports to the 2nd research question.

III. Background of Biodiversity at Tonle Sap Biosphere Reserve

3.1. Overview of Tonle Sap Biosphere
The Tonle Sap Lake and its vast peripheral wetland is a truly unique ecosystem encompasses the natural, economic and cultural value (Arias & Cochrane, 2012). It is the largest fresh water lake in Southeast Asia and contains diverse ecosystems, plus supports a wide variety of social, economic and cultural activities. It has been known as the largest freshwater body in South East Asia (Meinander, 2009). Tonle Sap is regarded as one among 4 region classified by MoE which conclude 6 provinces in such Kampong Thom, Siem Reap, Battambang, Banteay Meanchey, Pursat and Kampong Chhnang (MoE, 2009). Being the heart of Mekong River, Tonle Sap extends over an area of 2,500km² to 3,000km² in dry season and 10,000km² to 16,000km² in rainy season (Matsui et al., 2006). The lake is seen as the backbone of economic development in Cambodia, and directly or indirectly provides employment to approximately two million people living in its environment (Kummu et al. 2013; Hap 2006). Tonle Sap is a great lake, which became a Biosphere Reserve under the Man and Biosphere Programme of UNESCO in October 1997 (UNESCO, 2012). Due to the vast wetland area, Tonle Sap is a great habitat for abundance of species including fish, birds, mammals, reptile, and many kinds of plants in flooded forest (MRC, 2010; WCS, 2012). The lake is also one of the most productive captive fisheries in the World. The fish resources, however, have provided around 60% of the protein intake for the Cambodian population (Campbell, 2006; Live & Learn, 2007). Every year, thousands of tons of fish are caught by fishermen around the Mekong and Tonle Sap areas, helping to boost economic growth and provide food and jobs for people and relevant stakeholders. In 2008, around 1.7 million people who live in the Tonle Sap area depend on its resources for their survival (WD, 2013), though fishers earn on average only USD127 per person per year (Hap 2006). But, over recent decades the lake’s resources have been degraded significantly, having a serious impact on the livelihood activities of people living there. The decline in resources has been caused by a variety of factors, such as unclear property rights, overfishing, deforestation and pollution (Serrat, 2005; Chou et al., 2012).

The physical feature of the Tonle Sap Lake is unique for all species and human well-being. The lake is surrounded by a rather flat floodplain, and the soils are formatted in unconsolidated alluvial deposits, comprising clay, silt, and gravel (MRC, 2010). Around 57% of the water in Tonle Sap Lake
comes from the Mekong River by connecting to the Mekong River through 100km long Tonle Sap River. During the wet season, 52% the water come directly through Tonle Sap River, and 5% flows overland through the floodplain from the Mekong. And, 30% comes from other rivers that flow directly into the lakes and about 13% comes from the rainfall over the lake itself (MRC, 2010).

The hydrological regime of Tonle Sap is influenced by climate conditions, the flow of the Mekong River and hydrological processes across the Tonle Sap basin (MRC, 2003). Water flows into Tonle Sap through both a river system and a tributary run-off system. River water and Flood or Run-off water are the main water sources flowing to Tonle Sap and stored in the lake systems. The water level increases gradually during wet season from May to October or early November before it goes down from November to April. This hydrological creates a vast natural reservoir for all kind of species especially for the fish and birds. It provides a suitable period for fish breeding and agricultural activities (Mak & Carl, 2013). Consequently, the hydrology of the Tonle Sap is changing rapidly (Benger, 2007), as identified through the following flood indicators including timings, periods, levels, speed and scope (Kummuand & Sarkkula, 2008). This hydrological implication changes have brought the concern for all natural habitat as well human well-being (Chou, 2013).

3.2. Biodiversity Perspective of Tonle Sap Biosphere

Tonle Sap is one of the most productive aquatic products in the world. It acts as habitats and breeding ground for varieties of biodiversity such as water bird, fish, mammal and flooded forest (Starr and Smith, 2007). A great number of water birds are the result of rich ecosystem with fish, flooded forest and other biodiversity in Tonle Sap, which attract water bird to breed and inhabit. There are about a hundred of water bird species and around 500 fish species found in Tonle Sap (MoE, 2001). Tonle Sap also has around 46 species of reptiles, 14 of mammals, 2 of amphibians and 33 of Invertebrates (MoE, 2001). In addition, there are also many kinds of algae existing in Tonle Sap, but the data on
the phytoplankton is really little. There also many type of higher plants existing in flooded forest, swamp forests, swamp scrublands where provide a very good habitats for the rich biodiversity (Campbell et al., 2006).

Tonle Sap is the primary source of job and income and is the house of 3 million people which around 750,000 people live in the flooded villages, 40% live on floodplain, and the remaining live dependently on the lake (Mak, 2005). The priority occupation in Tonle Sap is fishery in family scale or small scale. Flooded villagers feed their animal (pigs, ducks, chickens, and crocodile) in the rear. The animals are kept above the fish pen and cage. Flooded villagers discharge the waste directly into the lake, but it is the fish’s food. Even though, the national fish product was calculated at 289,000 to 431,000 ton annually which is about 5 to 10% of the GDP (MoE & UNEP, 2009), there are 38% of people living in Tonle Sap live under the poverty line (Mak, 2005).

Value perspective of Tonle Sap is an essential indicator to identify resources, which involve in social welfare and country’s economics. In Tonle Sap communities, local people’s livelihood highly depends on aquatic ecosystem, which is use value and non-use value. There are three type of use value: Direct value, indirect value, and option Value. Direct value is the using, deriving, consuming, and selling the resources by fishing, farming, and firewood collecting, etc. Indirect value is ecosystem services such as flood control, storm protection, providing aquatic resources such as fish, and shell, and preventing sediment transport. Option value is avoiding using the resources; for instance, create protected area. Another type of value is non-use value or the inside value which the resources provide as knowledge. Non-use value keeps the ability of using the resources today without affecting the next generations (Hap et al., 2006).

3.3. Linkage between Biodiversity and Education Program

Improving the implementation of environmental conservation strategies, people have to pay much attention for the comprehensive, quantitative and critical assessment of the role of education (Howe, 2009). Jacoboson et al. (2006) claimed that the benefit of environmental education is the opportunity for learners to gain the knowledge, experience, awareness and sensitivity to environmental issues surround them, and leaners can also get positive services and strengthen their motivation. They also enable to identify and to deal with environmental problems. Integrating knowledge/skill with the comprehension of biodiversity issues in the real world leads students to explore the job opportunity by considering the changing of their lifestyle choices to conserve and protect the biodiversity for sustainable used; anyway, biodiversity education can be the basic concept which brings students feel familiar to face biological diversity problem locally. They also create their interest, motivation, commitment and action, which involve to biological conservation and protection (Ramadoss & Poyya Moli, 2011).

UNESCO also declares on the role of education for sustainable development on World Conference in Bonn, Germany, 2009. Through this declaration, the member states agree to promote ESD at policy level to all of education and to achieving quality education, increasing the public awareness about
ESD, mobilizing the adequate resources, re-orient education and training systems and developing the existing international, regional and national enabling mechanism (UNESCO, 2009). Along with this, there are many countries where have been applying this initiated framework into their education programs. The establishment of Eco Club in government, private, public schools and colleges with the purpose of creating the environmental awareness among future generation and undertaking various eco-friendly activities have been gotten a strong interest by many countries. The number of interesting activities to which Eco Club produced students’ motivation for keeping green and clean surrounds their environment such as promoting their willingness to involve in the plantation of tree, conserving water resources and minimizing the waste generation in their lifestyle. Students, furthermore, are developed the awareness on sanitation and public health, effects of using plastic bags and integrating basic concept of biodiversity by leading them to observe the wild life in sanctuaries, park and forest area. The environmental experts had trained teachers, who lead Eco Club schools or colleges, as master trainer on environmental issues, according to Department of Environment of New Delhi, India, 2004.

For illustration, India has applied the biodiversity education to high school level in order to develop the comprehension of biological diversity conservation framework and promote students' commitment to protect the local biodiversity (Ramadoss & Poyya Moli, 2011). Sam et al. (2002) reported Mai Po School, Hong Kong, has improved the environmental education concept within secondary school by integrating some subjects, related to environment, such as biology and geography subjects to formal educational curriculum. Besides giving lectures in class, students are invited to involve directly through site visit program, which provides students good opportunity to observe different aspects of biodiversity; for example, Mai Po school created site visit program and led students enjoyed wetland conservation with different topics including general visit, mangrove ecology, diversity of life in wetland, land use and Ramsar site, and water pollution. All these topics are closely linked to secondary school curriculum. Unlike secondary school students, Mai Po School integrated different topics for primary school curriculum in formal education.

Along with these activities, Cambodia has indeed promoted the concept of school eco-club. School Eco-Club is one of the three components (Village Environmental Action Team, School Eco-Club and pagoda) of Community Environment Action Team (CEAT) with the purpose of improvement of their environmental quality surround them including cleaning up waste, constructing latrine, boiling drinking water, practicing hygiene habit and so on. Mlub Bei Tong has been working with 34 schools from three provinces (Kampong Speu, Kampong Thom and Stung Treng). Teachers, directors and students were trained on environmental knowledge and they all involved in the project directly and actively. In addition, they also supported the facilities and material including posters, books, or newsletters (Mlub Bai Tong, 2012).

This has reflected the commitment of government and relevant agencies to act based on the agenda 21 of Earth Summit in Rio de Janeiro, Brazil in1992, which aimed for promoting sustainable development. In this agenda, education for sustainable development that focuses on balancing the three main pillars, encompassing social, environment and economics has been promoted.
Furthermore, the collective action between multiple stakeholders from local to global levels to achieve goal of sustainable development has been valued and enhanced through jointed design and implementation of development programs in the world nations (Kjos. B, 1998).

IV. Bringing Biodiversity Perspectives into Teaching and Learning

4.1 Overall description of multiple-perspective on biodiversity relevant to educational program

“Learning about Biodiversity: Multiple-perspective Approaches” is a very useful framework for guiding the holistic thinking on complex environmental issues in teaching programs. All perspectives existing in the toolkit provided additional information on how important biodiversity is for human wellbeing and what human activities could possibly lead to biodiversity degradation. To achieve sustainable development, we must educate people about how biodiversity is valued, governed and reserved throughout the World (UNESCO, 2009). Hence, integrating those perspectives into teaching and learning programs at schools is considered as the main driver for changing perception of users since the earlier stage.

As United Nations declared that “Education is an indispensable element for achieving sustainable development” (UNESCO, 2009), teaching programs can integrate innovative way of existing lessons, additional explanation or extra activities which interlink to biodiversity, cultural, society, economy and livelihood. The perspectives can be integrated in both formal and informal education programs, because biodiversity is completely connected to human wellbeing and science. More or less, all lessons in educational programs are always relevant and connect to environment.

There are eight perspectives considering as potentials for integrating into teaching and learning program at school efficiency (UNESCO, 2012).

- First is Scientific Perspective, which focuses on natural cycles and phenomena. This perspective provide the life cycle and important of biotic and abiotic existing in particularly ecosystem on the Earth. The connection to human livelihood is illustrated by using food chain concept as the simple example.

- The second perspective is Historical Perspective. This perspective provides learners understanding on how natural resources and climate have changed over the period in their particularly locations and the World. Through the change of the resources, we would have better actions on the natural resources for sustainable used in the future.

- The third perspective is Geographic Perspective, which provides us very useful information on resources identification in particularly areas. The specie diversities existing in different landscapes are the key empirical information for the learners, for they could aware of resources in their living location.

- Another interesting perspective is Human Rights Perspective. The information is closely connected between how society, institutional capacities and adequate governance affect to biodiversity. The learner also knows how quality of life in society can be affected by quality of the biodiversity.
• The fifth is **Gender Equality Perspective**. With this perspective, learners would explore more on how social and cultural practices regarding access and use of natural resources may affect men and women differently. The gender role for protecting biodiversity is also illustrated as well.

• The common perspective, which many people, has always talked but not fully understood is **Values Perspective**. Many people have talked on the benefits of biodiversity, but they do not know exactly how it values in term of provisioning services, cultural services, regulating services and supporting services. This perspective offers the broader picture of the benefits flow to human kinds.

• The seventh perspective is **Cultural Diversity Perspective**. The learner would understand more on the unique cultural groups, which affected biodiversity. The symbolic and belief on biodiversity in people’s view is also revealed.

• And, the last perspective is **Sustainability Perspective**. This perspective lets learners know how to harvest or to use the natural resources in sustainable ways. Knowing the role of ecosystem services which affect to human well-being and environment is also introduced.

4.2 **Training Work on Integrating “Learning about Biodiversity: Multiple-perspective approaches” into teaching and learning program**

4.2.1 **Phase I**

After UNESCO initiated the idea of doing the pilot project at 8 countries including Cambodia, UNESCO-Phnom Penh had started to coordinate with Ministry of Environment to be the project implementer. Department of Environmental Education and Communication, Ministry of Environment was responsible for implementing the project by cooperating with other review team who are from Department of Curriculum Development at MoEYS, NIE, and RUPP. UNESCO – Phnom Penh played the role as the coordinator in the project. MoEYS, NIE, and RUPP contribute to review the toolkit. In addition, each of representative institute had one resources person to train participants in the workshop. At the first stage, toolkit was translated from English into Khmer. The review team reviewed the Khmer version with appropriate terminology and sentence structure for better understanding to the readers or users. The project implementers together with UNESCO also identified the location, schools and targeted participants to receive the training on biodiversity.

After adjusted the toolkit and made a clear plan, Ministry of Environment prepared a project launching to relevant stakeholders including other government institutions and civil society. The clear plan of building capacity on using the toolkit of multiple-perspective approaches was informed to the participants. In addition, the location, schools and number of participants were also declared during the event.

4.2.2 **Phase II (2-day Training)**

There were three trainings conducted in three different provinces located around Tonle Sap Biosphere Reserve — Kampong Thom, Siem Reap and Battambang. Three teachers from 5 different lower secondary schools in each province were invited to attend the training workshop. In total, there
were 45 teachers (15 teachers per province). A representative of Provincial office of Education, Youth, and Sport (PoEYS) and a representative of Provincial office of Environment Department (PED) in each province also attended the workshop.

During the first day, the trainers introduced and explained about the toolkit of “Learning about Biodiversity: Multiple-perspective approaches”. The introduction on Eco-school was also made before a representative from ACCB delivered a presentation on his centre. In afternoon session, the case study on golden chanterelle was shown and discussed. The case study of golden chanterelle is an important example, which enabled participants to visualize how biodiversity perspectives were applied in the case study of mushroom. The geography where this mushroom grows was shown with a role of economic value, etc. At the end of the first day, resources persons provided the instruction of lesson plans by using multiple-perspective of biodiversity. During the second day, participants were asked to work in group based on their field of teaching to design the lesson plan using appropriate biodiversity perspectives they had learnt. At the beginning of exercise, participants were asked to identify the relevant perspectives, which can be integrated into their teaching subjects. After that, participants were asked to develop teaching techniques, objectives, materials, times, and teaching sequence, evaluation, extension, and sources by using UNESCO toolkit as the guideline.

The participants were really interested and impressed to receive such important 2 days trainings. “Learning about biodiversity by using multiple-perspective approaches is not a strange knowledge as the first thought”, quoted from participants during group discussions. The participants have learned the concept of sustainable development, which they realize on their daily life and how education contributes to this complex system. In addition, the empirical examples regarding to environmental problems were also illustrated for participants to have better understanding on how human and environment are connected. Moreover, the 8 perspectives in the toolkit of learning about biodiversity were the most important session. The participants were also interested to apply those biodiversity perspectives in the new lesson plans introduced by the resource persons. The participants were encouraged to link those perspectives into their current teaching course with proper lesson plan designed.

4.3 Relevant subjects possible to be mainstreamed with Eight Perspectives of Biodiversity

While the eight perspectives of biodiversity have been recognized as the important concepts to be understood, the level/possibility for integrating these into the teaching and learning activities at lower secondary schools remains deficient, as it has relied mainly on appropriate and reasonable context/circumstances. In other words, every perspective could only be applied in the existing subjects or lessons that are relevant to biodiversity. The result from group discussions and interviews with training participants indicated that the process of integration these into science subjects such as mathematic remain shallow. Base on the responses from training participants and key informants, the prospects of which the eight perspectives of biodiversity can be applied in the teaching and learning programs of lower secondary schools can be described as the following.
4.3.1 Scientific Perspective

The scientific perspective, which is focused on improving knowledge and understanding on the relationship and dynamic between biotic and abiotic components of the Earth based on the scientific data or experiments (UNESCO, 2012), can be applied mostly in the three subjects, including Biology, Earth Science and Chemistry. Study found that many sections in Biology subject of grade 7 and 8 has found to be more relevant to biodiversity and is easy to integrate or draw example from the scientific perspective. For grade 7, the topic of “Ecosystem” has more spaces and possibilities to include this perspective, while in grade 8 the most relevant section is “Technique for maintaining home gardening” and “The use of natural fertilizer”. In Earth Science subject, in addition, scientific perspective was included in the topic of “Flooded Forest” in both grade 7 and 8. What is more in the Chemistry subject, the scientific perspective has been integrated in the topic of “Wind” for grade 7 and topic of “Water” for grade 8.

The way in which the scientific perspective has been integrated in these subjects was that teachers has explained the concepts and core meaning of the lesson by relating to the real examples of biodiversity/species existing in their community. For example; teachers have often explained students about the cycles and phenomena of nature through presenting food chain and the impact of modern technologies on their local biodiversity.

4.3.2 Historical Perspective

Historical perspective, which aims to assist learners to comprehend the change in amount and quality of biodiversity between the past and the present, has been frequently applied in four subjects of grade 7 and 8. One of the key lessons entitles “Tonle Sap Lake” in Khmer Literature subject has been found to be the most relevant section where teachers can review the different situation of biodiversity in Tolesap Lake between the past times and the present. Also, in some lessons of History subject, the changes of biodiversity have been elaborated based on information in textbook and their personal experiences. Besides, in Physic subject, the historical perspective of biodiversity has been related to the lesson “The use of electric power” through explaining the alternatives of using natural resources for generating power. Furthermore, in the lesson of “Land and Natural Resources” in Earth Science subject, this perspective has been integrated through elaborating the changes in natural resource consumption and technologies applied in extracting those natural resources.

The key aspects for integrate the historical perspective in these subjects was to help students to be able to understand the changes of diversity from time to time, which are influenced by man-made activities and natural phenomenon. It was suggested that this perspective could be applied through consulting with textbooks and sharing actual personal experiences especially from the seniors. This perspective was also used to help students to reflect and understand the issues around biodiversity degradation and extinction.

4.3.3 Geographic Perspective

The geography perspective, which focuses on enhancing ability of learners to comprehend the different kinds and challenges of biodiversity across communities, nations or regions, has been integrated in four subjects encompassing Geography, Biology, Chemistry, and Earth Science. The
most relevant lesson in Geography subject is the study of “Landscape”. In this lesson, teachers have explained students about the different kinds of landscape and types of biodiversity that are available across world continents and across regions of Cambodia. For example, teachers have often explained kinds of species or biodiversity available in the plateau, mountain and coastal areas of Cambodia. Similarly, in Biology subject, the lesson of “Local Ecosystem” has focused on the study on the different types and benefits of those biodiversity and species such as trees, animals, insects, or reptiles of particular region and locations. Beside in the subject of Earth Science, teachers has also related the geography perspective in their lesson since this has helped student to understand about different types, amount and quality of natural resources based on the different communities, locations and regions. In addition, Khmer Literature subject also has a lesson on “Tonle Sap is a Wetland”. This lesson describes the numerous biodiversity living freely in Tonle Sap, which benefits to whole ecosystem and human well-being.

In term of approach of applying this perspective, teachers have regularly explained the situation of different regions and reflected back to local communities. Along with the explanation about the overall characteristic of landscape of different areas or locations, the elaboration about the different sorts of species/biodiversity was also made. Moreover, teachers have often tried to explain the relationship of ecosystem and biodiversity between communities, regions or continents.

4.3.4 Human Rights Perspective

Human rights perspective is a strange view, which many people do not expect it is a part of biodiversity. This perspective is an approach of connectivity between society, governance and biodiversity, so it could be integrated primarily in the subject of “Morality”. For illustration, in the lesson of national festival is also informed all kind of festivals in Cambodia. People engagement in festival and human behavior on rubbish dumping which polluted the environment are included in the lessons learned. So, the teacher could provide more discussion ideas on how we should contribute for the clean environment during and after the national festivals. Anyway, Khmer Literature Subject can also be integrated using this human rights perspective. For example, a poem on “Message from Flooded Forest” gives very useful information on benefit of flooded forest at Tonle Sap. The message also asks people together to protect our natural capital in Tonle Sap especially on flooded forest and other species living in that habitat. Another subject relevant to this perspective as well is “Chemistry”. The lesson of air pollution in this subject describes emissions of the danger smoke from factory could affect to the other people living nearby. So, the community has rights to discuss and find the best solution for the public health improvement through pollution management. However, even those three subjects can be integrated, but that is some difficulties of finding additional examples. The teachers also need to state carefully to the students to avoid the confusion to the students.

4.3.5 Gender Equality Perspective

Gender perspective aiming to promote gender equity and equality in accessing and consuming biodiversity has been included in some subjects of lower secondary schools. Study found that in the subject of Morality, a lesson of “Human Rights and Value” has been included with the gender
perspective through providing explanation about the equality between both men and women in accessing, using and managing of biodiversity or natural resources. In this lesson, there has been also open for the discussion and explanation about the roles of men and women in protecting local natural resources in a sustainable manner. Similarly, two lessons including “Technique for maintaining home gardening” and “The protection of useful insects” in the subject of Biology has also been integrated with the gender perspective. In these lessons, teachers have often explained the equality between men and women in creating and maintaining organic home gardening for improving their livelihoods and contributing to preserving biodiversity in the local communities.

In terms of the process of integrating this perspective in learning activities, teachers have normally clarified the situation and context and open for discussion about the reality of which community can access to local natural resources. Besides, teachers have also analyzed and helped students to understand the level and differences between men and women in accessing, using and controlling over natural resources and biodiversity in the communities. However, the critical analysis sometimes has not been made, as the consequence of limited capacity of teachers and sometimes it was quite hard for students to understand and comprehend the complicated concepts of this perspective.

4.3.6 Values Perspective
Value perspective refers to the flow of benefits from biodiversity to ecosystem and livelihood of local people. When saying about biodiversity, most of the relevant subjects always start by saying with this perspective, but they provide not adequate information or example regarding to the value of ecosystem or biodiversity in particularly area. However, there are many subject which this perspective can be integrated in existing lessons including Geography, Khmer literature, Biology and Chemistry. Regarding to the geography subject, a lesson describing the rich natural resources at Prek Toal, Tonle Sap provide a very good value of biodiversity. It explores a lot of species including fish, birds and landscape, which benefit to people’s livelihood. The beautiful landscape also attracts a lot of tourists benefit not only to community but also to the national’s economy. Biology subject also have an important lesson, which is closely related to the value perspective. That is “Natural Environment”. The lesson defines what the ecosystem is and how it provides benefits to people in particularly area. For Khmer Literature Subject, they also mention on the important of biodiversity to agricultural products. They state that, if we apply the natural fertilizer, the microorganism will help to increase the productivity of the crop in sustainable way. Moreover, in Chemistry subject also illustrate the consequence of human health and natural disaster could be occurred by the bad quality of air.

Even there are many subjects have existing lessons, which easily integrated this value perspective into the teaching, there is really limited lesson to introduce the methodology of value calculation especially into economic value. Knowing economic values from biodiversity are the important evident, for people realize those resources is important to them.

4.3.7 Cultural Diversity Perspective
Cultural perspective identifies the unique cultural groups, symbolic and belief, which affected biodiversity. This perspective connects very closely to the nation culture and the way of accessing biodiversity into daily life of people. However, this perspective can be integrated properly into Khmer Literature Subject. A poem on “Message from Flooded Forest” gives very useful information on benefit of flooded forest to people living at Tonle Sap. The daily life of local people who use the resources is explored. In the lesson, they also ask people to try their best to protect the resources in Tonle Sap for sustainable used in the next generation. In constraint, other subjects are hardly to integrate this perspective into their lesson. It is slightly relevant in some example existing in the lesson of other subjects. For example, the crop methodology, pest control, and organic fertilizer are the examples existing in the subject of “Biology”.

Even not so many lessons and subjects can be integrated by this perspective, we can provide extra examples regarding to the culture and traditional activities which influence to biodiversity over the period of time changes, especially during the time of gardening at school and other events at school relate to culture.

4.3.8 Sustainability Perspective
Sustainable perspective offers the useful information on how to use the natural resources in sustainable ways. Knowing the role of ecosystem services which affect to human well-being and environment is really important. However, the subjects which can be integrated in value perspective are also can be applied in this perspective due to the similarity. When they mention on the importance of biodiversity, they always mention about sustainability as well. So, this is a good opportunity to apply those lessons by using sustainable perspective into their teaching and sharing in the class.

4.4 Reflections on the toolkit
Toolkit is found as a useful document to support the process of integrating biodiversity perspectives into teaching and learning program at lower secondary school. The toolkit provides good definition and key questions on each perspective of biodiversity. It also gives sample of teaching plan case study writing as the guiding document for further reading. Since toolkit was not originally written in Khmer, some phases and sentences translated from English were difficult to comprehend due to literal translation and uses of technical terminologies. As a result, participants found it hard to understand the overall meaning of some sections in the toolkit; until, they got the explanation from the trainers. For example, human rights perspective, gender equality perspective, and historical perspective were claimed as the difficult sections to be understood. Study found that it was not easy for them to understand about the key concept in the toolkit by just reading the toolkit alone. However, it requires participants to consult with other documents in order to comprehend each perspective and be able to provide better explanation to the workshop participants. Therefore, this seemed to reveal that, in order to ensure the effectiveness in learning and sharing about biodiversity, toolkit alone would not bring participants to full understanding on those perspectives because it is written in global context. It needs supporting documents to explain more details and to give extra examples for participants. Also, it would be more effective if the toolkit could be adjusted and added more information or examples based on local context of Cambodian context. For instance, examples related to Irawadi Dolphin, elephant, Sarus Crane, and Palm tree, which are available in many
documents or research papers should be given because those species are well known among Cambodians.

V. Opportunities and Challenges of integrating Biodiversity Concept into action plan and practice

Through key informant interview and field observation, key opportunities and constraints for integrating the eight perspectives of biodiversity in teaching and learning activities of lower secondary schools have been identified.

5.1 Main Opportunities

This section elucidates main opportunities for integrating the eight perspectives of biodiversity into teaching and learning activities at lower secondary schools. Prospects considered as pushed factors for better integration are the following:

- **Better understanding and knowledge after training workshop lead to greater potential of integration:** With perspective and knowledge gained from training workshops, teachers have better capacity and approach to prepare lesson plans and been able to explain the concepts to students. Study found that after the trainings, lower secondary teachers who have participated in the training workshops seemed to have better understanding and gain more confidence to disseminate the concept or perspective of biodiversity to students. Many teachers claimed that despite they used to explain students about environment or concept of biodiversity; they have no realized those were the perspectives of biodiversity. What they have done so far was just based on their personal knowledge and understanding, but after the training workshops, teachers become more capable and have more skills to include the eight perspectives in teaching and learning activities.

- **There are some existing subjects relevant to the perspectives of biodiversity:** The curriculum of lower secondary school programs contains several subjects that are relevant to biodiversity. Many teachers assumed that the concept of biodiversity could be applied only in Environment and Biology subjects, but after attending the training workshops, they are aware that biodiversity concept can be mainstreamed in many other subjects such as Earth Science, Khmer Literature, History, Chemistry, Morality, Geography, and Physic. By teaching these subjects, it has allowed teachers to be able to link their lessons to the relevant biodiversity perspectives through drawing obvious examples or creating group exercise and class activities. When the examples of real life were given, students seemed to understand the contents of lessons much better and have more commitment to contribute in preserving biodiversity surrounding their communities.

- **Students are engaged in environmental protection activities:** In every lower secondary school, students have been involved in environmental conservation and protection activities such as planting trees and creating vegetable garden in the schools’ area. Many teachers urged that through these activities, the perspectives of biodiversity have been introduced and taught to students. These actions not only created green environment and shadow in the schools’ area, but also helped students love natural resources and contribute in protecting those natures for their long-term benefits. During
these activities, teachers had more opportunities to explain students about the importance and roles of biodiversity in maintaining ecosystem and supporting people livelihoods.

- **There is support from DoEYS, PoEYS and MoEYS in improving schools’ environment:** The topic of how to improve schools’ environment was often been discussed during meetings between principals of lower secondary schools and officials from DoEYS or PoEYS. This reflected the attention of DoEYS and PoEYS in encouraging lower secondary schools to preserve and ensure green environment in the schools’ area through eliminating plastic bags or rubbish and planting more trees and vegetables. It was believed that students would be healthy, feel fresh and learn effectively when schools’ environment is clean and green. From this aspect, the schools’ best environment program has been created, which allowed all lower secondary schools to compete with other schools within the regions. The winners have often been awarded or given certificate of appreciation for proceeding long-term commitment in preserving clean environment. Since this could be regarded as a process of creating eco-club at schools, many teachers urged that there have been more spaces to integrate the perspectives of biodiversity in lower secondary school program. This seems to reflect the connection and consistency between perspectives of biodiversity and school green environment program, which has been introduced and enforced by MoEYS.

- **There is support from lower secondary school principals/ management committee:** As a part of improving overall management performance, the principals/ management committees of some lower secondary schools have paid more attention and provided their strong support for improving good learning environment in the schools’ areas. Since this has aligned with the ideas/recommendations from the upper levels (DoEYS, PoEYS and MoEYS), the principals have opened to the perspectives of biodiversity and often encouraged teachers to integrate those concepts into teaching and learning activities. Study found that during monthly meetings, teachers have been reminded and updated about the process of integrating perspectives of biodiversity into their lessons because this was a great space for all teachers to give and get good experiences and approach for applying those concepts. Many teachers believed that when students understood concepts and the importance of biodiversity, they would play critical roles in contributing to create a clean schools’ environment and influence their communities to protect environment and preserve biodiversity.

- **Students’ life has strong connection with local biodiversity:** Since most of students have exposed to rural lives, which have depended very much on natural resources, it was very suitable to integrate the perspectives of biodiversity into their learning activities. Study found that the topic of biodiversity seemed to interest students most as their communities surrounded by natural resources and their lives have strongly connected with those natures. A part from schools, children have often followed their parents to collect local natural resources for livelihoods through fishing, hunting, and collecting non-timber forest product. Thus, it was very useful for teachers to introduce and discuss about the perspectives of biodiversity by introducing all perspectives in the toolkit of biodiversity during their learning process because this could help them to understand about the significance of biodiversity in their lives as well as to engage them in the process of preserving biodiversity in a sustainable way.
5.2 Key Challenges

While there are number of opportunities for incorporating the perspectives of biodiversity in teaching and learning program of lower secondary schools, some key constraints in applying these have also been raised.

- **Tight Curriculum:** Since lower secondary school curriculums/programs are based on the textbooks set by MoEYS, the integration of new concept such as Education for Sustainable Development and perspectives of biodiversity remains restricted. Training participants urged that although these concepts have been introduced and applied in some programs of Cambodian government and some NGOs in the last few decades, these have not been consolidated into curriculum of lower secondary level, according to the participants. Study found that there has been limited flexibility in terms of changing process or adding those new concepts into teaching and learning program of lower secondary schools since teachers are required to complete all core lessons and tasks provided/set by MoEYS for every academic year. For some Science subjects such as Physic, Mathematics or Chemistry, teachers found it hard to integrate the perspectives of biodiversity in their lessons as they have many content and tasks to be finalized and those perspectives were not really relevant to the lessons. Hence, teachers have had to run and force students to learn the contents in the textbook as fast as they can in order to meet requirements of MoEYS without caring much of incorporating biodiversity concepts. This situation, therefore, provided very limited spaces for teachers to be more creative and flexible in integrating biodiversity perspectives and allow students to discuss topics outside the lessons.

- **Limited Basic Knowledge and Understanding on Biodiversity:** Technical knowledge on perspectives of biodiversity remains a challenge for lower secondary school teachers. Since most of the teachers come from the diverse educational backgrounds and did not graduate from university, their levels of understanding on concepts and perspectives of biodiversity remain narrow. Commonly, lower secondary teachers have been trained and equipped with only their specialized subjects and pedagogy for improving their teaching quality. Other general knowledge and some other technical skills, particularly biodiversity concepts would have been provided to them only based on the requests or under special requirement. Therefore, the process of integrating biodiversity perspectives in teaching and learning activities have not been so effective as the teachers have limited capacity and understanding on biodiversity, and seem to have low interests on the theme. Study also found that teachers who were involved in the training workshop seemed to have more interests and willingness to integrate the perspectives of biodiversity into their teaching activities. On the other hand, teachers who were not included in the training workshop seemed to be reluctant in learning the concept from their peers as well as to apply the perspectives into their teaching activities.

- **Lack of Availability and Accessibility of Supporting Materials/Visual Aid for Teaching:** Another constraint in the process of integrating the perspectives of biodiversity in lower secondary school program associates with insufficient materials and visual aid for teaching. Study showed that teachers found it difficult to explain students about concepts and perspectives of biodiversity due to
limited materials/visual aid. In some lessons, for instance, it required teachers to use some supporting materials such as color printing books, maps, pictures or films to describe and reflect the situations and location of biodiversity. Because of lacking of those materials/visual aids, teachers could do only verbal explanation; thus, the objective of the lesson has not been satisfactorily achieved. A part of insufficient supporting materials or visual aid, there were very few reference books or documents related to environment or biodiversity, which were written in Khmer language. This has framed opportunities for teachers to enhance their understanding and knowledge on this topic. Even there are some video, broachers and posters regarding to biodiversity in Cambodia, which were produced by relevant ministries and NGOs, the accessibility to get and to use those materials were limited especially at the schools located in rural and remote areas.

- **Limited mechanism to support biodiversity perspectives integration:** While MoEYS has expressed it commitment and support through improving collaboration with relevant actors to disseminate perspectives of biodiversity in lower secondary school program, there is no clear mechanism to ensure the process of integration. Study found that despite lower secondary school principals have often received advices and encouragement from DoEYS, PoEYS and MoEYS to improve overall environment in schools’ area, every lower secondary school could do very limited activities in relation to preserving environment and integrating biodiversity perspectives in the teaching and learning activities. This shallow integration process associates with insufficient guideline and procedure from upper levels for teachers to follow. This means that without clear strategic guideline of how to integrate biodiversity perspectives into the lessons, teachers seemed to pay less attention and take less notice on this matter. Moreover, unclear mechanism from DoEYS, PoEYS, or MoEYS for promoting biodiversity perspectives integration has led to limited supporting materials/visual aid for teaching and meager resources for implementing biodiversity conservation plans. For example, lower secondary schools have had very limited environmental documents or books for referencing and received less financial support for creating eco-club activities at the schools.

- **Low Public Awareness:** In the context of Cambodia, the public awareness on the topic of environment or biodiversity remains quite low (Clements et al., 2009). While many understood that biodiversity has played very important roles in supporting people livelihoods activities, they seemed to be reluctant in actively participating in the process of preserving biodiversity and natural resources. Sometimes, people assumed that biodiversity is the natural resources for people consumption, and if they have not consumed it, others would utilize it. Moreover, it was claimed that local communities seemed to pay less attention or give low respect in biodiversity conservation activities, including planting trees or protecting wildlife. Therefore, this has led communities to continue maximized use of natural resources for their own benefits. Apart from this, the perception of local people on the importance of biodiversity remains limited. Teachers who participated in discussion indicated that unlike in some developed countries, even though people have been educated to look after and love nature and resources, they seemed to consume natural resources and biodiversity as much as they could without concerning the sustainability or any negative impact that might happen. For example, many children in the rural areas perceive that wildlife animals should be
hunted and forest should be cut for the benefits of the people. The result from group discussion showed that long-term perspective of which biodiversity should be used and preserved in a sustainable way remain beyond the understanding of most students and local communities. Thus, it seems to take time to change public perception and awareness through integrating biodiversity perspectives into teaching and learning activities of lower secondary schools.

VI. Possible Way-Forward and Recommendation

6.1 Possible Way-Forward
The possible way forward was constructed based on the interview with key informants of different institutions who have been involved in the project implementation. The possible planning forward of relevant institutions was illustrated as the following:

At Lower secondary schools Level
- Lower secondary school principals will continue supporting the process of disseminating the perspectives of biodiversity into teaching and learning activities as much as possible. Principals commit to do this because they believe that biodiversity education is one of the key tools to build public awareness and mobilize people to preserve and protect natural resources in a sustainable manner.
- Teachers will continue integrating the perspectives of biodiversity into the lessons and will also mobilize students to create eco-club at schools, through encouraging them to join in planting more trees, creating vegetable gardens, and being a part of environmental protection activities.
- Both principals and teachers commit to explore all possible opportunities to work with state agencies and development partners to mobilize technical and financial supports in improving biodiversity education quality and establishing eco-club at schools.
- They are willing to attend other training workshops which will enable them to improve their understanding and knowledge on the concepts of biodiversity.

At MoEYS Perspective
- MoEYS will continue collaborating with MoE, UNESCO and other development partners to improve biodiversity education programs through developing support documents and organizing further capacity building activities to all relevant education officials/staff, especially lower secondary school teachers.
- MoEYS will continue encouraging and involve all relevant departments and offices to work collaboratively in providing further education to relevant official/staff in order to improve their understandings on biodiversity and climate change impacts.

MoE
- MoE will continue working with MoEYS, development partners and donor agencies in order to improve biodiversity education programs through including the topic of
environment/biodiversity in curriculum and building capacity of teachers the concept of environment at all levels.

- MoE will work collaboratively with MoEYS and all relevant actors to introduce the idea of eco-club to all schools in Cambodia and help them to establish this for environmental sustainability.
- MoE will work with specialized departments across ministries to develop a glossary, which help environmental learners and practitioners to have common understanding on key terms or concepts.
- If possible, MoE will form an Education for Sustainable Development (ESD) agency for facilitating and providing training to all stakeholders on the environmental topic. As a part of this agency, a group of training of trainers in every province should be formed.

**UNESCO**

- UNESCO will find more possibilities and opportunities to mobilize resources for supporting biodiversity education program in Cambodia. Where possible, UNESCO will provide further technical and financial support to expand biodiversity education program. In case a Biodiversity Project will be established, UNESCO would be pleased to collaborate with either MoE and MoEYS and other development partners in order to ensure effectiveness of program implementation and produce greater impacts in preserving biodiversity in Cambodia as well as global environment.

### 6.2 Recommendation/suggestions

Some recommendations or suggestions have been raised in order to improve the effectiveness of integrating biodiversity perspectives into teaching and learning activities at lower secondary schools:

- In order to improve the effectiveness of learning about biodiversity perspectives, toolkit should have been adjusted base on local context and translated by using simple words. Many teachers who participated in the training workshop stated that the examples and information included in the toolkit mainly described biodiversity situation and context of other countries rather than the local context. Therefore, to make training participants realize more on biodiversity concept; examples of Cambodian context and existing lessons in the current program should be included and discussed. Also, supporting documents and visual aid should be provided or made available for teachers and students.

- It would be better if the duration of the training workshop could be expanded. Study found that because of participants came from the different background and knowledge, 2 days training has been suitable for participants who have similar background to understand the concepts of biodiversity. But, for those teachers who are not familiar with the subjects, it was very hard for them to comprehend the concepts within this short time period. Therefore, longer training would provide greater spaces for participants to improve their knowledge and understanding on biodiversity perspectives.
- Number of schools and number of participants of the training workshop should be increased, as it would extend the project’s impacts. The research found that few teachers from each school and some schools in each province would produce very limited impacts because the process of information sharing and knowledge transferring remains narrow. Larger amount of participants, in contrast, would be possible to enlarge networks to improve not only biodiversity concept, but also to the teaching and sharing methodology.

- The school principals or school management committee should have been invited to join the training workshop because they have often played very important roles to disseminate the concept to other teachers and follow up the progress. In addition, the school principals or school management committee play very important role to convince or share information and knowledge to other teachers more efficient and more regular where as normal teachers have limited voice and capacity to influence other teachers in the same position.

- The synergy between MoEYS and MoE should have been ensured and enhanced. Since MoEYS is the key actor who directly manages and transforms the school curriculum as well as teaching/learning programs, they should work closely with MoE to coordinate the project. This collaboration can promote effectiveness and efficiency for proposing change school curriculum or for cooperating with educational institutions particular schools to take more attention in biodiversity or environmental education program. MoE should provide technical and expertise support to MoEYS to produce teaching materials and agree on glossary, which can be used in common.

- There is no clear monitoring mechanism of the project to monitor the process and progress of integrating biodiversity into teaching and learning. The mission of the pilot project was ended by the trainings. It was not sure whether the participants have brought that knowledge and skills acquired from training workshops to apply in their teaching activities. So, UNESCO, MoE and MoEYS should assign a small team to monitor the performance of participants. The teamwork is not required to evaluate the understanding of participants, but they would play role as the proactive for participants.

- In order to promote the effectiveness of integration biodiversity perspective into teaching and learning, encouragement and supports including emotional support or small grant for implementing eco-club activities should be provided to schools or teachers in order for them to practise and share among students and peer teachers.

VII. Conclusion

In conclusion, biodiversity education project, which has been established under collaboration of MoE, MoEYS and UNESCO, was very important in contributing to build capacity of lower secondary teachers, students and public awareness to preserve biodiversity in Cambodia. Even though it was the pilot project with a short period of time, it has produced big impacts through creating spaces for key actors especially lower secondary teachers to gain knowledge on perspectives of biodiversity and method to apply these in their lessons. With this knowledge and
skill, teachers have been able to integrate biodiversity perspectives into teaching and learning activities.

All project participants have expressed the satisfactory feeling for having an opportunity to participate in the training workshop. Teachers have learnt a lot about concepts and perspectives of biodiversity and the ways in which those concepts and perspectives can be integrated in the teaching and learning activities. Training has equipped them with practical knowledge and built their confidence in bringing all eight perspectives to integrate in the relevant subject and lessons.

Besides, the toolkit provided during the training was found to be useful as it could be used as a reference or supporting document. This toolkit was kept in secondary school libraries where other teachers who have not joined the training can access and read to improve their understanding on biodiversity concept. However, while toolkit was very useful for extracting concept and information, many teachers suggested that the toolkit was not really easy to understand the whole meaning because this document was not perfectly translated and many technical words were used in the text, which are not easy to comprehend the meeting. Sometimes, they need trainers/facilitators or someone else to explain the meaning of some sentences in the toolkit.

The initiation of this pilot project and collaboration between UNESCO, MoE and MoEYS to promote the integration of biodiversity into teaching and learning program of lower secondary schools was regarded as a concrete step. This was considered as one of the key tools to improve biodiversity education activities since the project has provided opportunities for teachers to improve their knowledge and skills. The project was also to develop appropriate documents, which are used to support the teaching and learning process of teachers and students. It was expected that through this program, the education on biodiversity would be better because there are a lot of support from key relevant stakeholders including MoEYS, MoE, PoEYS, DoEYS, school principals, teachers and students.
Reference


