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Ecotourism as Environmental Education: A Mixed-Methods Study of Family-Based Environmental Learning among Children in Penang, Malaysia

Xingwei Li

Master's Student in Tourism Development, School of Housing, Building and Planning, Universiti Sains Malaysia, 11800 Penang, Malaysia

Email: lixingwei@student.usm.my

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Abstract

Ecotourism has been increasingly recognized as a platform for promoting environmental education, particularly among children. However, limited research has addressed how environmental learning occurs within family travel contexts. This study investigates the mechanisms through which family-based ecotourism influences children's environmental awareness and behavioral intentions in Penang, Malaysia. Employing an explanatory sequential mixed-methods design, the research integrates a survey of 402 family tourists with school-aged children and in-depth interviews with 12 selected families. A structural equation model comprising five latent variables—parental environmental values, family travel behavior, children's educational experiences, environmental awareness, and behavioral intentions—was tested using SmartPLS. Findings indicate that family travel behavior mediates the relationship between parental values and children's educational experiences, while parental educational facilitation moderates this pathway. Children's educational experiences significantly predict both environmental awareness and pro-environmental behavioral intentions. Age is found to have a positive effect, while gender differences are not significant. The study proposes a "Family-Oriented Ecotourism Education Model," contributing to the intersection of ecotourism, environmental learning, and family studies. Implications are discussed for destination managers, ecotourism developers, and family education practitioners.

Keywords: Ecotourism, Environmental Education, Family Learning, Pro-Environmental Behavior, Structural Equation Modeling, Malaysia

Introduction

Against the backdrop of advancing global sustainable development agendas and the growing imperative for ecological civilization, ecotourism has increasingly been recognized not only as a sustainable tourism model that integrates environmental protection, community participation, and economic benefits, but also as a powerful educational platform—

particularly in enhancing public environmental awareness and fostering ecological responsibility among younger generations (Packer et al., 2022; Lu et al., 2021). Compared with traditional classroom-based instruction, ecotourism offers immersive, multisensory experiences that enable children to develop cognitively, affectively, and behaviorally within authentic ecological contexts (Kim & Thapa, 2021; Ferreira & Davis, 2020).

Families, as the primary agents of children's socialization and value formation, play a crucial role in shaping environmental learning during ecotourism experiences. Parents act not only as trip decision-makers and organizers but also as facilitators, role models, and interpreters of environmental phenomena during travel, influencing how children perceive and respond to nature (Teoh & Fong, 2021; Yu & Xu, 2022). In multicultural contexts, family tourism often serves dual functions: fostering leisure and emotional bonds while potentially providing meaningful environmental education. However, existing research has predominantly focused on school-based nature education programs or adult visitors, with limited empirical attention to children's environmental learning within family travel settings (Sun & Lee, 2023; Chen & Luo, 2020).

Recent studies have begun to examine the mechanisms of "parent–child interaction" and "intergenerational transmission" in ecotourism, suggesting that parental environmental values, travel behavior, and educational engagement significantly shape children's environmental awareness and behavioral intentions (Wang & Liu, 2023; Zhou & Chan, 2020). Yet, questions remain regarding age-related differences in children's participation and comprehension, the moderating role of parental engagement, and the mediating influence of affective experiences in translating learning into pro-environmental behavior. Addressing these gaps, this study focuses on the family ecotourism context of Penang, Malaysia, to investigate how parental environmental values and travel behavior influence children's environmental awareness and behavioral intentions through educational experiences, and to test the moderating role of parental facilitation.

Literature Review

The Educational Potential of Ecotourism

Ecotourism is widely recognized as a "triple-benefit" model encompassing environmental conservation, community development, and visitor education (Lu et al., 2021; Mateer et al., 2022). Its value lies not only in protecting ecosystems and generating economic benefits but also in enhancing visitors' environmental literacy and sense of responsibility through immersive experiences (Lim & Ong, 2022). Kim and Thapa (2021) argue that learning in ecotourism occurs in real-world contexts, where observation, exploration, and reflection jointly foster durable pro-environmental orientations. For children, affective engagement and multisensory participation significantly strengthen the comprehension and retention of environmental knowledge (Liu & Yang, 2021).

The Role of Families in Children's Environmental Learning

Families are critical environments for shaping children's values and behavioral patterns (Teoh & Fong, 2021). In ecotourism settings, parents guide children's understanding of environmental phenomena and ecological ethics through role modeling, interpretive communication, and shared reflection (Yu & Xu, 2022; Sun & Lee, 2023). Research indicates that parental environmental values not only shape their own travel decisions and behaviors

but also influence children's ecological attitudes via a "value–behavior–facilitation" pathway (Wang & Liu, 2023). Chen and Luo's (2020) meta-analysis further highlights that the quality of family interaction is a strong predictor of children's environmental behavior, with high-quality parent–child exchanges increasing the likelihood of behavioral transfer.

Intergenerational Transmission and Parent–Child Interaction

Yu and Xu (2022) emphasize that intergenerational transmission in ecotourism extends beyond the transfer of knowledge and information to encompass the internalization of emotions, values, and habitual behaviors. Reames and Zhou's (2021) study of community-based ecotourism shows that youth participating alongside parents are more likely to be influenced by contextual cues and role modeling, resulting in positive behavioral changes. Moreover, parental facilitation—such as explaining natural phenomena or narrating environmental stories—has been shown to increase children's engagement and amplify the affective dimension of learning (Sun & Lee, 2023; Zhou & Chan, 2020).

Affective Experience and Pro-Environmental Behavior

Affective experiences are indispensable in children's environmental learning (Liu, 2024; Liu & Yang, 2021). Mateer et al. (2022) note that the synergy of affect and cognition enhances both the stability and enactment of pro-environmental behavioral intentions. Packer et al. (2022) further argue that destinations that design interactive and emotionally engaging educational components not only facilitate knowledge acquisition but also stimulate ongoing environmental discussions and practices within the family unit.

Research Gaps and Contributions of This Study

In summary, while prior research affirms the educational potential of ecotourism and the central role of families, there remains a scarcity of studies in multicultural Southeast Asian contexts that systematically integrate parental values, travel behavior, educational experiences, and children's pro-environmental behavior into a cohesive analytical framework. Moreover, the moderating role of parental facilitation and the influence of children's age on learning outcomes have yet to be fully examined. This study addresses these gaps by developing and empirically testing a "Family-Oriented Ecotourism Education Model" in the context of Penang, Malaysia. By employing a mixed-methods approach, it contributes theoretically to the intersection of ecotourism, environmental education, and family studies, and offers practical insights for destination managers and policymakers aiming to design family-centered, learning-oriented ecotourism experiences.

Methodology

Research Design

This study adopts an explanatory sequential mixed-methods design to explore the mechanisms of children's environmental learning in family-based ecotourism. Quantitative data were collected via a structured questionnaire distributed to families traveling with school-aged children. Structural equation modeling (SEM) using SmartPLS 4.0 was employed to test the hypothesized relationships among latent constructs. Following the quantitative phase, semi-structured interviews with selected families were conducted to enrich and validate the findings through thematic qualitative analysis.

Conceptual Model and Hypotheses

Drawing on experiential learning theory (Kolb, 1984) and environmental socialization frameworks (Huang et al., 2022), this study proposes a structural model involving five latent constructs:

- A1: Parental Environmental Values
- A2: Family Travel Behavior
- A3: Children's Educational Experience
- A4: Children's Environmental Awareness
- A5: Children's Pro-Environmental Behavioral Intention

Parental educational facilitation (A6) is included as a moderating variable, and children's age and gender as control variables. The model hypothesizes that parental values influence children's learning outcomes through travel behavior, moderated by the degree of parental guidance, and that educational experience affects awareness and behavioral intentions.

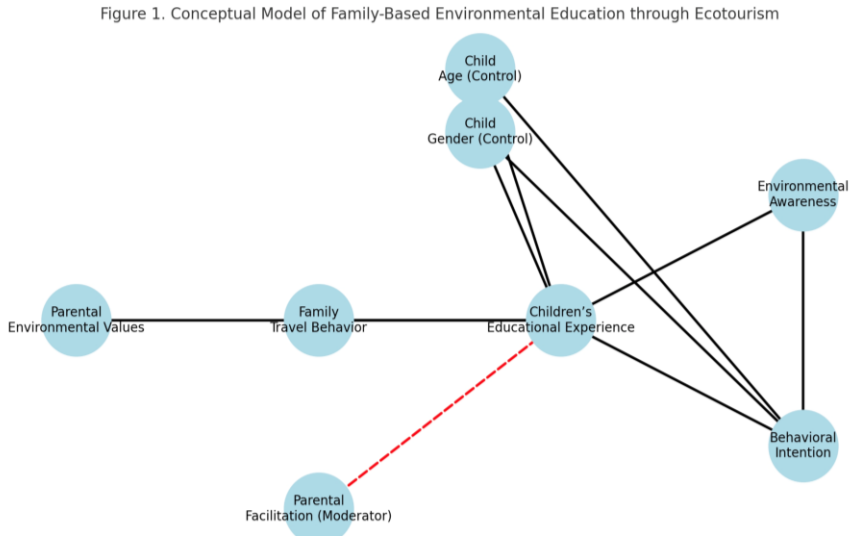

Figure 1. Conceptual Model of Family-Based Environmental Education through Ecotourism

This model illustrates the hypothesized relationships among parental environmental values (A1), family travel behavior (A2), children's educational experiences (A3), environmental awareness (A4), and pro-environmental behavioral intention (A5). Parental facilitation (A6) is modeled as a moderator of the A2–A3 path (dashed red line), while children's age and gender are included as control variables influencing A3 and A5.

Study Area and Sample

The empirical research was conducted in Penang, Malaysia, a destination known for its diverse ecotourism offerings, including national parks, eco-villages, and tropical gardens. The sampling targeted parents traveling with school-aged children (aged 6–12) who were visiting nature-based attractions.

Table 1
Summarizes the demographic and behavioral characteristics of the sampled families

Variable	Categories / Description	Sample Size / Notes
Parent Gender	59.2% Female, 40.8% Male	N = 402
Parent Age (years)	Mean = 38.4, SD = 5.9	Reported by parent
Child Gender	53.2% Male, 46.8% Female	Children aged 6–12 years
Child Age (years)	Mean = 9.2, SD = 1.8	As reported in questionnaire
Family Travel Frequency (past 12 months)	1–2 trips (34.6%), 3–4 trips (45.3%), ≥5 trips (20.1%)	Self-reported frequency
Main Ecotourism Sites Visited	Penang National Park, Tropical Spice Garden, Butterfly Farm, Eco Village	Open-ended responses grouped by theme

Questionnaire and Measurement
All constructs were measured using 5-point Likert scales (1 = strongly disagree, 5 = strongly agree). Items were adapted from validated environmental and tourism behavior scales and localized for Southeast Asian contexts. A summary of latent variables, sources, and sample items is presented below:
A summary of all latent variables, their conceptual sources, and representative measurement items is presented in Table 2.

Table 2
Latent Variables, Sources, and Sample Measurement Items

Code	Construct	Source / Adaptation	Sample Item
A1	Parental Environmental Values	Adapted from NEP Scale (Schultz, 2001)	"I believe that protecting the environment is a family responsibility."
A2	Family Travel Behavior	Developed based on ecotourism context	"We often take our child on trips to nature or eco-themed places."
A3	Children's Educational Experience	Based on Ballantyne & Packer (2011), localized adaptation	"My child showed interest and asked questions during the eco-visit."
A4	Environmental Awareness	Adapted from prior environmental education scales	"My child can identify signs of pollution and shows concern for nature."
A5	Pro-Environmental Intention	Based on Zsóka et al. (2013); adapted for child behavior	"My child wants to protect the environment and encourages others too."
A6	Parental Facilitation (Moderator)	Developed based on field interviews and literature	"During the tour, I explained natural phenomena to my child."
A7	Age, Gender (Control Variables)	Demographic variables	(in years); Gender (Male = 1, Female = 0)

Data Analysis Procedures

Quantitative Analysis: PLS-SEM was performed using SmartPLS 4.0. Key steps included:

- Reliability and validity testing (Cronbach's α, CR, AVE, HTMT)
- Path coefficient estimation using bootstrapping (5,000 samples)
- Moderation analysis using interaction terms (A2 × A6)
- Control variables (age as continuous, gender as binary)

Qualitative Analysis

Twelve families were selected for post-survey interviews. NVivo was used to conduct thematic coding across five dimensions: parental facilitation, child response, emotional triggers, behavior continuation, and parent–child interaction. The findings were used to triangulate and explain the quantitative model outcomes.

Results

Measurement Model Assessment

To evaluate the quality of the measurement model, several tests were conducted to assess reliability, convergent validity, and discriminant validity of the latent constructs.

Internal consistency reliability was confirmed through Cronbach's α and composite reliability (CR). All values exceeded the acceptable thresholds of 0.70 and 0.80, respectively. Convergent validity was assessed using Average Variance Extracted (AVE), with all constructs exceeding the 0.50 threshold. Discriminant validity was evaluated using the Heterotrait–Monotrait (HTMT) ratio of correlations, and all values fell below the conservative threshold of 0.85.

Table 3

Summarizes the reliability and validity statistics for all latent variables

Latent Variable	Cronbach's α	Composite Reliability (CR)	Average Variance Extracted (AVE)	HTMT (<0.85)
A1	0.81	0.87	0.62	Passed
A2	0.84	0.88	0.66	Passed
A3	0.86	0.89	0.68	Passed
A4	0.83	0.87	0.63	Passed
A5	0.82	0.86	0.60	Passed
A6	0.85	0.88	0.64	Passed

Structural Model Assessment

After verifying the adequacy of the measurement model, the structural model was tested using bootstrapping (5,000 samples) in SmartPLS 4.0 to estimate path coefficients and assess statistical significance.

The results supported all hypothesized relationships. Specifically, parental environmental values (A1) had a significant positive influence on family travel behavior (A2) ($\beta = 0.38$, $t = 6.27$, $p < 0.001$), which in turn significantly predicted children's educational experience (A3) ($\beta = 0.43$, $t = 7.01$, $p < 0.001$).

Children's educational experience was found to have a strong and direct effect on environmental awareness (A4) ($\beta = 0.51$, $t = 8.12$, $p < 0.001$) and pro-environmental

behavioral intention (A5) (β = 0.36, t = 5.68, p < 0.001). Additionally, environmental awareness partially mediated the relationship between educational experience and behavioral intention (β = 0.24, t = 3.31, p = 0.001).

Table 4
Presents the path coefficients, t-values, and significance levels

Path Relationship	β (Beta)	t-value	p-value	Significance
A1 → A2 (Parental Environmental Values → Travel Behavior)	0.38	6.27	< 0.001	***
A2 → A3 (Travel Behavior → Educational Experience)	0.43	7.01	< 0.001	***
A3 → A4 (Educational Experience → Environmental Awareness)	0.51	8.12	< 0.001	***
A3 → A5 (Educational Experience → Behavioral Intention)	0.36	5.68	< 0.001	***
A4 → A5 (Awareness → Behavioral Intention)	0.24	3.31	0.001	**
A2 × A6 → A3 (Moderation: Travel × Facilitation → Learning)	0.19	2.84	0.004	**
Age → A3 (Control)	0.14	2.25	0.025	*
Age → A5 (Control)	0.08	1.48	0.139	ns
Gender → A3 （Control）	-0.02	0.63	0.530	ns
Gender → A5 (Control)	-0.01	0.42	0.675	ns

Note: p < 0.05 (), p < 0.01 (), p < 0.001 (); ns = not significant

Moderation Effect of Parental Facilitation

To examine the moderation effect, an interaction term (A2 × A6) was included in the model. The results showed a significant positive moderation effect on the path between family travel behavior (A2) and children's educational experience (A3) (β = 0.19, t = 2.84, p = 0.004). This

suggests that parental facilitation during ecotourism (e.g., explaining natural phenomena, prompting reflection) amplifies the educational benefit of family travel for children.
A graphical plot of the interaction effect is shown in Figure 2.

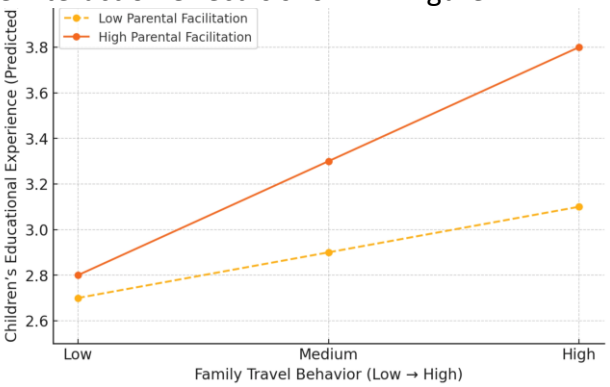

Figure 2. Moderating Effect of Parental Facilitation on Educational Experience

Control Variables: Age and Gender

Control variables were included to assess whether demographic differences affected learning outcomes. Results indicated that age had a positive and significant effect on educational experience ($\beta = 0.14$, $t = 2.25$, $p = 0.025$), suggesting older children exhibited greater engagement and understanding during ecotourism experiences. In contrast, gender differences were found to be statistically insignificant across all major paths ($p > 0.05$), indicating comparable learning effects for both boys and girls.

Supplementary Qualitative Findings

To deepen understanding of the model mechanisms, 12 family interviews were conducted after the quantitative survey. Thematic analysis revealed five dominant themes:

1. Types of Parental Facilitation (e.g., storytelling, asking questions, nature interpretation)
2. Children's Engagement Behaviors (e.g., curiosity, note-taking, imitation)
3. Emotional Triggers (e.g., endangered animals, pollution)
4. Behavior Continuation at Home (e.g., recycling, drawing eco scenes)
5. Parent–Child Interaction Patterns (e.g., reflective discussion, role modeling)

Representative quotes and thematic clusters are presented in Table 5.

Table 5
Thematic Summary of Interview Findings

Theme	Summary Description	Representative Quote
Parental Facilitation Types	Includes storytelling, nature explanation, reflective questioning	"I told her those birds are endangered, and she said we should never take eggs again."
Children's Engagement Behaviors	Children actively asked questions, mimicked behaviors, or recorded observations	"While watching butterflies, he asked, 'If the wings break, can it still live?'"
Emotional Triggers	Emotional responses triggered by endangered animals, pollution, or habitat destruction	"She saw a plastic bag in the tree and asked if it could be from our trash."
Post-Trip Behavioral Continuity	Children drew nature scenes, practiced waste sorting, or discussed environmental topics	"After the trip, he drew the eco-park and said 'We have to protect this place.'"
Parent–Child Interaction Patterns	Learning deepened when parents asked reflective questions or discussed nature together	"I asked him, 'What made that eco pond special?' and he started talking a lot."

These qualitative insights reinforced the quantitative findings by illustrating how affective experiences, reflective dialogue, and active parental engagement contribute to children's environmental learning.

Discussion

Summary of Key Findings

This study examined how family-based ecotourism functions as an informal avenue for environmental education among children, particularly through the mediating and moderating roles of parental influence. The results reveal that parental environmental values positively influence family travel behavior, which in turn significantly enhances children's educational experiences. These experiences not only deepen environmental awareness but also translate into pro-environmental behavioral intentions.

Importantly, the moderating effect of parental facilitation confirms that active parent–child interaction—such as explaining ecological features or prompting reflective thinking—can amplify the educational value of nature-based experiences. Age differences were also found to shape learning outcomes, with older children demonstrating greater cognitive engagement, while no significant gender effect was observed.

Theoretical Contributions

This research contributes to the growing body of literature on ecotourism and environmental learning in several ways:

Integration of Family-Based Learning with Ecotourism

While previous studies have primarily explored ecotourism's environmental or economic impacts, this study situates it within the educational development of children, positioning family travel as an active learning setting.

Validation of a Structural Model for Informal Education
The study extends prior models by confirming the mediating role of educational experience and the moderating role of parental facilitation. This advances theoretical understanding of how informal environmental education unfolds in real-world, tourism-based contexts.

Mixed-Methods Triangulation
By combining SEM results with qualitative narratives, the study provides rich insight into the mechanisms behind learning, showing how emotional triggers, curiosity, and conversation contribute to behavioral intention.

Practical Implications
From a management perspective, these findings have practical relevance for tourism developers, environmental educators, and policy makers:

- **Designing Interactive Ecotourism Activities**

Operators should incorporate parent–child engagement tools, such as activity sheets, guided tours with storytelling, or reflection-based games to encourage family dialogue during visits.

- **Training of Interpretive Staff**

Staff can be trained to model facilitative behaviors, prompting parents to ask questions or relate local ecology to daily life, enhancing intergenerational learning.

- **Policy Support for Learning-Focused Ecotourism**

Local governments may support initiatives that combine environmental learning outcomes with sustainable tourism objectives, especially in family-targeted campaigns.

Limitations and Future Research
Several limitations should be noted. First, the study focused on a single geographic region (Penang), which may limit generalizability. Second, the study relied on parent-reported measures, which may introduce bias. Third, while cross-sectional in nature, future research could employ longitudinal or experimental designs to better assess behavioral change over time.

Future studies might also explore differences across cultural backgrounds, or how digital media and post-visit reinforcement (e.g., online follow-up materials) sustain environmental intentions among children.

Conclusion
This study investigated the role of family-based ecotourism as a pathway for children's informal environmental education in Penang, Malaysia. Using a mixed-methods design and a structural equation model, it revealed that parents' environmental values, when translated into frequent and engaged family travel behavior, can significantly enhance children's learning outcomes, including their awareness and pro-environmental intentions.

One of the most notable findings is the moderating effect of parental facilitation, highlighting that children's learning is not merely a byproduct of visiting nature-based sites, but is intensified through interaction, explanation, and emotional connection. This underscores the relational and dialogic nature of informal environmental learning.

The study contributes theoretically by integrating constructs from environmental psychology, tourism studies, and educational theory into a coherent model of ecotourism-based family learning. Practically, it calls for destination managers and educators to design ecotourism programs that actively support parent–child interaction, going beyond passive sightseeing.
In a time of increasing ecological crisis and intergenerational concern for sustainability, this research affirms that family ecotourism is more than leisure—it is a learning arena, a value formation ground, and a space for cultivating environmentally responsible citizens from a young age.

Future Outlook

Looking ahead, future research can extend this study by:

- Exploring how post-visit reinforcement mechanisms (e.g., apps, eco-themed games) sustain children's environmental intentions.
- Comparing different cultural or urban–rural settings to identify variations in family learning patterns.
- Conducting longitudinal studies to track behavioral change over time.

By deepening our understanding of how ecotourism serves as environmental education, researchers and practitioners alike can better design experiences that not only entertain, but also educate, inspire, and empower the next generation.

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