

Evaluation of Place Attachment, Satisfaction, and Responsible Environmental Behaviors of Visitors to a Constructed Wetland on Campus

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Abstract

Constructed wetlands are one of the many popular eco-engineering products for wastewater treatment and environmental education. In this study, questionnaires were distributed to collect information regarding the place attachment, satisfaction, responsible environmental behavior, and behavioral intentions of individuals who had visited the constructed wetland in the campus of the National Taiwan Normal University. The results indicated that place attachment was positively correlated with satisfaction, responsible environmental behavior, and behavioral intentions. Additionally, satisfaction was positively correlated to responsible environmental behavior and behavioral intentions, and satisfaction adequately predicted responsible environmental behavior and behavioral intentions. Regarding constructed wetlands, other than maintaining ongoing environmental educational activities and developing constructed wetland educational programs to improve user place attachment, user satisfaction must be improved to benefit constructed wetlands on campus. The results suggested that place attachment could positively affect responsible environmental

behavior and revisit intention. Improving place attachment may benefit constructed wetlands and promote responsible behavior towards the environment.

Keywords: behavioral intentions, constructed wetland, place attachment, responsible environmental behavior, satisfaction, sustainable campus

Introduction

Ecological engineering techniques have been used to create constructed wetlands that have environments similar to those of wetland ecosystems, thereby providing ecosystem services that can be used to improve water eutrophication (i.e., waste and sewage treatment), flood retention design, groundwater recharge, landscaping, and microclimate adjustment (Cheng, Liu, Shyu, Chang & Fang 2011; Lin, Jing, Wang, & Lee, 2002; Nyakang'o & Van Bruggen, 1999; Tang & Huang, 2007). Ecological engineering can be employed to achieve balance in biodiversity, hydraulic performance, available nutrients, and the needs of society without considerable requirements for complex maintenance (Shih, Zeng, Lee, Otte & Fang, 2017); it is cost effective, does not require chemicals, and can facilitate energy conservation, ecological preservation, and sustainable development (Hedges, Fermor, & Dušek, 2008; Sakadevan & Bavor, 1999). Constructed wetlands have compound primary and ancillary functions. In addition to constructed wetlands on school campuses that serve educational purposes, many wetlands purify water or function as flood retention catchments. After constructed wetlands were constructed on campuses, more studies were performed to investigate wetland functions in terms of water purification, maintenance, and management as well as ecological resources, implementation of educational programs, and overall effectiveness (Kao, Wang, Lee, & Wen, 2001; Mitsch et al., 2008). However, few studies have explored records of the emotional, sensational, and dispositional connections between constructed campus wetlands and university faculty members, staff, students, and alumni as well as members of the local community.

We recognize that people are inseparable from their environment. When individuals form an association with a place, the place becomes valuable and meaningful to them (Riley, 1992). Therefore, this study adopted the concept of place attachment as a basis for exploring the relationships between campus wetlands and all stakeholders, including faculty members, students, alumni, and residents of the local

community. We may thus be able to discern how such place attachments affect the behavior of individuals toward the environment, thereby clarifying the social impact of place attachment on their behavior. With respect to university social responsibility (USR) (Vasilescu, Barna, Epure, Baicu, 2010), we hypothesized that such a wetland, as a community-based center with natural aesthetics and the landscaping features of a social amenity, provides value and possibilities for environmental education. However, the extent to which social impact is influenced by this facility constructed on campus is unclear; therefore, we attempted to detect the intention of visitors to return. The analysis of this variable of intention to revisit could deepen our understanding of wetlands with respect to their status as sites to which visitors are inclined to return. On a paved campus, the desire to return and embrace a natural landscape associated with birds, water, and vegetation is an intuitional human response, referred to as nature connectedness (Ernst & Theimer, 2011).

We reviewed literature related to this topic and determined that when people positively evaluate a place, they generate place attachment (Moore & Graefe, 1994), which, as we know, may relate to their feeling of satisfaction from achieving a “sense of place.” Personal satisfaction is the emotional state following expectation after a personal exploration or experience. When individuals are affected by society, psychological status (mood, personality, and needs), or external factors (climate and social interactions), they form an attitude or intention (Williams, Patterson, Roggenbuck, & Watson, 1992). Satisfaction can be utilized as a behavioral metric during research to measure perceptions of products, work, quality of life, communities, or outdoor recreational activities (Baker & Crompton, 2000). Regarding this metric, responsible environmental behavior refers to the actions that individuals or groups can perform to protect the environment (McKenzie-Mohr, Nemiroff, Beers, & Desmarais, 1995). A positive relationship between satisfaction and place attachment has also been reported by relevant studies (Hwang, Lee, & Chen, 2005; Prayag & Ryan, 2012; Ramkissoon, Smith, & Weiler, 2013; Yuksel, Yuksel, & Bilim, 2010). Accordingly,

we decided to use satisfaction as a mediating variable in this research model.

Because the ultimate goal of environmental education is to promote responsible environmental behavior (Hungerford & Volk, 1990; Liang et al., 2018), numerous studies have endeavored to identify the factors affecting responsible environmental behavior. Traditional environmental education is based on the theory that enhancing environmental knowledge can promote awareness or influence attitudes, thereby changing behaviors. However, this hypothesis is highly controversial and has been explored in few empirical studies. Since 1980s, scholars began to explore variables in addition to knowledge, awareness, and attitude that can affect responsible environmental behavior. Regarding previous documentation, responsible environmental behavior has been determined to have positive correlations with place attachment (Halpenny, 2010; Ramkissoon et al., 2013; Vaske & Kobrin, 2001) and satisfaction (Chiu, Lee, & Chen, 2014; Han, Lee, & Hwang, 2016; Ramkissoon & Mavondo, 2015). This supports our hypothesis that satisfaction can serve as a mediating variable in the relationship between local attachment and responsible environmental behavior.

The rate of return visits also constitutes a key variable indicating the willingness of individuals to reserve the opportunity to come into contact with such wetlands. Therefore, we believe that we should also discuss whether the intention to revisit. The variable of intention to revisit is also considered to be related to place attachment (Lee, Kyle, & Scott, 2012; Prayag & Ryan, 2012; Stylos, Bellou, Andronikidis, & Vassiliadis, 2017), with several studies reporting a positive correlation (Huang & Hsu, 2009; Jang & Feng, 2007; Lee et al., 2012).

This study considered responsible environmental behavior and revisit behavior in the context of behavioral intentions. Behavioral intention, regarded as the tendency to take personal action according to a subjective judgment, can be used as an indicator for measuring future behavior and is often used in studies to explore consumer behavior toward a service or tourist behavior toward a place of recreation (Zeithaml,

Berry, & Parasuraman, 1996). Mullen and Johnson (2013) believed that consumer intention can predict purchase behavior. Although consumer intention cannot enable perfect prediction, it is a feasible method for predicting behavior. Fishbein and Manfredo (1992) suggested that if an appropriate measurement is employed, then intention can accurately predict the majority of social behavior.

Campus wetlands provide a functional research, educational, and leisure field for students and faculty members. To understand the emotional link between visitors and wetlands, this study adopted a questionnaire to document user perceptions of constructed wetlands and investigate place attachment (two dimensions: place dependence and place identity), satisfaction (four dimensions: physical environment, social environment, operational management, and event facilities), and differences in responsible environmental behavior and behavioral intentions. In addition, the efficacy of using place attachment to predict satisfaction, responsible environmental behavior, and behavioral intention to revisit was explored, and the effectiveness of applying satisfaction to predict responsible environmental behavior and revisit behavioral intentions was determined.

Experimental Materials and Methods

I. Study area and respondents

The area of investigation in this study (see Figure 1) was the constructed wetland and wetland ecosystem at the Gongguan Branch (25°0'30"N, 121°32'8"E) of National Taiwan Normal University (NTNU), Taipei, Taiwan. The questionnaire respondents comprised users who had used and revisited NTNU's constructed wetland at least once and more. To ensure that respondents could understand the questionnaire topics and context, users who were too young were omitted; therefore, respondents comprised users aged 20 or older. The survey period was from 6:00 to 8:00 for morning users, from 10:00 to 14:00 for regular users, and from 17:00 to 19:00 for after-school users from October through December 2013.

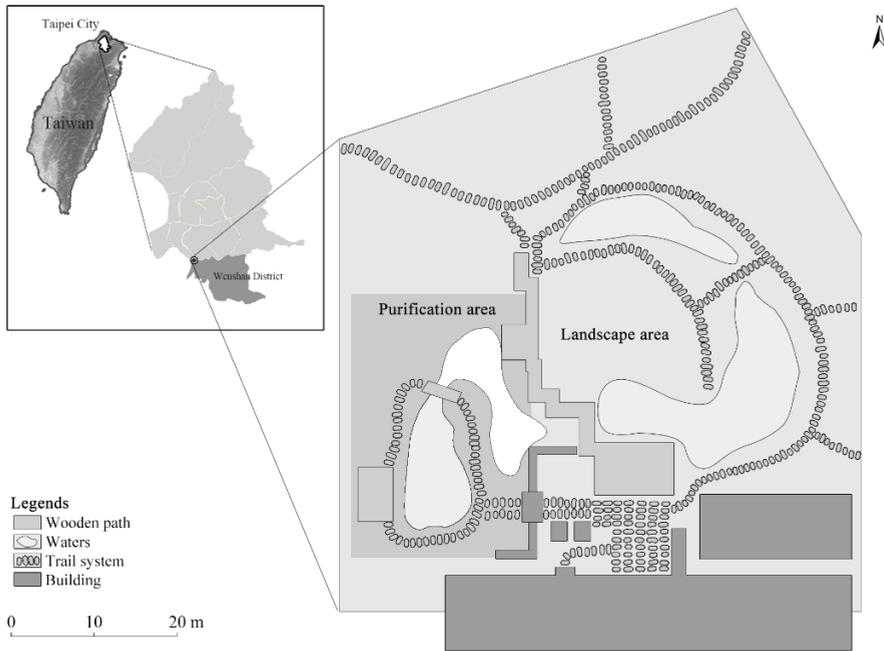


Figure 1. The map of study location

This study used a sampling method with a questionnaire to categorize all participants according to whether their living or work places were in neighboring or nonneighboring areas.

We assessed the content validity of the questionnaire to ensure that the questionnaire items reflected the study purpose. For content validity, we invited five experts to review the questionnaire using knowledge of their respective domains. In this study, we also referenced other studies related to place attachment, satisfaction, responsible environmental behavior, and behavioral intention to revisit to explore causal relationships. The results of a composite reliability analysis of convergent validity revealed that composite reliability was greater than 0.7, thus exceeding the recommended threshold of 0.60 suggested by Bagozzi and Yi (1988, p. 82), for place attachment, satisfaction, responsible environmental behavior, and behavioral intention

to revisit (Table 1). Our questionnaire can be accessed using the following link:
<https://ppt.cc/f6wtCx>

II. Questionnaire, sampling, and survey process

The questionnaire used in this study was designed with reference to related national and international studies and comprised six parts with a total of 80 questions. Sampling was conducted by randomly selecting people who were nearest to the wetland, such as teachers and students at the Graduate Institute of Environmental Education, administrative personnel of the NTNU Gongguan Branch, and members of the local community, to be study respondents until the sample quota was met. According to Moore and Graefe (1994), one-time sight-seeing visitors were beyond the scope of this study. After the Water and Green Project was implemented under the National Development Plan of Taiwan in 2003 by the Ministry of Education to provide universities with subsidies for creating wetlands, NTNU, partially supported by the Architecture and Building Research Institute, Ministry of the Interior created this constructed wetland, which may have affected the local residents, faculty members, and students engaged in education. Local residents who visit this wetland for exercise, fresh air, or to practice sports as well as faculty members and students who volunteer to maintain the environment by clearing litter and pool waste are involved in in-depth exploration of this environment and may share their opinions with others concerning the value of this wetland with respect to the utility and learning opportunities that it affords. We mainly explored the perspectives of visitors residing in the local community, faculty members on campus (e.g., the staffs of the neighboring post office who grow organic pepper plants around this wetland), and students (e.g., graduates and college students who organize events for clearing exotic floating plants and guide at-risk youths attending junior high school).

Table 1. The reliability value of four variables

Variables	Cronbach's α
Place attachment	0.95
Satisfaction	0.92
Responsible environmental behavior	0.82
Revisit behavioral intentions	0.85

III. Statistical characterization

This study explored whether the background variables and variables of user experience and level of participation differed considerably between place attachment, satisfaction, responsible environmental behavior, and behavioral intentions to revisit.

(1) Place attachment: This term can be separated into two notions, namely place dependence and place identity. Place dependence refers to the ability of a place to bring satisfaction to individuals by affording them a sense of wellbeing (Scannell & Gifford, 2017). Place identity indicates the self-clarity that individuals experience in accordance with a sense of belonging to a place that they have developed from making regular visits during certain periods of time. We combined these two notions into place attachment in our research hypotheses.

(2) Satisfaction: When individuals have a pleasant feeling from exploring or experiencing something, they can better understand their own mental state and needs. Therefore, satisfaction represents a pleasant feeling individuals have when they attribute an emotion to a sense of fulfillment or gratification (Hwang et al., 2005; Prayag & Ryan, 2012; Ramkissoon et al., 2013; Yuksel et al., 2010).

(3) Responsible environmental behavior: This term is defined in this study as a demonstration or aspect of environmental empathy related to activities that have been suggested to resolve problems in the natural environment (Van Liere & Dunlap, 1981). Individuals or community members are considered to engage in responsible environmental behavior when they demonstrate agreement with this notion by taking

beneficial action to protect the environment as pro-environmental behaviors (Chiang, Fang, Kaplan & Ng, 2019; Fang, Ng, & Chang, 2017; Fang, Ng, Wang, & Hsu, 2017). Because our research focused on a constructed wetland, we identified relevant types of responsible environmental behaviors, such as picking up litter in this wetland.

(4) Behavioral intention to revisit: To revisit means to return or visit again. We defined behavioral intention to revisit as whether a visitor intended to return for a second or subsequent visit (Huang & Hsu, 2009; Jang & Feng, 2007; Lee et al., 2012), rather than as their behavior of actually returning to see this constructed wetland.

We used multiple regression and path analysis to analyze the relationships among all variables. η^2 was used to explain the correlation intensity. When homogeneity of variance was determined, the Bonferroni test was used for post hoc comparisons, and when heterogeneity was ascertained, Dunnett's T3 procedure was also employed. A simple regression analysis was conducted to ascertain whether place attachment could be used to predict satisfaction, responsible environmental behavior, and behavioral intentions as well as whether satisfaction could be applied to predict responsible environmental behavior and behavioral intentions after the application of Pearson correlation. A multiple regression was then conducted to analyze the predictive relationships between place attachment and satisfaction (independent variables) and responsible environmental behavior and behavioral intentions (dependent variables). The model's explanatory power (R^2) was calculated. Finally, a path analysis was conducted to estimate the parameters of the place attachment model. The framework for the hypotheses is presented in Figure 2. Furthermore, the path structure model was used to determine the impact of the place attachment and satisfaction of wetland visitors on their behavioral intention to revisit and responsible environmental behavior. Thus, the following hypotheses, which are associated with five paths from related studies, are proposed.

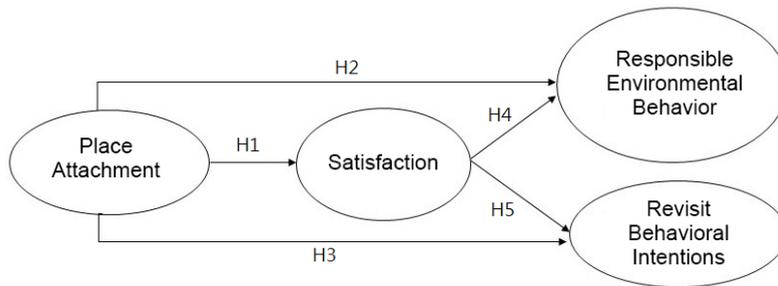


Figure 2. Model hypothesis in this study

Hypothesis 1 (H1): Place attachment positively affects satisfaction (Hwang et al., 2005; Prayag & Ryan, 2012; Ramkissoon et al., 2013; Yuksel et al., 2010).

Hypothesis 2 (H2): Place attachment positively affects responsible environmental behavior (Halpenny, 2010; Ramkissoon et al., 2013; Vaske & Kobrin, 2001).

Hypothesis 3 (H3): Place attachment positively affects Revisit behavioral intentions (Lee et al., 2012; Prayag & Ryan, 2012; Stylos et al., 2017).

Hypothesis 4 (H4): Satisfaction positively affects responsible environmental behavior (Chiu et al., 2014; Han et al., 2016; Ramkissoon & Mavondo, 2015).

Hypothesis 5 (H5): Satisfaction positively affects behavioral intention to revisit (Huang & Hsu, 2009; Jang & Feng, 2007; Lee et al., 2012).

The results of this study contribute to filling the gaps detected by relevant studies that have had insufficient evidence for determining the influences among variables and can therefore serve as a reference for future research on the behavioral intention to revisit wetlands.

Results and Discussion

Among the 411 questionnaires received, 391 were valid and 20 were invalid, yielding an invalidity rate of 4.87%; 51 users provided recommendations for improving the constructed wetland.

I. Demographic information

The demographic information of wetland users in our sample is presented in Table 2. Overall, there were 185 (47.3%) male respondents and 206 (52.7%) female respondents; their average age was 36 years. Regarding occupation, most participants were students (39.6%), followed by faculty members and employees (30.4%).

The results revealed no significant differences between female and male respondents according to a chi-square test and no significant differences between neighboring and nonneighboring respondents to this constructed wetland in terms of place attachment, satisfaction, responsible environmental behavior, or behavioral intention to revisit.

Table 2. Demographic information of the sampling

Items	Category	Number	Percentage
Gender	Male	185	47.3
	Female	206	52.7
Occupation	Engineering	7	1.8
	Business	18	4.6
	Service	28	7.2
	Student	155	39.6
	Government official	9	2.3
	Housekeeper	119	30.4
	Retirement	30	7.7
	Others	24	6.1
	Missing value	1	0.3
Educational level	Junior high school (including under)	7	1.8
	Senior high school	20	5.1
	College	162	41.4
	Graduate school	202	51.7
Age	Under 20	36	9.2
	21-30 yrs	153	39.1
	31-40 yrs	62	15.9
	41-50 yrs	56	14.3
	51-60 yrs	43	11.0
	Above 61	30	7.7
	Missing value	11	2.8

II. Path analysis

The data obtained from the multiple regression analysis were used to conduct the path analysis. First, the endogenous variables in the model that could not be explained by the exogenous variables constituted the residual variance. In this study, the standard error coefficient of estimate (s_e) was adopted to indicate the path analysis diagram and can be expressed as $\sqrt{1-R^2}$. The results obtained were as follows: satisfaction, $s_e = 0.93$; responsible environmental behavior, $s_e = 0.85$; and behavioral intention to revisit, $s_e = 0.72$. By using the standardized regression coefficients in Table 3, the path analysis coefficients of the place attachment model could be determined. Figure 3 presents the estimated results of the model parameters.

The effect analysis of the model can be separated into direct effect, indirect effect, and total effect.

(1) Direct effect.

The standardized regression coefficient was the direct effect of the path analysis.

a. Place attachment is the direct effect of satisfaction, and the coefficient value is 0.38.

b. Place attachment is the direct effect of responsible environmental behavior, and the coefficient value is 0.28.

c. Place attachment is the direct effect of revisit behavioral intentions, and the coefficient value is 0.48.

d. Satisfaction is the direct effect of responsible environmental behavior, and the coefficient value is 0.35.

e. Satisfaction is the direct effect of revisit behavioral intentions, and the coefficient value is 0.36.

(2) Indirect effects.

The strength of indirect effects could be determined by multiplying the direct effect between two end variables (standardized regression coefficient). Therefore, when satisfaction was used as an intermediary variable, place attachment produced

Table 3. Multiple regression parameters test results to predict satisfaction, responsible environmental behavior, and revisit behavioral intentions

Dependent variable	Estimated value (B)	Standard error	Beta allocation	t value	p-value	adjusted R ²
Satisfaction						
(Constant)	2.70	0.11		25.49	<0.00	
Place attachment	0.26	0.03	0.38	8.11	<0.00	0.14
Responsible environmental behavior						
(Constant)	1.84	0.17		10.65	<0.0	
Place attachment	0.21	0.04	0.28	6.00	<0.0	
Satisfaction	0.38	0.05	0.35	7.45	<0.0	0.28
Revisit behavioral intentions						
(Constant)	0.04	0.19		0.22	0.83	
Place attachment	0.47	0.04	0.48	12.15	<0.00	
Satisfaction	0.52	0.06	0.36	9.14	<0.00	0.49

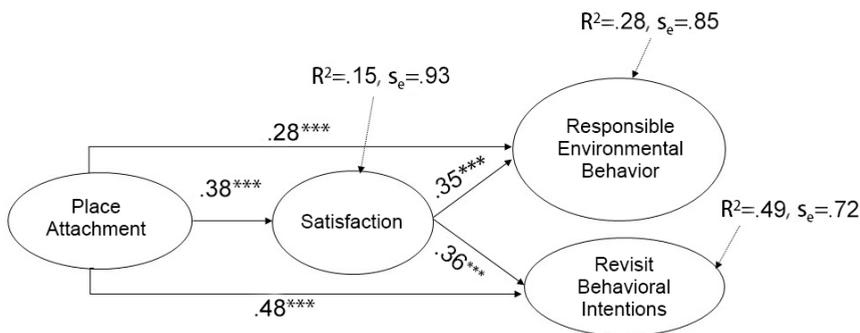


Figure 3. The parameter estimation of path analysis from place attachment

the following indirect effect as a multiple of direct effect on responsible environmental behavior: place attachment is the direct effect of satisfaction, and satisfaction is the direct effect of responsible environmental behavior. Sobel's t test was used to determine the significance of the indirect effects.

The indirect effects of place attachment on behavioral intention to revisit were determined using the same method. The results are as follows:

a. Place attachment \rightarrow satisfaction \rightarrow responsible environmental behavior: $0.38 * 0.35 = 0.13$ ($t = 5.47, p < 0.001$)

b. Place attachment \rightarrow satisfaction \rightarrow behavioral intention to revisit: $0.38 * 0.356 = .14$ ($t = 6.06, p < 0.001$)

c. Total effect. Direct effect + indirect effect (both must achieve significance).

Two indirect effects of the place attachment model were significant; responsible environmental behavior predicted the total effect of place attachment and behavioral intention, which were $0.28 + 0.13 = 0.41$ and $0.48 + 0.14 = 0.61$. The results could be explained by the intermediary place attachment effects of satisfaction on responsible environmental behavior and behavioral intention to revisit (i.e., the mediating effect of indirect effects). However, because the direct effect remained significant, satisfaction produced partial mediating effects. Table 4 summarizes a detailed analysis of the effect.

The path analysis results indicate that adding satisfaction to the place attachment model increased the explanatory power of the model's endogenous variables and enabled the direct and indirect effects to achieve significance. Thus, satisfaction could be a moderating variable, and various intervening effects existed. The place attachment model diagram demonstrates that regarding environmental behavior and behavioral intention to revisit, place attachment had direct predictive power and satisfaction had indirect effects. Therefore, after individuals generated an emotional connection to the NTNU constructed wetland, they directly demonstrated responsible environmental behavior and behavioral intentions. However, some users needed to

Table 4. Place attachment model path analysis of the various effects disassembly instructions

Independent variables	Dependent variables: endogenous variables			
	Satisfaction	Responsible environmental behavior	Behavioral intentions	
Exogenous variables				
Place attachment	Direct effects	.38***	.28***	.48***
	Indirect effects	-	.13***	.14***
	Total effects	.38***	.41***	.61***
Endogenous variables				
Satisfaction	Direct effects	-	.35***	.36***
	Indirect effects	-	-	-
	Total effects	-	.35***	.36***

***indicates $p < 0.001$.

generate a feeling of satisfaction toward the wetland to be able to efficiently perform responsible environmental behavior and exhibit behavioral intention to revisit.

Discussions and Conclusions

In this study, a path analysis was employed to verify that place attachment was positively correlated to satisfaction, responsible environmental behavior, and behavioral intention to revisit and that satisfaction was positively correlated to responsible environmental behavior and behavioral intention to revisit. Our results support our hypotheses. The results of the path analysis indicated that satisfaction could serve as an intervening variable that indirectly affected the relationships of place attachment to responsible environmental behavior and behavioral intention to revisit. This finding is consistent with the findings reported by Vaske and Kobrin (2001); moreover, place attachment was reported to positively influence satisfaction, responsible environmental behavior, and behavioral intention to revisit (Ramkissoon et al., 2013). Similarly, our results suggested that place attachment could positively

affect responsible environmental behavior and intention to revisit. Promoting place attachment may benefit constructed wetlands and increase the engagement of visitors in responsible behavior toward the environment. One-time visits may not be sufficient for altering the place attachment of visitors; thus, we suggest that the place attachment of visitors can be enhanced by wetland managers organizing environmental and experience programs (e.g., instructional activities for K-12 students that grant them the opportunity to wear wader's suits and fishing boots) or interpretation outreach activities for individuals who are interested in sound-science wetland studies. Thus, the aforementioned users can revisit frequently to join wetland events and benefit socially and emotionally from learning through outdoor education. An increased feeling of place attachment among individuals may lead to the detection of their association with a place, but visitors could have increased place attachment without expressing positive evaluations of a place. However, place identity, in this study, was considered to be the understanding that individuals have of consistently belonging to this constructed wetland through regular visits (e.g., for education, experience, or exercise).

In addition, the increased satisfaction of some visitors could create an intervening effect on their responsible environmental behavior and behavioral intention to revisit. The satisfaction experienced by users of the NTNU campus constructed wetland caused their social environment satisfaction to increase. If the physical environment, operational management, event facilities, and other dimensions can be improved, then the overall satisfaction of users will increase, thereby increasing the likelihood that they will demonstrate environmentally responsible behaviors that are beneficial to the constructed wetland.

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校園人工濕地使用者地方依附、滿意度與負責 任環境行為之評估

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摘要

人工濕地在發展學校環境教育規劃活動中，係為重要之環境生態項目。本研究採用問卷調查方法蒐集了國立臺灣師範大學校園人工濕地的使用者之地方依附、滿意度、重遊行為意圖、負責任的環境行為之自述問卷。研究結果表明地方依附與滿意度、負責任的環境行為，以及重遊行為意圖，產生正相關。此外，滿意度與負責任的環境行為，以及重遊行為意圖產生正相關。上述滿意度明顯地預測了負責任的環境行為和重遊行為意圖之關係。因此，地方依附可能會對負責任的環境行為產生積極影響。本研究重新審視改善地方依附可能有利於校園人工濕地永續發展，並且促進負責任的環境行為。本研究建議校園人工濕地之營造，除了強調環境教育活動重要性之外，需要透過人工濕地教育計畫，以改善使用者地方依附程度，還必需要提高使用者在校園人工濕地之整體滿意程度。

關鍵字：行為意圖、人工濕地、地方依附、負責任環境行為、滿意度、永續校園