Environmental Literacy Indicators: Development for Communities in the Ranong UNESCO Biosphere Reserve

Krisada Tharasook*, Wee Rawang, and Patranit Srijuntrapun

Abstract— *A major purpose of Environmental Literacy (EL) is to provide people with Knowledge, Awareness, Attitude, Skill, Participation, and Ability to evaluate (KAASPA) to allow them to live successful, productive lives and to function as responsible citizens within society. This research paper developed Environmental Literacy Indicators (ELIs) for communities residing in the Ranong UNESCO Biosphere Reserve (RBR), Thailand the first mangrove forest in the world to be declared as a Biosphere Reserve by UNESCO. The KAASPA model was applied, incorporating internal and external behavioral surveys and mixed-method research. Data collection was conducted through in-depth interviews and questionnaires. The 84 questions in the questionnaires were statistically analyzed by percentage (%), mean score ($\bar{x}$), standard deviation (S.D.), and index of congruence (IOC). The results revealed the overall EL score is 3.89 (out of 5), further indicating that the respondents' level of Attitude, Awareness, Ability to Evaluate are slightly above their Skill, Knowledge, and Participation. In conclusion, it can be said that the strategy for improving EL among local communities in the RBR must be tailored to suit different knowledge levels, skill levels, and participation levels of each person, and must be implemented continuously in order to ensure truly sustainable development achievement.*

Keywords— **Environmental literacy, environmental education, Ranong–UNESCO biosphere reserve.**

1. INTRODUCTION

In 1997, the Ranong UNESCO Biosphere Reserve (RBR) was the first mangrove area in the world to be declared a Biosphere Reserve. It is one of the four Biosphere Reserves in Southeast Asia to have been certified by UNESCO. Located in Mueang district, Ranong province, it has an area of 30,525.14 hectares, divided into three zones as follows: The core zone (22.24%), which serves the primary objective of conservation and research; The buffer zone (24.47%), which allows activities that do not have an adverse effect on the ecology and environment; The transition zone (19.44%), which is a place of residence and occupation for the surrounding community. The rest is sea area. The environmental characteristics of the RBR are very rich in mangrove forests and biodiversity, consisting of 53 species of plants, 98 species of fish, 124 species of phytoplankton, 28 species of crustaceans, 77 species of benthic animals, 30 species of insects, 20 species of bacteria and 59 species of mold. Research and collaboration on these species is being conducted on an international scale [1]. The three main ecological functions of the RBR are (1) Conservation of biodiversity (Conservation Function); (2) Promote economic and social development (Development Function) and (3) Education, training, environmental research and monitoring of issues related to sustainable conservation and development (Logistics Function). [2]. The existing environmental education of the local community in the RBR does not play a role in the management of learning resources. This is due to a lack of knowledge, and a perception that where they own their own private resources, the management of learning resources in the area is the duty of officials only. Even though the RBR meets the criteria set out under the Biosphere Reserve framework, UNESCO remains concerned that the local community has limited knowledge on the concepts of the Biosphere Reserve. Responsible stakeholders should therefore continue to raise awareness and knowledge for the local community on the Biosphere Reserve, as well as levels of participation. [1].

Chu Van Coung and team's research entitled *Biosphere Reserves: Attributes for Success* (2016) [3] studied 90 Biosphere Reserves around the world. 60 Biosphere Reserves were considered to have been successful, while thirty were considered to be less successful. The RBR was one of the Biosphere Reserves identified as being less successful. The concept of literacy has evolved considerably from its origins: that is, literacy being the basic ability to read and write. Especially over the last 50 years, expectations for literate people have been extended to include the ability to understand, make informed decisions, and act with respect to complex topics and issues facing society today. The term literacy also has been extended to refer to such knowledge and capabilities in many different discourses such as digital literacy, health literacy, cultural literacy, scientific literacy, arts literacy,

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environmental literacy, etc. [4].

Environmental Literacy is the desired outcome of Environmental Education, which strives to provide learners with knowledge, attitude, awareness, skill, participation and ability to evaluate (KAASPA). It is an individual's understanding, skills, and motivation to make responsible decisions that considers his or her relationships to natural systems, communities, and future generations [1][5]. The researcher found that most of the existing research on Environmental Literacy for communities in Biosphere Reserves has not holistically adopted all six of the aforementioned objectives of Environmental Education (KAASPA) as established by UNESCO. [2] There has been some focus on knowledge management, awareness, and participation, but limited focus on attitudes, skills, and the ability to evaluate. The researcher has therefore applied all six objectives of Environmental Education as a basis for Environmental Literacy development under the KAASPA framework (Table 1).

This paper focuses on determining a measurement for Environmental Literacy based on six Environmental Education objectives. The specific characteristics and applications of Environmental Literacy among communities in the Ranong UNESCO Biosphere Reserve, in accordance with UNESCO objectives, have been taken into account.

Table 1. Environmental Literacy categories adapted under the KAASPA framework

Categories	Descriptions
Knowledge (K)	A variety of basic understanding and experiences in the environment and its allied problems
Attitude **(**A**)**	Feelings, values of motivation and concern for activity participating in environmental protection and improvement
Awareness **(**A**)**	Sensitivity to the total environment and its associated problems
Skill (S)	Solving and identifying environmental problems
Participation **(**P)	Involvement at all levels of working toward the resolution of environmental problems
Ability to evaluate (A)	Balance of environmental, social, and economic perspectives

Source: UNESCO (1976:3)

2. LITERATURE REVIEW

It has been accepted in the last several decades that Environmental Literacy (EL) has become increasingly prevalent. The North American Association on Environmental Education [6] has defined "*EL is an environmentally literate person, both individually and together with others, making informed decisions concerning the environment.*" The term "*Environmental Literacy"* was first introduced by Roth (1968) [7] in an issue of the Massachusetts Audubon Society publication, which asked "*How shall we know the environmentally literate citizen*?" Since then, the meaning of the term has been extensively examined and developed [8], [9], [10], [11], [12], [13], however there is still no consensus definition. After its inception, [7] the development of the term "Environmental Literacy" has been thoroughly revised with respect to development and definitions [8], [13] and different components and relationships, level and / or theoretical framework [8], [9], [12], [6], [11]. Moreover, during 1974 to 2011, Environmental Literacy has been defined in numerous ways and attempts have been made to measure how environmentally literate people are. Most attempts to measure literacy have conventionally measured people's knowledge about pollution and their attitudes toward the environment. Some authors and organizations such as Stapp and Cox, Hungerford et al, Ballard and Pandya, Iozzi et al, ASTM, Marcinkowski, Roth, Wisconsin Center for Environmental Education, Project learning Tree, NAAEE, NSTA Coyle, and Mc Beth et al had proposed a development framework for environmental literacy clearly reflecting its roots in the environmental education movement with respect to their major components [4]. Their frameworks include knowledge of basic ecological concepts, awareness of environmental problems and issues, environmental appreciation or sensitivity, and behaviors and skills to prevent and/or resolve those problems as key attributes of the environmentally literate individual (Table 2). The concept of environmental literacy has been promoted through creative and intensive discourse from a diversity of perspectives by authors and organizations. The most widely accepted definition of Environmental Literacy is that it consists of an awareness of, and concern about, environmental problems and its associated issues, as well as the skills, knowledge, and motivations to work toward the solutions of current issues and the prevention of new ones. [5].

Table 2. Environmental Literacy descriptions of Framework during 1974-2011

Year	Authors/ Organizations	Description of Framework
1974	Stapp and Cox	The spaceship earth philosophy of Environmental Literacy
1978	UNESCO	Categorization of Environmental Literacy objectives

[1] **Oregon State University (2019).** Oregon Environmental Literacy Program, http://oelp.oregonstate.edu/oelp-plan/what-environmental-literacy

Table 2. Environmental Literacy descriptions of Framework during 1974-2011 (continued)

Year	Authors/ Organizations	Description of Framework
1980	Hungerford et al,	Four goals of Environmental Literacy
1990	Ballard and Pandya	Knowledge of three key systems for Environmental Literacy
1990	Iozzi et al.	Five Taxonomies of educational objectives for Environmental Literacy
1991	Curriculum Task Group, ASTM	Twelve recommendations for Environmental Literacy
1991	Marcinkowski	Nine items comprising Environmental Literacy
1992	Roth	Three levels of Environmental Literacy
1992/1997	Wisconsin Center for Environmental Education	Four general Environmental Literacy outcomes
1993/2006	Project Learning Tree	Five goals of Environmental Literacy
1994	Hungerford et al, EL Consortium	Four categories of objectives for Environmental Literacy
2000/2004	NAAEE	Four strands of Environmental Literacy
2003	NSTA	Nine declarations for Environmental Literacy
2005	Coyle	Three levels of Environmental Literacy
Year	Authors/ Organizations	Description of Framework
2008	Mc Beth et al.	Four components of Environmental Literacy
2011	NAAEE	Four elements of Environmental Literacy

Source: Environmental literacy, ecological literacy, ecoliteracy: What do we mean and how did we get here? Ecosphere Volume 4, Issue 5, May 2013, Page 7.

In Thailand**,** academic literature has very rarely discussed the definition and competencies of environmental literacy. One of the earliest frameworks was that proposed by Minna Hares (2006) [14]. It was used as a tool to examine people's views, interests, knowledge, and motivations associated with forests in Northern Thailand. The related literature review pertained to digital literacy and health literacy, such as the framework proposed by The Department of Education of Thailand (2006) [15] which provided four core skills of digital literacy, namely technology, critical thinking, collaborative working, and social awareness. A more recent example is a research paper by Wawta Techataweewan and Ujsara Prasertsin (2018) [16], which summarized four digital literacy skills including awareness, thinking, operation, and collaboration. The researcher found that most existing research on Environmental Literacy Indicators for communities in Biosphere Reserves has not holistically adopted all six objectives of Environmental Education as established by UNESCO. [**5**]. There has been some focus on knowledge management, awareness, and participation, but limited focus on attitudes, skills, and the ability to evaluate.

This paper adds to the limited body of literature on Environmental Literacy research, particularly in Biosphere Reserves in Thailand, by filling the gap with the application of the six objectives of Environmental Education under the KAASPA framework to develop Environmental Literacy Indicators **(ELIs**) for communities in the Ranong UNESCO Biosphere Reserve.

3. RESEARCH OBJECTIVES

This research aims to study the current situation of the environment, as well as the characteristics of environmental literacy among communities in the Ranong UNESCO Biosphere Reserve. An additional objective is to develop ELIs based on environmental education objectives through the use of a mixed method approach.

4. METHODOLOGY

Numerous scholars have argued that the term *Environmental Literacy* has been used in many different ways. Nevertheless, this research aims to develop ELIs for communities in the Ranong UNESCO Biosphere Reserve by utilizing the six factors of Environmental Education and using a mixed method approach. The research design started with qualitative data to establish the status of environmental literacy among communities in the Ranong UNESCO Biosphere Reserve. The results of the qualitative phase were used to develop an environmental literacy test that was then used in the quantitative phase. To elaborate, the research methodology consisted of two phases:

The first phase used a qualitative method consisting of two parts.

The first process was an analysis and synthesis of the local context, local lifestyle, social structures, culture, ecology, and natural resource capital in the Ranong UNESCO Biosphere Reserve, as well as the macro context, policies, laws, regulations, rules, projects, plans, operations, and technologies related to the Ranong UNESCO Biosphere Reserve. This was completed through the review of documents and research produced among Thai and international academia. The output of

this process led to a definition of environmental literacy, as well as a conceptual framework for environmental literacy that is applicable to the majority of Biosphere Reserves in Thailand and more globally. The second process involved framework verification through interviews and small group discussions.

The tool used for collecting data was a structured interview form, pre-evaluated by three experts for content and construct validity of the questions [17]. The approved interview questions earned an Index of Congruence (IOC) score of 0.67–1.00 for the following questions:

1. What are the main environmental problems and/or issues in the Ranong UNESCO Biosphere Reserve?

2. Who plays a participating role in managing the Ranong UNESCO Biosphere Reserve?

3. How are the local people involved in the Ranong UNESCO Biosphere Reserve?

4. What are the levels of environmental literacy in the Ranong UNESCO Biosphere Reserve?

5. Which of the factors of environmental literacy based on six objectives of environmental education for communities in the Ranong UNESCO Biosphere Reserve (knowledge, attitude, awareness, skill, participation and ability to evaluate) would you or your organization support? How?

The researcher made appointments with 17 key informants for face-to-face interviews using the questions above. The informants were representatives of subcommittees on human and biosphere projects in the Ranong UNESCO Biosphere Reserve, as well as local experts in the communities.

Data collection took place in the period between October 2018 to December 2018. All interview data was analyzed for content, and ultimately led to the construction of a framework of environmental literacy indicators developed for communities in the Ranong UNESCO Biosphere Reserve. The informants of this research were 15 males (88.24%) and 2 females (11.76%); 7 worked in central government agencies, 7 worked in local government agencies, and 3 worked in provincial government agencies. There were heads of agency (64.70%), deputy heads of agency (29.41%), and members of the central agency (5.89%). Most had a degree of knowledge on the local context of the Ranong UNESCO Biosphere Reserve, spanning across 1-25 years of experience, with an average of 9.29 years of experience.

The following sample quotes from each of the interviewees provide an overview of local perspectives of Environmental Literacy. These perspectives then supported the creation of the 84-question questionnaires in the second phase of this research, which aimed to develop ELIs for communities in the Ranong UNESCO Biosphere Reserve.

"*The Ranong UNESCO Biosphere Reserve is an important learning resource for mangrove forests which, if developed continuously, would be a major tourist attraction for Ranong Province and a potential future World Heritage Site*" (Personal Interview, 18 December 2018).

"*The community lacks resources to learn about natural resources and mangrove forests. The Ranong, UNESCO Biosphere Reserve will be a learning resource that can educate the community*" (Personal Interview, 29 October 2018).

"*...should be strictly enforced against encroachers, and there should be a department dedicated to the inspection and continuous improvement of operations.*" (Personal Interview, 30 October 2018).

"*...locals have limited participation in the management of the Ranong UNESCO Biosphere Reserve. This poses the risk of misuse of the budget, and therefore good governance principles should be adopted...*" (Questionnaire comment).

In addition, at a personal interview held on 29 October, 2018, one interviewee stated that "*...the Ranong UNESCO Biosphere Reserve has many involved units, there are many laws that are redundant, ranging from authority and ownership of power. The most important issue is the coordination of conflicting government agencies, and disruptions in the law*."

The second phase consisted of the study of internal behaviors (knowledge, awareness, and attitude) and external behaviors (skill, participation, and ability to evaluate one's environment) through the use of questionnaires and used a quantitative method that aimed to develop Environment Literacy indicators. The 84 questions on the questionnaire consisted of internal and external behaviors across the aforementioned six factors. The first pertained to knowledge. The second pertained to attitude. The third factor pertained to awareness. The fourth factor pertained to skill. The fifth factor pertained to participation. The sixth factor pertained to ability to evaluate (Figure 1).

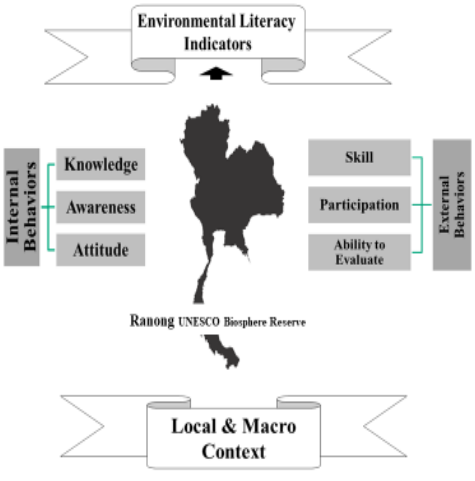

Fig. 1. The conceptual KAASPA framework used in the development of Environmental Literacy Indicators for communities in the Ranong UNESCO Biosphere Reserve.

The respondents were selected through simple random sampling of 400 heads of household from four sub-districts in the Ranong UNESCO Biosphere Reserve, all of whom had to have the following qualifications: (1)

Being the head or acting head of the household; (2) Age 20 or over and (3) Having permanent residence in the RBR. Selection was completed using the Yamane Formula [18], [19]. There is a total population of 24,250 households in the RBR across four sub-districts, namely Bang Rin sub-district, Pak Nam sub-district, Ngao sub-district, and Ratchakrut sub-district in Mueang district, Ranong province (Table 3). One person represented one household.

Table 3. The proportional allocation of sample groups of population and number of households in the RBR

Sub-district	Number of households	Sample proportion
Bang Rin	12,679	208
Pak Nam	4,642	77
Ngao	4,176	70
Ratchakrut	2,753	45
Total	24,250	400

Source: National Statistical Office (2010). The 2010 Population and Housing Census (Whole Kingdom)

Data collection was conducted through questionnaires. Responses to the questionnaire were organized into five levels, namely (1) Lowest, (2) Low, (3) Moderate, (4) High and (5) Highest. All 400 respondents completed the questionnaires for this study. Questionnaire components were analyzed for content validity and structural validity, with the analysis indicating whether there was a consistent value between the research questions and their corresponding objectives, by using the formula developed by Rovinelli and Hambleton [17].

5. RESULTS

Of the 400 heads of household in the Ranong UNESCO Biosphere Reserve, all of whom completed questionnaires for this study: The majority of respondents were female (56.25%), with an average age of 42.19 years ($\bar{X}$ = 42.19, S.D.=12.78). Some were Muslims (7.50%) and Christians (1.25%), while the remainder were Buddhists. This closely mirrors the overall demographics of Thailand as a nation, which is Male (49%), Female (51%), Buddhist (93.6%), Muslim (4.9%) and Christian (1.3%) National Statistical Office (2010)[2]. [20]. Other demographic factors are as follows: primary education (25.75%), secondary education or vocational certificate (30.50%), undergraduate degree (13.25%), agricultural workers (16.00%), employees (36.75%), and civil servants (10.00%). The average monthly income was 14,433.50 baht or US$ 465. ($\bar{X}$=14,433.50, S.D. =7,543.00). The average length of residence in the community was 30.59 years ($\bar{X}$=30.59, S.D. =17.37). The researcher found that most respondents own an average of 0.768 hectares of land, of which an average of 0.622 hectares was allocated for agricultural purposes. Respondents are all impacted by wildfire, over-utilization of water resources, and land encroachment by individuals from within the community, outside the community, as well as government officials, local politicians, or investors seeking commercial gain. The major issue concerning water resources in the RBR is supply shortages in certain seasons. The major issue concerning air pollution in the RBR is the unpleasant odor from the fishmeal factory. The major issue concerning energy is the rising price of energy, where it is important to note that in the community, electricity and oil are important sources of energy. Regarding crops, most locals are cultivating palm oil, rubber, and rice. Local plant specimens of the RBR are the *Lepironia articalata* and *Melaleuca quinquenervia*, both of which possess important properties and can be utilized for various purposes such as the production of local handicrafts and basketry, as well as for general household consumption. There are local efforts for plant conservation, including sporadic crop substitution, prevention of land encroachment through neighborhood watch initiatives, and limiting the picking of crops to only when it is strictly necessary. The main cause of deforestation in the RBR is firstly human action (from investors seeking commercial gain as well as villagers), followed by natural disasters such as forest fires, floods, and tsunamis. The primary causes of deforestation in the RBR is for humans to use the land for housing, industry, and agriculture. The main benefit to be derived from forest resources in the RBR is the collection of grasses for the creation and sale of consumer products, and the collection of wood for burning, house construction, and sale on the commercial market. The animals which locals commonly cultivate for consumption include fish, shrimp, shellfish, and other downstream animals, while animals kept in the household include fish, monkeys, mud lobsters, and reptiles. Overall populations of these animal species have declined due to various reasons, such as the deterioration of the mangrove forests where they live, natural extinction, excessive hunting, and excessive exposure to agricultural chemicals. The main reasons for the decline of marine animal species in the RBR are improper fishing, such as the capturing of fish during breeding season or the improper usage of small mesh nets, as well as an overall deterioration in the quality of the water. The human cultural environment in the RBR consists of cultural ideas, collective culture, and lifestyle culture, traditions around production and craftsmanship, as well as cultural thoughts. It was found that the majority of people live in accordance with the Sufficiency Economy Philosophy or within their own means. The major occupational groups in the community include handicraft groups, local fishing groups, herb-growing groups, and food-processing groups. Furthermore, there is an important sense of community through networks such as the volunteers who work collectively to extinguish forest fires within the vicinity, occupational networks, community networks, and

[2] **National Statistical Office (2010).** The 2010 Population and Housing Census (Whole Kingdom), http://popcensus.nso. go.th/file/Popcensus-10-01-56-E.pdf.

environmental conservation networks. In regards to collective culture, it was found that there are adequate conflict resolution mechanisms in the community. These are based on the application of laws, as mediated by seniors in the community and supported by a sense of forgiveness for one another. In regards to occupations, the most common occupations are those which have been passed down within the community from generation to generation, whereas others have been introduced through marriage or commercial affairs. The community receives news regarding the conservation and development of the RBR directly from government officials, public service announcements, and training workshops, and there is a widespread agreement that it is the duty of all stakeholders to work together towards these goals. In regards to local production, it was found that the most common products were shrimp paste and cashew nuts. Overall, the majority of locals believe that the environment in the RBR has a high degree of abundance.

Environmental literacy in the Ranong UNESCO Biosphere Reserve consists of the level of knowledge, awareness, attitudes, skills, participation, and the ability to evaluate one's environment. It was found that in general, the public had an average environmental literacy score of 3.89. Furthermore, (1) Environmental awareness score is 4.04: Individuals perceive a marked difference in the abundance and fertility of the Ranong UNESCO Biosphere Reserve from past to present, and possess an understanding of the challenges around global warming; (2) Environmental attitudes, specifically towards the use of chemicals in agricultural activities score is 3.92: Individuals demonstrate an understanding that excessive use of these will negatively affect soil quality, water, and overall public health. Furthermore, that the over-utilization of natural resources will deteriorate the ecosystem and the environment; (3) Environmental knowledge score is 3.77: Individuals understand that the Ranong UNESCO Biosphere Reserve has been designated as a conservation area which will be developed and used for environmental research. Furthermore, there is environmental knowledge that the encroachment of mangrove forests results in the decline of plant and animal species in the Ranong UNESCO Biosphere Reserve; (4) Environmental skills score is 3.76: Locals are equipped and confident in giving advice to neighbors in the community about conservation and development in the Ranong UNESCO Biosphere Reserve, specifically as local occupations have faced great difficulties due to the deterioration of natural resources; (5) Environmental participation, specifically in meetings with local government agencies or community gatherings where everyone is invited to be involved in the conservation and management of the Ranong UNESCO Biosphere Reserve, score is 3.77; (6) Environmental ability to evaluate, such as applying the Sufficiency Economy Philosophy in order to improve one's own quality of life as well as the collective community efforts to conserve the environment in the Ranong UNESCO Biosphere Reserve, score is 4.07. Results are shown in Table 4.

Table 4. Environmental Literacy indicator scores among communities in the Ranong UNESCO Biosphere Reserve

EL -indicators	Mean	S.D.
Internal Behaviors		
1. Knowledge (**K**)	3.77	0.87
2. Attitude (**A**)	3.92	0.83
3. Awareness (**A**)	4.04	0.75
External Behaviors		
1. Skill (**S**)	3.76	0.83
2. Participation (**P**)	3.77	0.87
3. Ability to Evaluate (**A**)	4.07	0.78
Total average	**3.89**	0.82

Utilizing the Index of Congruence (IOC), the results indicated that the framework meets its overall objectives; the score for content validity is 0.67-1.00 and the score for construct validity is 0.67-1.00.

The evaluation of the KAASPA framework was assessed for content validity and construct validity by three external experts from the fields of environmental education, environmental management and environmental studies.

6. DISCUSSION

The Ranong UNESCO Biosphere Reserve (RBR) was one of the Biosphere Reserves identified as being less successful by Chu Van Coung and team's research entitled Biosphere *Reserves: Attributes for Success* (2016). [3] As shown in Table 4, our findings on Environmental Literacy under the KAASPA Framework revealed the overall Environmental Literacy score in the community to be 3.89 (out of 5). On internal behaviors, respondents possess environmental awareness, environmental attitude, and environmental knowledge with scores of 4.04, 3.92, and 3.77, respectively. On external behaviors, respondents possess environmental ability to evaluate, environmental participation, and environmental skill with scores of 4.07, 3.77, and 3.76, respectively. The three Environmental Literacy Indicators which scored less than average was Knowledge (K), Skill (S) and Participation (P).

While the local participation is necessary in order to create knowledge, wisdom, tenacity, reduce conflict, and increase cooperation with government agencies in the conservation of natural resources, development of the economy, and generation of income. The researcher found that local communities in the Ranong UNESCO Biosphere Reserve do not participate in the management of the learning resources. The main reasons are: (1) The locals lack environmental knowledge, awareness, or a sense of ownership that empowers them to participate in the management of what is indeed their own resource; (2) The locals perceive the management of the learning resources to be the duty of the Ranong UNESCO Biosphere Reserve officials. This aligns with some

research papers conducted by Tawee Nootong (2018) [21] who studied the sustainability of Thailand's protected areas and found that locals lacked knowledge and participation in environmental conservation;

Moreover, Archibald P. Sia, Harold R. Hungerford & Audrey N. Tomera (1986) [22] analyzed selected predictors of responsible environmental behavior in USA, and their results demonstrated that the three major behavior predictors are perceived skill, knowledge of environmental action strategies, and environmental sensitivity. They concluded that these need to be addressed in curriculum development and instructional practice;

In addition, Elitsa I. Barukchiva (2017) [23] who found that Romania Biosphere Reserve has focused on local participation through the integration of "Cultural Landscape", with the natural conservation process linked to the local way of life, art, religion, language, traditions, legends, and folklore of the Danube Valley community and the Danube Delta. This includes the transfer of complex concepts and vocabulary relating to Biosphere Reserves through simple explanations for tourists as well as locals;

The latest UNESCO evaluation of the RBR confirmed in its report that the conditions of the Ranong Biosphere Reserve, especially the mangrove forests, have been greatly improved. As such, it confirmed that Ranong would continue to be certified as a Biosphere Reserve. Still, UNESCO expressed its concern on local communities and their lack of conceptual knowledge of Biosphere Reserves. It also expressed its concern on the lack of participation from local communities in the RBR. Responsible stakeholders should therefore continue to raise knowledge and awareness for the local community on the Biosphere Reserve, as well as levels of participation in local communities [1]. Furthermore, the objectives of the Biosphere Reserve are not very well understood by visitors and local communities, nor are they communicated clearly enough from the RBR management to the visitors and local communities in the RBR. Therefore, the dissemination of more information and sharing in the implementation of said objectives could benefit not only the sustainable development of tourism, but also the Biosphere Reserve itself.

In summary, it can be said that the strategy for improving Environmental Literacy among the people of the RBR must be tailored to suit different knowledge levels, skill levels, and participation levels of each person, and must be implemented continuously in order to ensure truly sustainable development achievement.

7. RECOMMENDATIONS

Biosphere Reserves have encountered problems beyond those limited only to institutional constraints. To promote local communities to be environmentally literate is an essential responsibility of all related agencies. The Environmental Literacy Indicators (ELIs) are extremely important in policy formation and planning. Tracking their performance is a measure of success or failure of environmental development, ecology, quality of life, and sustainable society in accordance with the SDGs of the United Nations. The research results of ELIs would serve to indicate existing strengths and weaknesses, and therefore support the planning and execution of environmental literacy promotion. Moreover, Biosphere Reserves have a responsibility to promote environmental literacy in order to educate, develop skills and participation among nearby local communities. The results of this study showed widespread support and satisfaction with all six objectives of Environmental Education, as proposed by UNESCO. However, it is strongly recommended that there be continuous evaluation and increased emphasis on the improvement of Environmental Literacy among communities in UNESCO Biosphere Reserves.

8. CONCLUSION

"Environmental Literacy" was first introduced as a concept several decades ago and has since been redefined in numerous ways, with attempts made to measure how environmentally literate people are. Conventionally, many attempts to measure literacy have measured people's knowledge about pollution and their attitudes toward the environment. Some authors and organizations had proposed a development framework for environmental literacy clearly reflecting its roots in the environmental education movement with respect to their major factors. However, there is still no consensus definition of Environmental Literacy.

The current existing situation in the Ranong UNESCO Biosphere Reserve (RBR) refers to the natural and cultural environment, as well as causes of destruction and management methods of the RBR in accordance with the research objectives. Following UNESCO designation, the Ranong UNESCO Biosphere Reserve became a source of learning on matters relating to biodiversity, culture, and society due to its exceptional diversity: The Ranong UNESCO Biosphere Reserve has vegetation that ranges across 17 families and 35 species, including 20 species of seedlings. There are 98 species of fish, 124 species of plankton, 28 species of crustaceans, 77 species of amphibians, 30 species of insects, 20 species of bacteria, and 59 species of fungi.

In addition, the designation of the area as a biosphere reserve plays an important role in conservation, the development of natural resources and the environment, as well as the study, research, and knowledge-sharing from practical lessons learned in sustainable natural resource management. These can be effectively applied in both surrounding areas and beyond, to the benefit of government officials, community leaders, tourists, and related stakeholders.

The characteristics and development of environmental literacy indicators among communities in the RBR based on environmental education objectives, it was found that, in general, the public had a degree of Environmental Literacy (EL), namely (1) Environmental Knowledge (K)**:** (Score 3.77) A variety of basic understanding and experiences in the Ranong UNESCO Biosphere Reserve's environment*;* (2) Environmental Attitude (A): (Score 3.92) Feelings, motivation, and concern for environmental protection and improvement in the Ranong

UNESCO Biosphere Reserve; (3) Environmental Awareness (A): (Score 4.04) Sensitivity to the total environment and its associated problems in the Ranong UNESCO Biosphere Reserve; (4) Environmental Skill (S): (Score 3.76): Solving and identifying environmental problems in the Ranong UNESCO Biosphere Reserve ; (5) Environmental Participation (P): (Score 3.77) Involvement at all levels of working toward the resolution of environmental problems in the Ranong UNESCO Biosphere Reserve; and (6) Environmental Ability to evaluate (A): (Score 4.07) Balance of environmental, social, and economic perspectives in the Ranong UNESCO Biosphere Reserve.

The results revealed the overall EL score is 3.89 (out of 5), further indicating that the respondents' level of Attitude, Awareness, Ability to evaluate are slightly above their Knowledge, Skill, and Participation.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this paper.

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REFERENCES

[1] Wijarn Meepol (2015). Ranong UNESCO Biosphere Reserve Management. Academic seminar documents For Marine and coastal resources. [Online] Source: www.dmcr.go.th

[2] UNESCO (1976). The Belgrade Charter. Connect 1.NO. 1 (January)

[3] Chu Van Cuong, Peter Dart (2017). Using Enhancing our Heritage Toolkit assessing management effectiveness of the Kien Giang Biosphere Reserve. International Journal of UNESCO Biosphere Reserves Volume I, Issue 2, August 2017, VIU PRESS | ISSN: 2371-7890 (Online)

[4] B.B. McBride, C.A.Brewer, A.R.Berkowitz, W.T. Borre (2013). Environmental literacy, ecological literacy, ecoliteracy:What do we mean and how did we get here? Ecosphere an asa open access Journal https://esajournals.onlinelibrary.wiley.com/doi / full/10. 1890/ES13-00075.

[5] Oregon State University (2019). Oregon Environmental Literacy Program, Oregon State University, http://oelp. Oregonstate.edu/oelp-plan/what-environmental-literacy

[6] North American Association for Environmental Education (NAAEE) (2011). Developing a framework for assessing environmental literacy. North American Association for Environmental Education, Washington, D.C., USA. http://www.naaee.net/ sites/default/ files framework/DevFramewk.Assess. Env.Lit [Online] Ed.pdf

[7] Roth, C. E. (1968). On the road to Conservation. Massachusetts Audubon 38–41

[8] Roth, C.E.(1992). Environmental literacy: it's roots, evolution, and direction in the 1990s. ERIC Clearinghouse for Science, Mathematics, and environmental Education, Columbus, Ohio, USA

[9] Simmons, D. (1995). Papers on the development of Environmental education. North American Association for Environmental Education,Troy, Ohio, USA

[10] Morrone, M. K., K. Mancl, and K. Carr (2001). Development of a metric to test group differences in Ecological knowledge as one component of environ mental literacy. Journal of Environmental Education 32:33–42

[11] Weiser, B.G.(2001). The Environment and its effects on students' environmental literacy. Dissertation 3027890. University of Houston, Houston, Texas, USA. ProQuest UMI Dissertations Publishing

[12] North American Association for Environmental Education (NAAEE) (2000/2004). Excellence in Environmental education: guidelines for learning (K–12). NAAEE, Washington, D.C., USA

[13] O'Brien, S. R.M. (2007). Indications of Environmental Literacy: using a new survey instrument to measure awareness knowledge, and attitudes of university-aged students. Dissertation 1446054. Iowa State University, Ames, Iowa, USA. Pro Quest UMI Dissertations

[14] Minna Hares (2006). Environmental literacy in Interpreting endangered sustainability: Case studies from Thailand and the Sudan, Geoforum Volume 37, Issue 1, January 2006, Pages 128-144

[15] The Department of Education of Thailand (2006). Digital technology literacy: World-class standard school Author, Bangkok, Thailand

[16] Wawta Techataweewan and Ujsara Prasertsin, (2018). Development of Digital literacy indicators for Thai undergraduate students using mixed method research Kasetsart Journal of Social Sciences, Volume 39, Issue 2, May-August 2018, Pages 215-221

[17] Rovinelli, R.J., & Hambleton, R.K. (1977). On the use of content specialists in the assessment of criterion referenced test item validity. Dutch Journal of Educational Research, 2, 49-60

[18] Yamane, Taro (1967). Statistic: an ntroduction Analysis. 3rd ed. Tokyo: Hasper International Education.

[19] Boontham Kijpredarborisuthi (2003). Research Hand book, Research reports and theses writing. Faculty of Social Sciences and Humanities, Mahidol University, Nakhon Pathom

[20] National Statistical Office (2010). Thailand Population Census. http://popcensus.nso.go.th/en/

[21] Tawee Nootong (2018). Catalyzing Sustainability of Thailand's Protected Area System (CATSPA). https://www.slideshare.net/catspa/ss-64516475 (11 April 2018).

[22] Archibald P. Sia, Harold R. Hungerford & Audrey N. Tomera (1986). The Selected Predictors of Responsible Environmental Behavior: An analysis. The Journal of Environmental Education, Volume 17, 1986- Issue 2

[23] Elitsa I. Barukchieva (2017).The Relationship between Tourism and the Biosphere Reserve Status:The Danube Delta - If the Danube is "the sustainable highway' of Europe, then the Danube Delta should be the sustainable gate to the Black Sea. International Journal of UNESCO Biosphere Reserves Volume 1 | Issue 2 | August 2017.