Eco-tourism Education Effectiveness Indicator System Research for Macau SAR in Practice

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Abstract. The study of education in Ecotourism is one of the many important focuses among the field of Ecotourism; and the evaluation of Ecotourism education effectiveness in Ecotourism is a key topic in it. The result of this study can be very useful in the development of Ecotourism education. In addition, affect greatly in its improvement in the future. The Delphi method had been used in this study to establish a valid indicator system of evaluation in Ecotourism education; then followed by the analytic hierarchy process (AHP) with 11 paired-comparison matrices being constructed. Weights of these evaluation indicators were then determined by using Matlab7.1. Throughout, data was obtained by doing sampling surveys, and the fuzzy comprehensive evaluation method was used to calculate the validity of Ecotourism education, where validity was classified into different levels. As the result, the evaluation model of the education effectiveness in Ecotourism was constructed. The Macau Special Administrative Region (Macau SAR) was chosen in this case for the empirical stage. Data of ecological knowledge, ecological cultural level, ecological consciousness, ecological ethics and ecological behaviors of tourists, who had entered and exited Macau SAR, was collected and analyzed in SPSS. Differences and impact of these indicators were studied to conclude the effect of its education in Ecotourism of this region. In addition, the results of education effectiveness in Ecotourism were also compared among different population subgroups and observations were given accordingly.

1. Introduction

In 2016, Macau Special Administrative Region (Macau SAR) had received around 30.95 million tourists, a 0.8% growth from the previous year. Among these tourists, there were 0.1% and 7.9% increases of tourists from mainland and foreign countries compare to 2015, respectively. The number of overnight visitors exceeded 15.7 million; it had a 9.8% annual growth, which accounted for 50.7% of the total number of visitors; the average length of stay for visitors also increased to 1.2 days, a 0.1 days increase compared to the previous year. Hotel facilities receive about 12 million visitors in the same year, with an annual growth rate of 4% according to the Macau Statistics and Census Service (2017). In particular, the number of tourists from mainland China and their tourism consumption both are ranked first on the corresponding lists. Such large group of tourists in the tourism industry do stimulate tremendously the

economic momentum for the Macau SAR, while at the same time, has brought significant negative impact to this region:

First of all, the negative impact to the local environment has been going on continuously. The impact of tourists on the natural environment is mainly manifested in water pollution, vegetation damages, air and noise pollution, landscape damages, damages of cultural relics, and other aspects. For instance, some travel hot spots often were overcrowded, tour facilities and construction were damaged as a result.

Secondly, social conflicts have been raised from time to time. In recent years, there have been many conflicts among tourists, tour guides, tourist places, and Macau residents. The negative behavior of some tourists also affected the country image of China, causing many Macau residents to both love and hate such holiday economy.

The reasons for these phenomena are multifaceted and complex. There are reasons from the tourists themselves, and there are the external environmental factors such as tourism management being imperfect, tourism services being not in place, cultural differences and so forth. To simply blame anyone party on the bad effects party is one-sided.

The Macau SAR government has been aware of the issue of tourism education and have been making emphasis on the importance of the quality of tourists intervene in the work, by promulgating the relevant laws and regulations. However, it is difficult to state whether it is effective. In order to promote the sustainable development of educational activities in tourism and the construction of tourism ecological civilization in Macau, it is necessary to consider the evaluation of the effectiveness of education in tourism scientifically.

In recent years, the education in tourism with tourist activities as a medium has caught the attentions from domestic and foreign researchers. However, most of the topics focused were on definitions, characteristics, educational technology, tourism of tourism and so forth. Through literature search found through CNKI, China Knowledge Resource Integrated Database, which relatively few studies were done in past 10 years on evaluation of the education effectiveness in tourism domestically. In 2009, Li and Zhong conducted a study on the Poyang Lake National Nature Reserve as an example to make attempt in developing an evaluation index system on ecotourism education, which includes four levels, seven secondary indicators, with total of 21 quaternary indicators (Li et al. 2009). Then, Li (2012) and others carried out an empirical study on eco-tourism education for Poyang Lake National Nature Reserve. In 2010, Wen and Ng used the KAP intervention to measure and evaluate the effectiveness of ecological education interventions. Chen (2015) also established the evaluation model of the effectiveness of education in tourism. The research done by the above scholars is the only research result of the evaluation of the effect of education in tourism in China so far, which provides theoretical reference and practical guidance for the future scholars in research. However, there is still room for improvement on their evaluation system, where it can become more comprehensive and systematic. This study looks at to the experimental comparison method from scholars of Li and Wen as reference, combined with the results obtained from above research to construct the evaluation system of tourist's education effect to in line with the Macau SAR. Through empirical research to verify the applicability of the evaluation indicator system and its model; in addition, the effect of tourist education intervention also will be measured.

2. Development and testing of Evaluation Indicator System

2.1. Building up the Evaluation Indicator System

Tourist education, as an important part of modern social education, is a public project to meet the social development needs of the country or region to enhance the social service as the ultimate goal of investment. Tourist education should be people-oriented, with the principle of sustainable development, and requiring tourists, tourism resources and tourism business operators to coordinate its development. Therefore, a complete assessment of the effectiveness of tourist education should include knowledge, culture, morals, consciousness and behavioural intention these five areas. There are two basic methods to construct the evaluation indicator system; one is the sub-statistical method which each factor is

evaluated closely; the other is to build a quantitative model, and through examining the difference between the standard and the observations to evaluate the overall result. This study constructs the evaluation indicator system with the use of the comprehensive method, and evaluate the overall and the sub-elements accordingly.

Evaluation. The selection of the system and the construction of the system are mainly based on the tourist education system of ecotourism in this paper. Construction principles: First, scientific. Accurately and objectively, reflect the connotation and essence of tourist education in ecotourism. The second is comprehensive. Fully reflect the overall characteristics of the tourist education system, indicators independent of each other, clear boundaries. Three is hierarchical. The index system is in line with the complexity of tourist education, comprehensive and structured. Four is feasible. All indicators must be measurable, and the indicators are comparable.

The principles of construction of evaluation indicator system and the selection of indicators used in this study are mainly based as follows: First, the method used should be scientific. Accurately and objectively reflecting the connotation and essence of tourist education in ecotourism is essential. Secondly, it should be comprehensive. While fully reflecting the overall characteristics of the tourist education system, independency among indicators is to be maintained with no overlapping. Thirdly, it is hierarchical. The system is aimed to be in line with the complexity of tourist education; it is comprehensive and structured. Finally, yet importantly, it is feasible. All indicators must be measurable and comparable.

2.2. Building up the levels for the Evaluation Indicator System Model

In this study, the analytic hierarchy process (AHP), analysis of literature and the Delphi method are used to solve the complex system of evaluation in tourist education effect. By constructing the evaluation indicator model and calculating the weight of the indicators followed by the test of consistency, the construction of the evaluation indicator system of tourist education is finalized.

Based on the analysis of the relevant literatures of tourist education, the potential indicators of tourist education are extracted and organized according to the relationship among the indicators. The initial formation are target level, system level, area level and indicator level, which includes 35 indicators in the evaluation indicator system.

In order to make this study more scientific and more suitable for the use of respondents, the first round of expert interviews was conducted. On one hand, through the small sample test, the reliability and validity of the indicators can be tested. On the other hand, through the experts, front-line tourism management, and interviews of tourists, modification of the indicators can be done. After the increase or decrease some of the indicators with the procedures mentioned (Li, 2006; Wen 2009; Dou et al., 2016; Xu, 2015), the resulting system is more comprehensive and more targeted, with five levels of 28 indicators (Table 1).

Table 1. Echo-Tourism Education Effectiveness Indicator System Heirachy Model

Target level (A)	Principle level (B)	Area level (C)	Indicator level (D)
Effectiveness of Education in Eco-tourism (A)	Knowledge level (B1)	Ecological Resources knowledge of tourist destination (C1)	Characteristics of ecological resources (D1) Knowledge of ecological resources (D2)
		Ecotourism Knowledge (C2)	Connotation and significance of Ecotourism (D3) Ecotourism safety and risks (D4) Knowledge of ecological protection (D5) Code of conduct for Ecotourism (D6) Eco-tourism policies and regulations (D7)
	Cultural level (B2)	Social and cultural knowledge of tourist destination (C3)	Social and cultural characteristics (D8) Social and cultural awareness (D9)
	Moral level (B3)	Environmental ethics (C4)	Concepts of relationship between human and nature (D10)
		Management and development ethics (C5)	Concepts of relationship between development and protection (D11)
		Social organization ethics (C6)	Concepts of participation and benefit for tourism development organizations (D12)
		Consumer ethics (C7)	Concepts of concerning consumer rights of others and realistic consumption (D13)
	Consciousness level (B4)	Ecological environment awareness (C8)	Sense of Ecological value (D14) Environmental awareness (D15) Sense of Ecological protection (D16)
		Tourism consumption ethics (C9)	Respecting the interests of others (D17) Respecting the culture of tourist destination (D18) Agreement and obeying the management of the tourist destination (D19)
	Behavioral Intention level (B5)	Self-behavior (C10)	Willingness of participation in ecotourism (D20) Willingness of continuous access to Ecological knowledge (D21) Following Code of Conduct for Ecotourism (D22) Environmental living behavior (D23) Participation in environmental activities (D24) Economic contribution behavior (D25) Participation in tourism management behavior (D26)
		Intervention (C11)	Dissuading others from damaging environment (D27) Reporting others who damage the environment (D28)

2.3. Criteria weights

Accurate and reasonable criteria weights are very important as the foundation in evaluating the effectiveness of education in Eco-tourism properly.

2.3.1. Building the comparison matrix, Comparison matrix was built to compare the relative importance of each pair of criteria. The relative importance is measured from a numerical scale of 1 to 9. For criterion i and j under each rank A, 1 represents that i and j being equally important; 3 represents that i is slightly more important than j; 5 represents that i is obviously more important than j; 7 represents that i is strongly more important than j; and 9 represents that i is absolutely more important than j. On the other hand, if i is less important than j, then the reciprocal of the corresponding values will be used accordingly.

2.3.2. Computing the criteria weights, 11 comparison matrixes were built when determining the criteria weights. Each entry was calculated after surveying experts the second time following the above guidelines. First the corresponding priority vectors of each expert are to be computed. Then it is followed by the test of consistency. If the data acquired meet the requirement, then the entries will be used for criteria weights for the indicators. The overall consistency test is also conducted after elimination of inconsistent data. The calculation process is presented as followed.
Each entry of the *normalized comparison matrix* can be computed using formula (1):

$$\overline{a}_{ij} = \frac{a_{ij}}{\sum_{k=1}^{n} a_{kj}} \quad \text{where } i = 1,2,3,\dots,n. \tag{1}$$

According to the following formula we can obtain the normalized principal eigenvector, which is also called *priority vector*, $\overline{\mathrm{W}} = \left[\overline{\mathrm{W}}_1, \overline{\mathrm{W}}_2, \dots, \overline{\mathrm{W}}_n\right]^T$:

$$\overline{W_i} = \sum_{j=1}^{n} \overline{a_{ij}} \quad \text{where } i = 1,2,3,\dots,\mathrm{n}. \tag{2}$$

2.3.3. Test of Consistency
To insure validity of this Indicator system, tests of consistency are conducted for each expert, where *Consistency Indicator* (CI) and *Consistency Ratio* (CR) are acquired.

The *principle eigenvalue* of the matrix can be obtained using the following formula:

$$\lambda_{max} = \sum_{i=1}^{n} \frac{(AW)_i}{nW_i} \tag{3}$$

Where *AW* is *obtained* by multiplying *A* by eigenvector *W*, and $(AW)_i$ represents the i^{th} criteria of *AW*.
Computing *CI* and *CR* with the following formula, with approval of consistency if $CR < 0.1$:

$$CR = \frac{CI}{RI} \quad \text{where} \quad CI = \frac{\lambda - n}{n-1} \tag{4}$$

Table 2 shows that the inconsistency ranges from 0.0212 to 0.0588 which are all less than 0.1, thus the data acquired is consistent.

Table 2. Priority Vectors for Each Matrix and Test of Consistency

Matrix	Priority Vectors	λ_{max}	CI	RI	CR
1	W = [0.2102, 0.3496, 0.4403] ^{T}	3.0861	0.0222	0.59	0.0381
2	W = [0.3827, 0.2524, 0.3649] ^{T}	3.0240	0.0150	0.48	0.0212
3	W = [0.6333, 0.3667] ^{T}	2	0	0	-
4	W = [0.7618, 0.2382] ^{T}	2	0	0	-
5	W = [0.5847, 0.4153] ^{T}	2	0	0	-
6	W = [0.4194, 0.5806] ^{T}	2	0	0	-
7	W = [0.1552, 0.1023, 0.2133, 0.3153, 0.2140] ^{T}	5.3677	0.0561	1.22	0.0588
8	W = [0.3442, 0.2396, 0.4162] ^{T}	3.0300	0.0150	0.59	0.0267
9	W = [0.2439, 0.3787, 0.3774] ^{T}	3.0321	0.0221	0.57	0.0342
10	W = [0.1472, 0.0889, 0.2025, 0.1892, 0.1961, 0.0685, 0.1075] ^{T}	7.3125	0.0688	1.42	0.0421
11	W = [0.7465, 0.2535] ^{T}	2	0	0	-

Overall consistency test is done using the following formula:

$$\overline{CR} = \frac{a_1 CI_1 + a_2 CI_2 + \cdots + a_m CI_m}{a_1 RI_1 + a_2 RI_2 + \cdots + a_m RI_m} \quad (5)$$

We can obtain $\overline{CR} = \frac{0.0342}{0.8272} = 0.0414$. Since $CR < 0.1$, the consistency test has been approved.

3. Evaluation Indicator System

After defining the indicators, the calculation of the corresponding weights and the test of consistency, a reasonable evaluation indicator system is developed for education in Eco-tourism (Table 3).

Table 3. Evaluation Indicator System for Education in Eco-Tourism

Target level (A)	Principle level (B)	Area level (C)	Indicator level (D)	Overall weight
Effectiveness of Education in Eco-tourism (A)	Knowledge level (B1) (0.2102)	Ecological Resources knowledge of tourist destination (C1) (0.3827)	Characteristics of ecological resources (D1) (0.5847)	0.0470
			Knowledge of ecological resources (D2) (0.4153)	0.0334
		Ecotourism Knowledge (C2) (0.3649)	Connotation and significance of Ecotourism (D3) (0.1552)	
			Ecotourism safety and risks (D4) (0.1023)	0.0119
			Knowledge of ecological protection (D5) (0.2133)	0.0078
			Code of conduct for Ecotourism (D6) (0.3153)	0.0164
			Eco-tourism policies and regulations (D7) (0.2140)	0.0242
				0.0164
	Cultural level (B2) (0.2002)	Social and cultural knowledge of tourist destination (C3) (0.2524)	Social and cultural characteristics (D8) (0.4194)	0.0223
			Social and cultural awareness (D9) (0.5806)	0.0308
	Moral level (B3) (0.1989)	Environmental ethics (C4) (0.2740)	Concepts of relationship between human and nature (D10) (0.4539)	
			Concepts of relationship between development and protection (D11) (0.3411)	0.0662
		Management and development ethics (C5) (0.2603)		0.0730
		Social organization ethics (C6) (0.2432)	Concepts of participation and benefit for tourism development organizations (D12) (0.2434)	0.0321
		Consumer ethics (C7) (0.2225)	Concepts of concerning consumer rights of others and realistic consumption (D13) (0.4437)	0.0945
	Consciousness level (B4) (0.3496)	Ecological environment awareness (C8) (0.6333)	Sense of Ecological value (D14) (0.3442)	0.0762
			Environmental awareness (D15) (0.2396)	0.0530
			Sense of Ecological protection (D16) (0.4162)	0.0921
		Tourism consumption ethics (C9) (0.3667)	Respecting the interests of others (D17) (0.2439)	0.0313
			Respecting the culture of tourist destination (D18) (0.3787)	0.0485
			Agreement and obeying the management of the tourist destination (D19) (0.3774)	0.0484
	Behavioral intention level (B5) (0.4403)	Self-behavior (C10) (0.7618)	Willingness of participation in ecotourism (D20) (0.1472)	
			Willingness of continuous access to Ecological knowledge (D21) (0.0889)	0.0494
			Following Code of Conduct for Ecotourism (D22) (0.2025)	0.0298
			Environmental living behavior (D23) (0.1892)	0.0679
			Participation in environmental activities (D24) (0.1961)	0.0634
			Economic contribution behavior (D25) (0.0685)	0.0658
			Participation in tourism management behavior (D26) (0.1075)	0.0230
				0.0361
		Intervention (C11) (0.2382)	Dissuading others from damaging environment (D27) (0.7465)	0.0783
			Reporting others who damage the environment (D28) (0.2535)	0.0266

Based on this evaluation indicator system, tourists' education effectiveness can be calculated using the following formula:

$$G = \sum_{i=1}^{n} G_i * W_i \quad (6)$$

Where, G_i is the scores of indicators of the tourists and W_i is the overall weight.

Obvious results cannot be obtained easily by simply looking the total score in one occasion to evaluate the effect of education in Eco-tourism. Therefore, sampling survey is conducted to compare the effect before and after the education, in this case tourists entering Macau SAR and exiting it, is done for a reasonable result. Then the mean results of different characteristic groups are compared for observations. The larger the differences of the means, the more effective the education is. So the evaluation indicator system is used in evaluating the effectiveness of Eco-Tourism Education in Macau SAR.

3.1. Overall Effect of Education in Eco-tourism

3.1.1. Demographic characteristics of surveyed tourists, In this section, the demographic characteristics of tourists will be discussed according to their genders, ages, personal annual income, education levels, marital statuses, occupations and residencies.

A total of 450 visitors were surveyed in the Macau SAR for this study. From Table 4, we can see that among the 360 valid samples, 177 were women and 183 were males, which is approximately equally proportional. On the other hand, the 25-44 group is the largest age group, while 55 years or older one is the smallest. This may be caused by the physical and traditional concepts, where the elderly travel less, or that elderly people may more likely to reject being surveyed. Among these people, about one-third of them is within the group of personal annual income being under MOP20, 000. In addition, the highest educational levels of about 60.8% of the surveyed individuals are high school, associate or bachelor degrees. The family structure is mainly singles and tourists who traveled with their children. On occupation structure, Enterprise employees and management staff accounted for 53% of the overall individuals, followed by public institutions personnel. Most surveyed tourists come from three or fourth-tier city, which is about 54%, and the least is from rural areas, indicating the possibility that proportion of people traveling from rural area is still not high.

Table 4. List of Surveyed Tourists with Characteristic Groups

Group	Characteristics	No. of people	Proportion (%)	Group	Characteristics	No. of people	Proportion (%)
Gender	Male	178	49	Educational Background	Middle School or below	45	12
	Female	182	51		High School	78	22
Age	Younger than 19	51	14		Associate	113	31
	19-24	54	15		Bachelor	71	20
	25-34	120	33		Master or Above	53	15
	35-44	73	20	Family Structure	Single	120	33
	45-54	43	12		Married Couple	65	18
	55-64	10	3		Married & living with Children	106	29
	65 or older	9	3		Married & living Away from Children	64	19
					Other	5	1
Personal Annual Income	Under MOP20,000	31	9.5	Occupation	Students	52	14
	MOP20,000 ~ MOP40,000	59	16		Workers	102	28
	MOP40,000 ~ MOP60,000	100	28		Cooperate Managers & Executives	89	25
	MOP60,000 ~ MOP80,000	103	29		Institutional staff	56	16
	MOP80,000 ~ MOP100,000	47	13		Retired	40	11
	Over MOP100,000	20	5.5		Other	21	6
Residency	First-Tier City	70	19				
	Second-Tier City	60	17				
	Third-Tier City	100	28				
	Fourth-Tier City	95	26				
	Rural Area	35	10				

3.1.2. Analysis of overall effectiveness in Eco-tourism education, Test of reliability is performed in SPSS to ensure trustworthiness of the acquired data. Cronbach's α based on standardized items is α = 0.842, where the Cronbach's α in each level is above 0.7. Therefore, the data acquired is reliable (Table 5).

Table 5. Analysis of Reliability of Education in Ecotourism

Cronbach's α based on standardized items	Indicator level	No. of items	Cronbach's α
Effectiveness of Education in Eco-tourism α = 0.842	Knowledge level	7	0.785
	Cultural level	2	0.707
	Moral level	4	0.710
	Consciousness level	6	0.705
	Behavioral intention level	9	0.706

Through the survey, tourists are divided into A and B groups, namely Group A represents visitors who are entering the Macau SAR, and Group B represents visitors who are exiting the Macau SAR. Statistics of all visitors of the indicator scores according is computed and are then multiplied by the weight of the indicators accordingly, resulting in the actual score of the indicators. With the completion of the scores, the SPSS software analysed the difference among groups of tourists. As can be seen from Table 6, education of Ecotourism in Macau SAR tourist education is effective. All areas show significant differences between groups with all five levels of knowledge, cultural, moral level, consciousness and behavioral intention being significant. That is, all five levels of tourist education are effective.

Table 6. Comparison of Effect before and after Education

Area	Group	Mean	Standard Deviation	F-value	Sig.
Overall Effect	A	1.130391	.1871227	80.001	.000
	B	1.320562	.1712451		
Knowledge level	A	.420512	.1611422	15.324	.000
	B	.495248	.1486412		
Cultural level	A	1.279815	.2498068	21.241	.000
	B	1.395214	.1692542		
Moral level	A	1.225873	.2425813	22.124	.000
	B	1.368962	.1623147		
Consciousness level	A	1.279811	.2495267	19.145	.000
	B	1.392456	.1668928		
Behavioral Intention Level	A	1.36925	.2641295	87.324	.000
	B	1.68972	.2912541		

*Note: Group A represents the scores of indicators before the visit and Group B represents the ones after the visit.

3.2. Analysis on Education Effectiveness based on Evaluation Indicator System

The questionnaire is designed based on the evaluation index system and visitors entering and exiting the Macau SAR were divided into two groups, A and B, and surveyed respectively. The resulted differences of the tourist education were compared, and the scores were used as the standard to measure the effect of education in Ecotourism. All the evaluation indicators in accordance with the previous two groups were compared and the result shows that there are significant differences in 17 indicator scores (Table 7).

Moreover, another 11 indicator shows indifferences. One possible reason for these indicators not showing effective results may be that tourists have well enough performance before entering Macau. Thus, their results may not have significant differences. Through comparing means with SPSS, these ineffective indicators are Ecotourism safety and risks (D4), Code of conduct for Ecotourism(D6), Eco-tourism policies and regulations (D7), agreement and obeying the management of the tourist destination (D19), respecting the interests of others (D17).

Another reason may be the lack of the corresponding facilities or policies, or that education effort is not enough to change the concepts or behaviours of tourists. By comparing means with SPSS, the ineffective indicators are concepts of participation and benefit for tourism development organizations (D12), willingness of continuous access to Ecological knowledge (D21), economic contribution behavior (D25), participation in tourism management behavior (D26), dissuading others from damaging environment (D27), reporting others who damage the environment (D28).

Table 7. Comparsion of Education Effect Based on Evaluation Indicator System

Indicator	Group	Mean	Standard Deviation	F-value	Sig.
Characteristics of ecological resources (D1)	A B	1.45 1.98	1.221 1.196	16.781	.000
Knowledge of ecological resources (D2)	A B	2.11 2.69	1.712 1.489	14.12	.000
Connotation and significance of Ecotourism (D3)	A B	3.41 3.91	1.241 0.912	10.152	.001
Knowledge of ecological protection (D5)	A B	2.31 2.61	1.171 1.004	9.421	.002
Social and cultural characteristics (D8)	A B	2.71 3.34	1.382 1.328	9.563	.002
Social and cultural awareness (D9)	A B	3.20 3.56	1.480 1.271	7.420	.007
Concepts of relationship between human and nature (D10)	A B	4.28 4.61	1.030 0.741	7.162	.008
Concepts of relationship between development and protection (D11)	A B	2.34 2.68	1.560 1.559	6.901	.009
Concepts of concerning consumer rights of others and realistic consumption (D13)	A B	3.51 3.81	1.240 1.081	6.831	.009
Sense of Ecological value (D14)	A B	2.41 2.64	1.235 1.160	31.310	.011
Environmental awareness (D15)	A B	4.02 4.30	1.146 0.869	6.124	.012
Sense of Ecological protection (D16)	A B	3.70 4.02	1.276 1.115	6.154	.014
Respecting the culture of tourist destination (D18)	A B	4.31 4.63	0.951 0.690	5.71	. 017
Willingness of participation in ecotourism (D20)	A B	3.17 3.27	1.331 1.216	4.890	.026
Following Code of Conduct for Ecotourism (D22)	A B	3.69 3.81	1.268 1.112	12.895	.027
Environmental living behavior (D23)	A B	2.76 2.89	1.213 1.259	72.20	.032
Participation in environmental activities (D24)	A B	2.30 2.51	1.514 1.381	3.891	.049

3.3. Comparison of Education Effect in Ecotourism among groups

The effectiveness of tourist education is expressed by the difference between the indicators before and after the visit, that is, the mean of each indicators in each group after visit minus the mean before the visit. Using the t-Test to compare the means, and conclude that the difference is significant if Sig. < 0.05. Moreover, that facilities or policies to carry out in education in Ecotourism is effective.

3.3.1. Comparison of Educational Effect between Gender Groups, the effect on both male and female tourists were both effective. The education on female tourists are more effective for the knowledge and behavior aspects. On the other hand, the education is more effective on male tourists on the conscious aspect. However, there was indifference effect on both groups on the overall effect.

Table 8. Comparison of Educational Effect Between Gender Groups

Gender	Overall effect	Knowledge level	Cultural level	Moral level	Consciousness level	Behavioral level	t-Test		
							t	df	sig
Female	0.179	0.078	0.081	0.072	0.076	0.281	-7.30	173	.000
Male	0.166	0.046	0.073	0.084	0.126	0.259	-5.23	184	.000

3.3.2. Comparison of Educational Effect among Age Groups, the education is effective for tourists younger than 55 years old (Table 9) and ineffective for the ones who are older. Possible reason may be due to the subjective cognitive impairment of the elderly. Some may tend to pay less attention to signboard tips. Another possible reason may be the lack of awareness of the value of Eco-tourism that is more widely introduced in recent years.

The Eco-tourism education in Macau is the most effective for 35-44 age group in consciousness level; secondly, it is the most effective for 25-34-year-old tourists in behavioural intention level. Finally, yet importantly, it is the most effective for 45-54 age group both in the overall effect and in the knowledge level.

Table 9. Comparison of Educational Effect among Age Groups

Age	Overall education effect	Knowledge level	Cultural level	Moral level	Consciousness level	Behavioral Intention level	t-Test		
							t	df	sig
Younger than 19	0.118	0.072	0.064	0.031	0.001	0.234	-2.705	54	.009
19-24	0.115	0.029	0.020	0.015	0.013	0.234	-2.035	52	.005
25-34	0.171	0.072	0.085	0.170	0.077	0.406	-5.672	119	.000
35-44	0.178	0.070	0.060	0.071	0.366	0.225	-3.540	70	.001
45-54	0.425	0.121	0.196	0.187	0.172	0.284	-3.492	32	.001
55-64	0.203	0.090	0.153	0.211	0.182	0.161	-2.031	9	.072
65 or older	0.240	-0.005	-0.171	0.179	0.180	0.293	-1.721	9	.117

3.3.3. Comparison of Educational Effect among Income Groups, The education of Macau SAR in Eco-tourism is effective for tourists with personal annual income under MOP100, 000 (Table 10). However, it is ineffective for the ones who earn over MOP100,000 annually. It is possibly because such group has a relative small sample size, and may not be representable. Among the surveyed individuals, the group of MOP60, 000 ~ MOP80,000 has the best improvement in overall effect, knowledge level, consciousness level, behavioral intention level. Moreover, for people who are in this range of income level, approximately 70% of them are in age between 35 to 54 years old. From previous discussion, both 35-44 and 45-54 age groups has effective results, thus the result does follow through.

Table 10. Comparison of Educational Effect among Income Groups

Personal Annual Income	Overall Education effect	Knowledge level	Cultural level	Moral level	Conscious-ness level	Behavioral Intention level	t-Test		
							t	df	sig
Under MOP20,000	0.113	0.061	0.059	0.102	0.062	0.213	-3.862	105	.000
MOP20,000 ~ MOP40,000	0.191	0.033	0.102	0.210	0.124	0.312	-5.651	104	.000
MOP40,000 ~ MOP60,000	0.138	0.072	0.082	0.102	0.053	0.240	-2.912	63	.004
MOP60,000 ~ MOP80,000	0.265	0.132	0.136	0.252	0.236	0.333	-4.855	54	.000
MOP80,000 ~ MOP100,000	0.125	0.069	0.038	0.031	0.049	0.232	-2.902	65	.003
Over MOP100,000	0.091	0.017	0.030	0.021	0.083	0.146	-1.358	21	.189

3.3.4. Comparison of Educational Effect among Family Groups, The group of other, which has only five people, is too small of a sample to be considered. Thus, all groups of various family structures have effective results (Table 11). Among them, married couple who live apart from their children has the best result in the overall effect. If we take a closer look at the survey results, we can also deduce that most of the married couple who live apart from their children are 45 years or older. Moreover, by result from age groups (Table 9), people who are 45 years or older has effective improvement in all aspects. Thus, it is not hard to understand that the group with this family structure also has good improvement in their Eco-tourism education.

Table 11. Comparison of Educational Effect among Family Groups

Family Structure	Overall education effect	Knowledge level	Cultural level	Moral level	Conscious-ness level	Behavioral intention level	t-Test		
							t	df	sig
Single	0.132	0.070	0.078	0.041	0.042	0.251	-5.100	150	.000
Married Couple	0.193	0.028	0.012	0.210	0.140	0.312	-3.189	40	.002
Married & living with Children	0.186	0.071	0.126	0.135	0.149	0.270	-5.891	139	.000
Married & living apart from Children	0.312	0.086	0.114	0.251	0.186	0.524	-3.365	19	.003
Other	0.078	-0.152	0.021	0.053	0.036	0.211	-0.345	2	.787

3.3.5. Comparison of Educational Effect among Educational Background Groups, As seen from Table 12, the Macau SAR tourist education is effective for all groups of educational background. Tourists with master degrees or above have better improvement in overall education effect and moral level. The education of the junior secondary education is better in all aspects of education. The education of the

high school or secondary education is better in terms of consciousness. Moreover, tourists with middle school or below background tend to do well in all aspects.

Table 12. Comparison of Educational Effect among Educational Background Groups

Educational Background	Overall education effect	Knowledge level	Cultural level	Moral level	Conscious-ness level	Behavioral Intention level	t-Test		
							t	df	sig
Middle School or below	0.258	0.186	0.210	0.168	0.171	0.468	-5.659	52	.000
High School	0.165	0.089	0.031	0.131	0.169	0.210	-4.116	98	.003
Associate	0.160	0.072	0.046	0.063	0.059	0.290	-3.812	68	.000
Bachelor	0.116	-0.032	0.038	0.121	0.053	0.232	-3.932	117	.000
Master or Above	0.289	0.190	0.125	0.231	0.136	0.390	-3.456	18	.003

3.3.6. Comparison of Educational Effect among Occupation Groups, Table 13 shows that except for retired personnel, Eco-tourism education in Macau is effective for other occupations. Reason may be that ages of people who had been retired are relatively large. They may have misunderstandings on the contents of the questionnaire, or maybe that they are less likely to pay attention to the educational information available; thus, it is ineffective for these group of tourists in education result. In the behavior level and the overall educational effect, the management of the enterprise management is the best; at the Knowledge level, the employee's education is the best. Among all, cooperate managers and executives have the best result within the behavioral intention level and the overall education effect.

Table 13. Comparison of Educational Effect among Occupation Groups

Occupation	Overall education effect	Knowledge level	Cultural level	Moral level	Conscious-ness level	Behavioral intention level	t-Test		
							t	df	sig
Students	0.119	0.051	0.041	0.051	-0.032	0.262	-3.521	84	.000
Workers	0.190	0.071	0.083	0.011	0.123	0.312	-3.913	57	.000
Cooperate Managers & Executives	0.265	0.034	0.062	0.043	0.167	0.450	-3.801	28	.001
Institutional staff	0.152	0.035	0.043	0.086	0.094	0.238	-3.698	86	.000
Retired	0.223	-0.079	0.031	0.032	0.191	0.389	-1.810	17	.089
Other	0.211	0.065	0.062	0.102	0.123	0.250	-2.250	23	.032

3.3.7. Comparison of Educational Effect among Residency Groups, Effectiveness on third-tier and fourth-tier cities are approximately the same, both being effective (Table 14). Moreover, tourists from the rural area has the best result in consciousness level.

Table 14. Comparison of Educational Effect among Residency Groups

Residency	Overall education effect	Knowledge level	Cultural level	Moral level	Conscious-ness level	Behavioral Intention level	t-Test		
							t	df	sig
First-Tier City	0.141	0.051	0.065	0.072	0.091	0.293	-3.912	85	.000
Second-Tier City	0.151	0.062	0.059	0.086	0.093	0.286	-3.810	84	.000
Third-Tier City	0.188	0.081	0.073	0.101	0.109	0.290	-5.298	104	.000
Fourth-Tier City	0.189	0.083	0.086	0.109	0.106	0.296	-5.456	125	.000
Rural Area	0.152	0.023	0.061	0.113	0.143	0.219	-2.306	36	.027

4. Conclusion

This study used the evaluation indicator system to determent the education effects in Eco-tourism by measuring the differences in the rating of visitors when entering and exiting the Macau SAR. The results show that the current Ecotourism education in Macau is effective by 17 indicators, such as the ecological resource characteristics and ecological resource evaluation of the Macau SAR. And on the other hand, 11 indicators, such as the concept of participation and benefit of tourism development organizations and the willingness to obtain ecological knowledge, shows that it is not effective. Finally, yet importantly, analysis among groups of different characteristic groups has been done. Effectiveness of Female and male tourists are about equal. 45-54-year-old tourists in all aspects has better results compared to other age groups in general. while 25-34 and 35-44-year-old tourists has significant improvements in the behaviour intention and consciousness levels, respectively; tourists with middle school educational background, the ones with personal annual income between MOP20,000 to MOP40,000, and the ones who are married and living separately with children, have generally effective improvement on their education in Eco-tourism. Moreover, result shows that it is ineffective to retired tourists.

In short, this paper establishes a set of evaluation indicator system for the effectiveness of Eco-tourism education in Macau SAR, and uses the system to evaluate the effect of the current educational effect on tourists in Macau by conducting a sampling survey. Comments and suggestions have been made for future study in this area for Macau.

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