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Digital Forest Bathing: Stress Reduction through Virtual Nature: Exploring the Effectiveness of Digital Wellness Solutions

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Abstract

This investigation examines the efficacy and cultural acceptance of digital forest bathing (DFB) as a contemporary adaptation of traditional "Shinrin-yoku," utilizing structural equation modeling (SEM) to elucidate gender-specific response patterns across 347 participants (197 female, 150 male). Our analysis reveals pronounced gender-differentiated reception patterns of virtual nature experiences. Female participants consistently demonstrated a critical disposition toward DFB implementations, maintaining this skepticism regardless of their predisposition toward traditional forest immersion practices. Conversely, male participants exhibited greater receptivity toward digital alternatives, though significantly, those with strong affinities for authentic outdoor experiences demonstrated measurable reluctance to advocate for DFB within their social networks. A compelling finding transcending gender demarcations was that perceived therapeutic efficacy functioned as a powerful determinant of subsequent advocacy behaviors—participants reporting positive experiential outcomes consistently engaged in recommendation activities, irrespective of gender. This correlation yields substantial implications for wellness business strategy development. The research suggests three critical success factors for digital wellness implementations: (1) cultivation of initial experiential receptivity, (2) strategic education regarding empirically validated health benefits to catalyze word-of-mouth promotion, and (3) gender-calibrated marketing approaches. For business development, our findings indicate that while men might progressively transition to DFB through established connections with traditional nature immersion, women may respond more favorably to campaigns emphasizing immediate therapeutic benefits, circumventing traditional forest bathing as an intermediate step. These insights suggest that resource-efficient wellness business strategies should prioritize direct

DFB experiential campaigns over investments in traditional forest bathing exposure, particularly when female demographic segments constitute primary target populations. This research advances understanding of digital wellness interventions and offers strategic pathways for developing contemporary stress-reduction modalities in an increasingly digitalized society, highlighting the necessity of gender-informed approaches in virtual nature experience implementation.
Keywords: Digital Forest Bathing, Sinrin-yoku, Structural Equation Modeling, Digital Wellness Solutions, Stress Reduction, Virtual Nature Experience

Introduction

Background of the Study

In an era marked by rapid urbanization and technological advancement, the relationship between humans and nature has undergone a significant transformation (Wilson, 2017). Forest bathing, or Shinrin-yoku, a practice rooted in Japanese tradition, emphasizes the restorative qualities of immersing oneself in a natural environment (Hansen et al., 2017). Historically, individuals derived psychological and physiological benefits from their interactions with nature, which was integral to their wellbeing (Ulrich et al., 2019). However, the encroachment of modern lifestyles, characterized by relentless schedules and digital distractions, has severed this essential connection to the natural world (Bratman et al., 2019). This disconnection has been associated with rising levels of stress, anxiety, and a general decline in mental health among urban populations (White et al., 2019). The present study seeks to illuminate the concept of digital forest bathing—a novel adaptation of this age-old practice—by examining its potential to reconnect individuals with nature in a profound yet accessible manner (Browning et al., 2020).

Originality and Value

This research proposal endeavors to contribute original insights to the burgeoning field of environmental psychology by exploring the innovative intersection of technology and nature (Kaplan, 2020). While numerous studies have elucidated the mental health benefits of traditional forest bathing (Li et al., 2018), there exists a substantial gap in the literature addressing how digital formats can replicate or enhance these experiences (Yin et al., 2020). By investigating digital forest bathing, this study aspires to offer valuable contributions to both academic discourse and practical applications (Park et al., 2021). It aims to identify how such digital interactions may serve as therapeutic alternatives for people constrained by geographical, physical, or time limitations, thereby promoting mental wellness in an increasingly disconnected world (Hartig and Kahn, 2016).

Literature Review

Forest Bathing and Modern Humans

A comprehensive review of literature reveals that engagement with natural environments yields multifaceted benefits for psychological and emotional health (Song et al., 2016). Studies demonstrate that even short exposures to green spaces can significantly reduce cortisol levels, lower blood pressure, and enhance overall mood (Yu and Hsieh, 2020). As modern humans grapple with the stresses of urban living, the necessity for such restorative experiences becomes increasingly critical (Thompson et al., 2018; Oe and Weeks, 2025). The literature emphasizes the rich tapestry of cultural practices surrounding forest bathing, which

underscore humanity's intrinsic need to connect with nature for holistic well-being (Miyazaki et al., 2020; Oe, 2025a).

Forest Bathing: Remote Visits and Stress

The advent of remote technologies opens new avenues for experiencing nature, especially for those unable to access natural spaces physically (Litleskare et al., 2020). Research indicates that virtual nature experiences can evoke similar physiological responses to real-world interactions with nature (Browning et al., 2019). Emerging studies that utilize virtual reality (VR) environments have documented reduced stress levels and improved feelings of tranquility among participants (Chirico and Gaggioli, 2019), suggesting the viability of remote nature visits as a method for stress alleviation (White et al., 2018; Oe and Yamaoka, 2022).

New Styles of Forest Bathing through DX (Digital Transformation)

Digital transformation (DX) significantly reshapes our interactions with the environment, fostering innovative approaches to health and wellness (Rakova and Liang, 2021). This section explores how applications, online platforms, and immersive technologies—such as augmented reality (AR) and VR—have birthed novel styles of forest bathing (Kim et al., 2020). By integrating nature experiences with digital interfaces, individuals can cultivate an intimate relationship with the natural world, even from the confines of their urban settings (Nukarinen et al., 2020).

Possibilities and Discussions of Digital Forest Bathing: Hypothesis Formation

In light of the findings from the literature review, this subsection proposes several hypotheses regarding the efficacy of digital forest bathing as a therapeutic alternative to traditional practices (Dadvand et al., 2019). The potential benefits—ranging from enhanced accessibility to personalized experiences—will be discussed alongside crucial considerations regarding the authenticity of digital experiences (Villani et al., 2017). These hypotheses serve as a foundation for empirical investigation, guiding the subsequent research methodology (Pritchard et al., 2020).

To explain our conceptual framework briefly, the top left oval (first explanatory variables) represents the positive evaluation of the forest bathing effect. The bottom left oval (second explanatory variables) represents the affinity for actual forest bathing.

The rightmost oval is the dependent variable, and represents the degree to which DX (digital transformation) forest bathing is recommended to others. The central mediating variable is the perception of stress reduction.

Table 1 shows the hypothesis of digital forest bathing. There are eight hypotheses, and Figure 1 shows them as a conceptual framework.

Table 1
Hypothesis of digital forest bathing

Number	Hypothesis
H1	'Positive evaluations of the effects of forest bathing' have a significant influence on 'recommendation for DX forest bathing'.
H2	'Affinity for actual forest bathing' have a significant influence on 'recommendation for DX forest bathing'.
H3	'Positive evaluations of the effects of forest bathing' have mutual relation between 'affinity for actual forest bathing'.
H4	'Positive evaluations of the effects of forest bathing' have a significant influence on perceived stress reduction effect.
H5	'Affinity for actual forest bathing' have a significant influence on 'perceived stress reduction effect'.
H6	'Perceived stress reduction effect' has a significant influence on 'recommendation for DX forest bathing'.
H7	'Positive evaluations of the effects of forest bathing' have indirect effect through 'perceived stress reduction effect to recommendation for DX forest bathing'.
H8	'Affinity for actual forest bathing' have indirect effect through 'perceived stress reduction effect' to 'recommendation for DX forest bathing'.

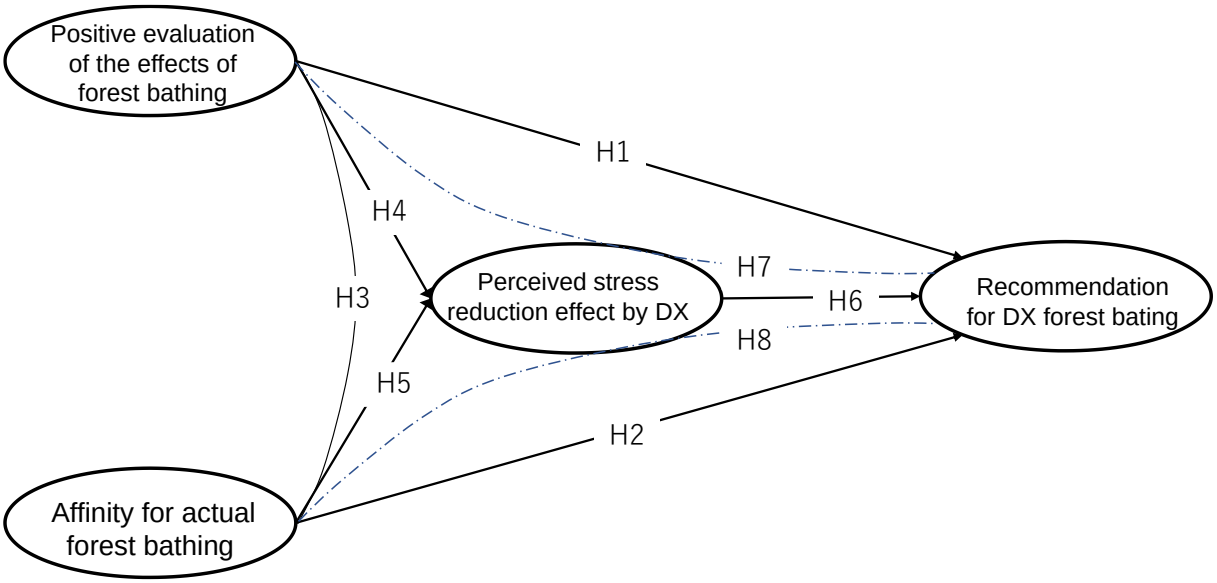

Figure 1 Conceptual framework of digital forest bathing

Methodology

Quantitative Analysis Using Surveys

To garner comprehensive insights into participants' experiences and perceptions of digital forest bathing, a structured survey will be employed as the primary research instrument. The survey will be meticulously designed to capture various dimensions of user experience, including emotional responses, perceived stress reduction, and overall satisfaction levels. A diverse participant demographic will be targeted, encompassing individuals from various backgrounds and locations to ensure a rich and multifaceted data set. The analysis tools used for this research were IBM SPSS statistics ver. 26 and AMOS ver. 26.

Software and Analysis Plan (SEM via AMOS)

For the analysis of the collected data, Structural Equation Modeling (SEM) will be employed via AMOS software. This advanced statistical technique will enable the exploration of complex relationships between variables, providing a nuanced understanding of the impacts of digital forest bathing. The analysis plan will detail the measurement models and the pathways to be examined, ensuring a rigorous investigation into the hypotheses posited earlier.

Data Analysis

The data analysis process will be systematic and thorough, entailing a series of steps to ensure the integrity and validity of the findings. Descriptive statistics will first be employed to characterize the sample population, followed by the application of SEM to test the formulated hypotheses. The results will be interpreted in light of existing literature, allowing for a comprehensive discussion of the implications of the findings in relation to both practice and future research directions.

Findings

This section will present a synthesis of the key discoveries emerging from the data analysis, delineating how they align with or diverge from the initial hypotheses. The findings will elucidate the effect of digital forest bathing on participant wellbeing, offering insights into the validation of digital approaches as effective alternatives for stress relief.

Data Profile

Before conducting a full-scale analysis, examine the profile of the data set. Demographic profile shows that a balanced data set was recovered by attribute (Table 1).

Table 1
Demographic profile

Gender	Frequency	Percent
Female	197	56.8
Male	150	43.2
Total	347	100.0
Age		
10s	90	25.9
20s	87	25.1
30s	83	23.9
40s	41	11.8
50s	31	8.9
60 above	15	4.3
Total	347	100.0

Table 2 shows that a descriptive analysis result of the data set includes 13 questionnaires.

Table 2
Descriptive analysis

Questionnaire	N	Min.	Max.	Mean	Std. Deviation
Digital forest bathing is likely to make me feel refreshed	347	1	5	3.36	1.035
I can expect to feel more balanced in body and mind as a result of digital forest bathing	347	1	5	3.24	0.949
Digital forest bathing is expected to relieve mental fatigue	347	1	5	3.35	0.976
Digital forest bathing is likely to give me a feeling of being in nature	347	1	5	3.19	1.000
If I have experienced forest bathing before, I would like to experience it again	347	1	5	3.88	0.936
I like forest bathing	347	1	5	3.77	0.954
I am interested in the health benefits of forest bathing	347	1	5	3.86	0.915
I am a person who goes out for forest bathing	347	1	5	3.08	1.212
I feel stress could be reduced by forest bathing	347	1	5	3.43	0.862
Viewing forest scenic seems to improve sleep quality	347	1	5	3.37	0.994
Watching forest scenic is likely to help boost creativity	347	1	5	3.42	0.893
I want to try digital forest bathing	347	1	5	3.47	1.147
I want to recommend digital forest bathing to my family and friends	347	1	5	2.97	1.005

Factor Analysis Outcome

A detailed profile of the data obtained will be provided, including demographic characteristics of respondents, response distributions, and relevant statistical metrics. This profile will serve to contextualize the findings within larger societal trends, enhancing the overall understanding of the implications of digital forest bathing in contemporary health practices.

All data were subjected to factor analysis, resulting in the formation of four factors, which were named as follows: (1) Positive evaluation of the effects of forest bathing effects (alpha = 0.918), (2) Affinity for actual forest bathing (0.887), (3) Perceived stress reduction effect (0.754), and (4) Recommendation for DX forest bating to others (0.761). Also mention of sampling adequacy: the Kaiser-Meyer-Olkin measure (KMO) points to 0.924, which means there is a high degree of confidence. Then, cumulative % is 63.034 (Table 3).

Table 3
Factor Analysis

Acronym		Component 1	2	3	4	Alpha
PEEF1	Digital forest bathing is likely to make me feel refreshed	0.822	0.134	0.255	0.035	0.918
PEEF2	I can expect to feel more balanced in body and mind as a result of digital forest bathing	0.813	0.160	0.225	0.038	
PEEF3	Digital forest bathing is expected to relieve mental fatigue	0.800	0.146	0.296	-0.012	
PEEF4	Digital forest bathing is likely to give me a feeling of being in nature	0.800	0.069	0.202	0.101	
AAF1	If I have experienced forest bathing before, I would like to experience it again	0.123	0.892	0.114	0.178	0.887
AAF2	I like forest bathing	0.134	0.856	0.154	-0.072	
AAF3	I am interested in the health benefits of forest bathing	0.191	0.772	0.258	0.037	
AAF4	I am a person who goes out for forest bathing	0.247	0.709	0.070	0.385	
PSRE1	I feel stress could be reduced by forest bathing	0.217	0.145	0.786	0.053	0.754
PSER2	Viewing forest scenic seems to improve sleep quality	0.273	0.140	0.701	0.222	
PSER3	Watching forest scenic is likely to help boost creativity	0.205	0.192	0.650	0.208	
RDF1	I want to try digital forest bathing	0.145	0.165	0.231	0.778	0.761
RDF2	I want to recommend digital forest bathing to my family and friends	0.091	0.299	0.248	0.708	
	Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. Rotation converged in 5 iterations.					
	Component name: (1) Positive evaluation of the effects of forest bathing (2) Affinity for actual forest bathing (3) Perceived stress reduction effect (4) Recommendation for DX forest bating					

Convergent and Discriminant Validity Test

Once each item's ability to explain its construct was verified, validity and reliability tests were conducted. Composite reliabilities (CRs) and average variance extracted (AVE) were calculated (Fornell & Larcker, 1981) and presented in Table 7. Most values exceeded the minimum thresholds: 0.7 for CR (Urbach & Ahlemann, 2010) and 0.5 for AVE (Leontitsis & Pagge, 2007). Discriminant validity was confirmed if the square root of AVE exceeded the Pearson correlation coefficient. Cronbach's alpha values, all above 0.6 (Hair et al., 2010), indicated consistency. Correlation analysis ensured no multicollinearity, with coefficients below 0.7 (Ratner, 2009). Overall, the constructs were reliable, valid, and suitable for SEM analysis (Fornell & Larcker, 1981).

Table 4
Convergent and discriminant validity test

	N	Mean	SD	Alpha	CR	AVE	C1	C2	C3	C4
Component 1	347	3.286	0.990	0.918	0.883	0.654	**0.809**			
Component 2	347	3.647	1.004	0.887	0.879	0.708	0.460**	**0.841**		
Component 3	347	3.404	0.916	0.754	0.757	0.383	0.597**	0.572**	**0.619**	
Component 4	347	3.219	1.076	0.761	0.538	0.553	0.668**	0.520**	0.579**	**0.744**

Values bold on the main diagonal are the square rooted of AVEs; SD is standard deviation; Alpha is Cronbach alpha;
CR is Composite reliability; AVE is average variance standard.
**P<0.01

Confirmation of Multicollinearity
As shown in Table 5, there is no problem of collinearity between the three latent variables that make up SEM.

Table 5
Multicollinearity test

		[A]	[B]	[C]
[A]Positive evaluation of the effects of forest bathing	Pearson Correlation	1		
	Sig. (2-tailed)			
	N	347		
[B]Affinity for actual forest bathing	Pearson Correlation	.313**	1	
	Sig. (2-tailed)	0.000		
	N	347	347	
[C]Perceived stress reduction effect by DX	Pearson Correlation	.579**	.287**	1
	Sig. (2-tailed)	0.000	0.000	
	N	347	347	347

**. Correlation is significant at the 0.01 level (2-tailed).

Structural Equation Modelling (SEM)
The entire 347 sample has been completed. The following are the specifications that express the reliability of the SEM. The Chi-square is 189.448, the degrees of freedom is 59, the C/D, which is the value obtained by dividing the Chi-square by the degrees of freedom, is 3.203, p is 0.000, the GFI: Goodness of Fit Index is 0.920 (<0.9), AGFI: Adjusted Goodness of Fit Index was 0.877 (<0.9), CFI: Comparative Fit Index was 0.978 (<0.9), RMSEA: Root Mean Square Error of Approximation was 0.080 (<0.1). The numbers in parentheses indicate the desired level (Hair et al., 2010).
The detailed figures are shown in Tables 6 and 7.

The path coefficient for the indirect path from the two explanatory variables on the left to the central mediating variable and then to the dependent variable on the right was very small and not significant. Therefore, we will interpret the SEM from the two perspectives of the direct path and the total path.

The SEM diagram of the overall 347 samples is shown in Figure 2. As an explanatory variable in the upper left, people who are sympathetic to DX Forest Bathing and who are convinced by the middle effect will recommend it to others with a total of 0.795***. However, true forest bathing believers have a middle mediating variable of DX effect of 0.220***, but only a total of 0.121 for the final total path effect, which is not significant. In other words, it seems that genuine forest bathing believers are somewhat accepting of the effects of DX forest bathing, although they are skeptical about it, but they do not intend to recommend DX forest bathing to others.

Next, we investigated whether there were any differences between men and women. First, we observed the female sample (N=197) in Figure 3. The path coefficient for the perceived stress reduction effect by mediating variables of DX in the center is 0.598***, which is a strong relationship with the explanatory variable of positive evaluation of the effects of forest bathing in the upper left.

As an explanatory variable in the upper left, people who are sympathetic to DX Forest Bathing and who are convinced by the mediating variable effect will the dependent variable recommend it to others with a total of 0.776***.

Next, we observed the male sample (N=150) in Figure 4. An explanatory variable of under left, affinity for actual forest bathing to the mediating variable reaches 0.359*** which is larger than female samples. Also, total effect from the upper left explanatory variable to the dependent variable through the mediating variable is 0.816***. It can be said that when the mediating variable in the middle, the perceived stress reduction effect by DX, was included, the results showed that men were more likely to recommend DX forest bathing to others than women.

Table 6
Path coefficient of the SEM research model

To		From	All (347)			Female (194)			Male (150)		
			P	Std.Estimate	95% PC	P	Std.Estimate	95% PC	P	Std.Estimate	95% PC
Perceived stress reduction effect by DX	<--	Positive evaluation of the effects of forest bathing	***	0.573	0.450, 0.682	***	0.598	0.435, 0.735	***	0.491	0.450, 0.682
Perceived stress reduction effect by DX	<--	Affinity for actual forest bathing	***	0.220	0.098, 0.348	0.031	0.155	-0.012, 0.326	***	0.327	0.178, 0.523
Recommendation for DX forest bating	<--	Perceived stress reduction effect by DX	0.140	0.093	-0.068, 0.255	0.331	0.076	-0.098, 0.249	0.268	0.111	-0.249, 0.404
Recommendation for DX forest bating	<--	Positive evaluation of the effects of forest bathing	***	0.741	0.605, 0.870	***	0.730	0.569, 0.876	***	0.761	0.553, 1.007
Recommendation for DX forest bating	<--	Affinity for actual forest bathing	0.024	0.100	-0.000, 0.206	0.015	0.134	0.011, 0.261	0.512	0.048	-0.146, 0.274
PEEF1	<--	Positive evaluation of the effects of forest bathing	***	0.893		***	0.918		***	0.857	
PEEF2	<--	Positive evaluation of the effects of forest bathing	1 fix	0.860		1 fix	0.838		1 fix	0.897	
PEEF3	<--	Positive evaluation of the effects of forest bathing	***	0.882		***	0.901		***	0.855	
PEEF4	<--	Positive evaluation of the effects of forest bathing	***	0.805		***	0.795		***	0.819	
AAF1	<--	Affinity for actual forest bathing	1 fix	0.889		1 fix	0.913		1 fix	0.846	
AAF2	<--	Affinity for actual forest bathing	***	0.893		***	0.903		***	0.876	

AAF3	<---	Affinity for actual forest bathing	***	0.750		***	0.768		***	0.727		
AAF4	<---	Affinity for actual forest bathing	***	0.771		***	0.789		***	0.754		
PSRE1	<---	Perceived stress reduction effect by DX	1 fix	0.734		1 fix	0.711		1 fix	0.738		
PSRE2	<---	Perceived stress reduction effect by DX	***	0.793		***	0.850		***	0.728		
PSRE3	<---	Perceived stress reduction effect by DX	***	0.698		***	0.744		***	0.662		
RDF1	<---	Recommendation for DX forest bating	1 fix	0.880		1 fix	0.918		1 fix	0.827		
RDF2	<---	Recommendation for DX forest bating	***	0.883		***	0.877		***	0.896		
Affinity for actual forest bathing	<-->	Positive evaluation of the effects of forest bathing	***	0.341	0.221, 0.453	***	0.319		***	0.359		
Total effects:												
Recommendation for DX forest bating	<---	Positive evaluation of the effects of forest bathing		0.795	0.718, 0.858		0.776	0.672, 0.856		0.816	0.697, 0.917	
Recommendation for DX forest bating	<---	Affinity for actual forest bathing		0.121	0.027, 0.216		0.146	0.021, 0.275		0.085	-0.075, 0.240	

Table 7
R2 and model fit summary of the SEM research model

Squared Multiple Correlations (R2):	R2	R2	R2
Perceived stress reduction effect by DX	0.463	0.441	0.464
Recommendation for DX forest bating	0.716	0.699	0.729
AAF2	0.797	0.815	0.767
AAF4	0.595	0.622	0.568
PEEF3	0.778	0.811	0.732
PSRE2	0.487	0.553	0.438
PSRE1	0.539	0.506	0.545
PSRE2	0.629	0.723	0.529
PEEF1	0.797	0.842	0.735
RDF1	0.774	0.842	0.683
RDF2	0.781	0.768	0.803
PEEF2	0.740	0.702	0.805
PEEF4	0.647	0.633	0.671
AAF1	0.790	0.834	0.716
AAF3	0.563	0.591	0.529
Model fit summary:			
Chi squire	189.448	125.471	155.343
df	59	59	59
C/D	3.203	2.127	2.163
p	0.000	0.000	0.000
GFI	0.920	0.911	0.865
AGFI	0.877	0.863	0.793
CFI	0.978	0.964	0.924
RMSEA	0.080	0.076	0.094

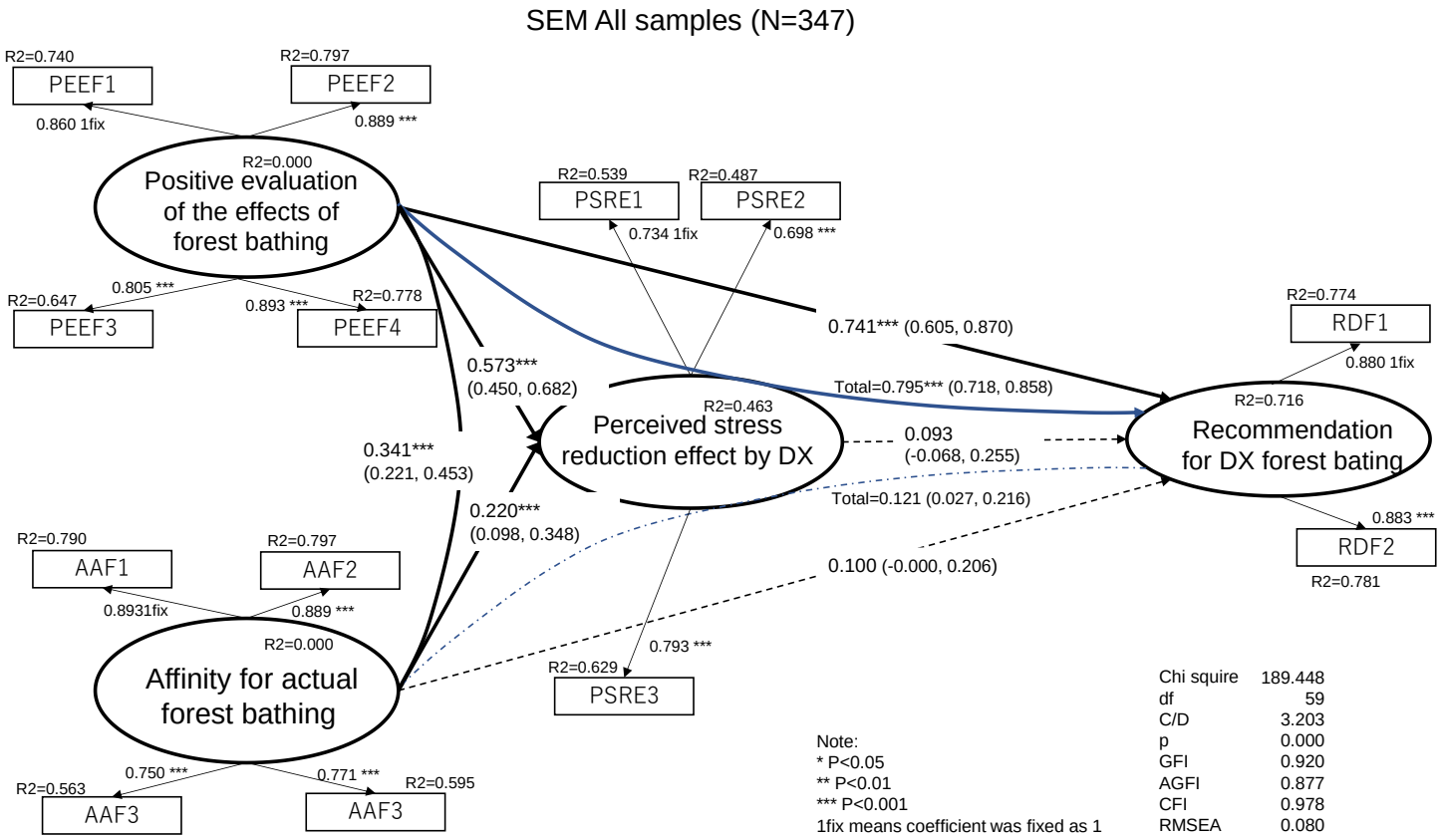

Figure 2 SEM All 347 samples

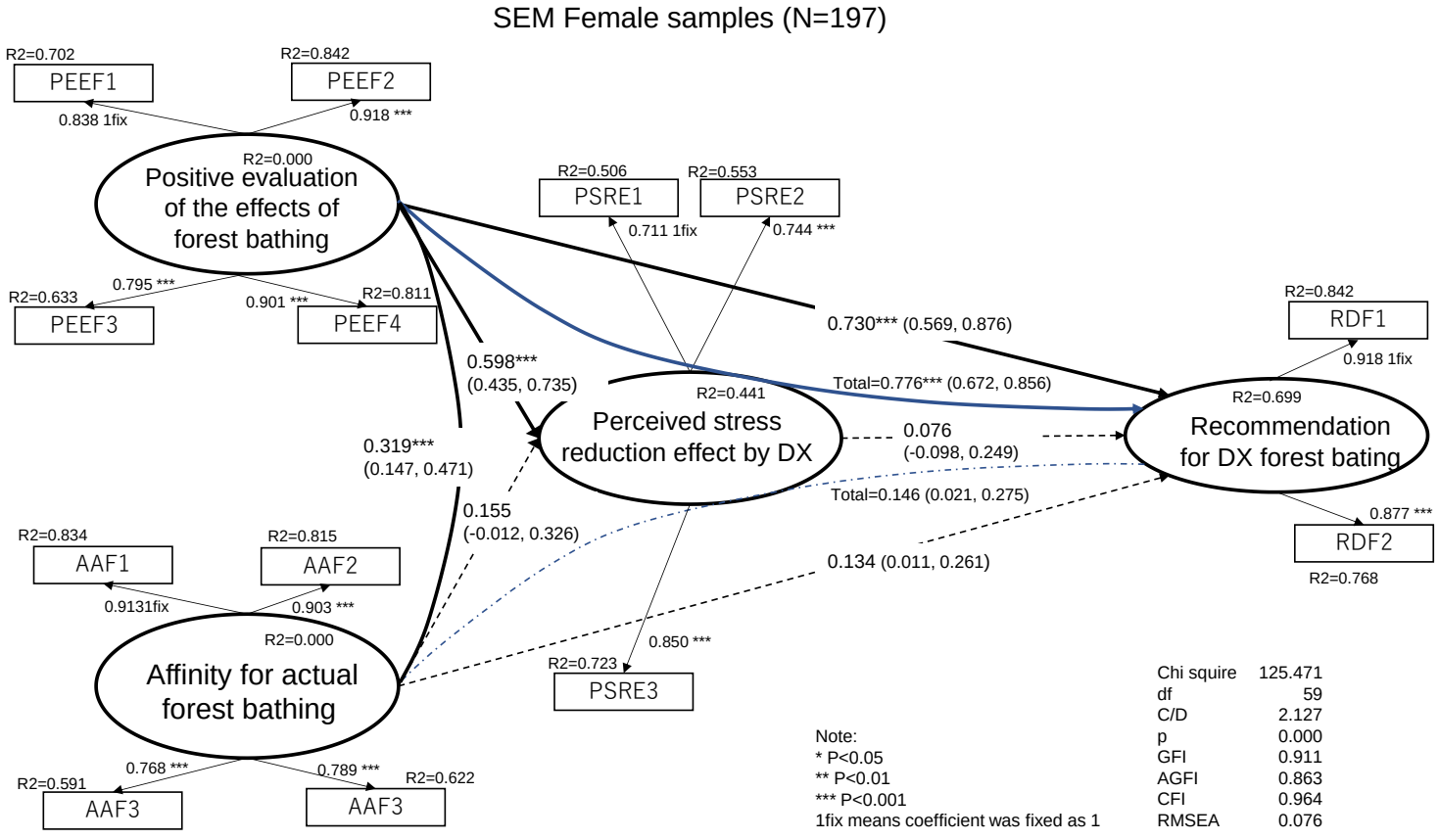

Figure 3 SEM Female 197 samples

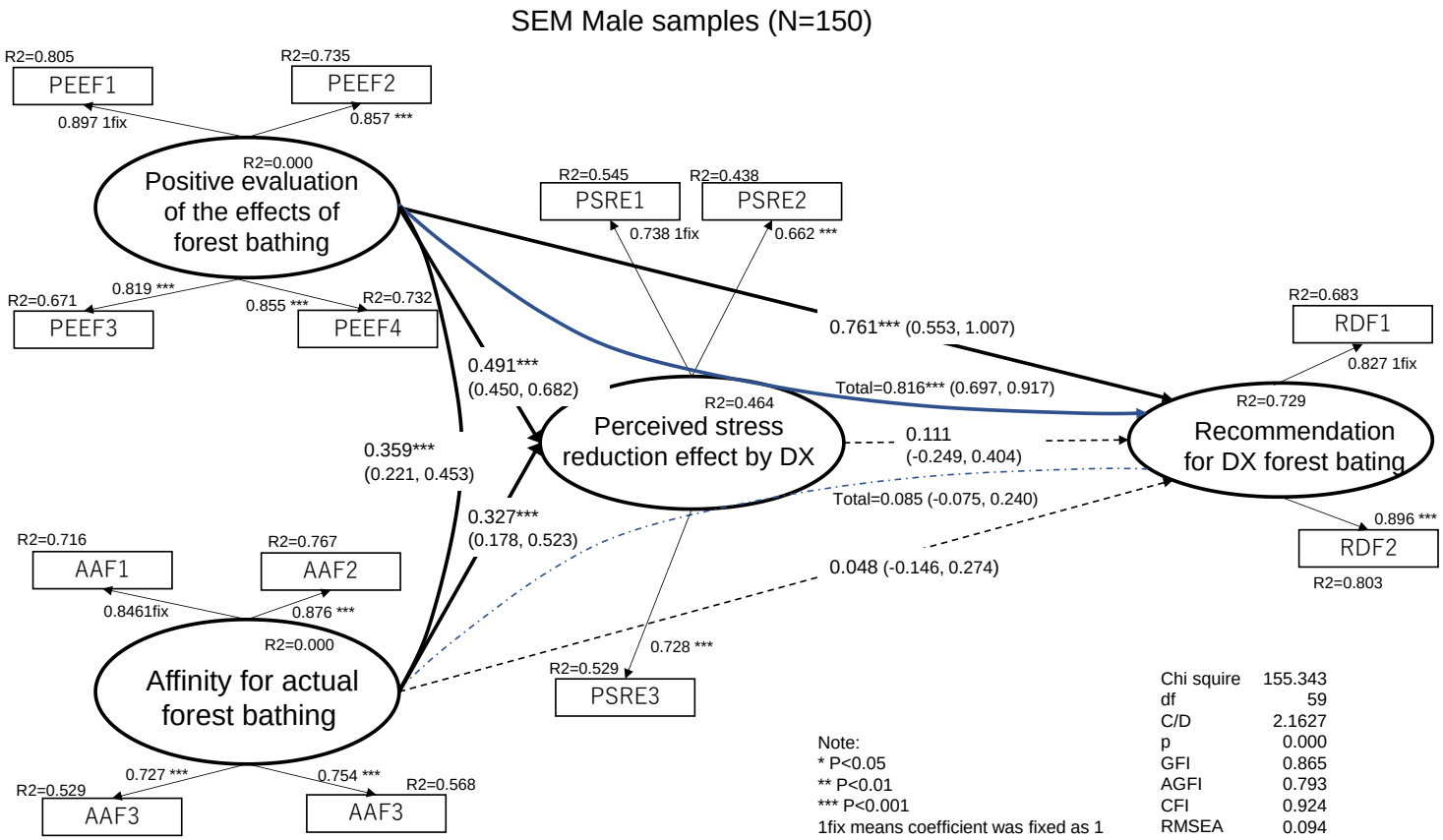

Figure 4 SEM Male 150 samples

Hypothesis Testing Results and Implications for Digital Nature-Based Interventions

Table 8 presents the comprehensive statistical analysis of our proposed hypotheses. The findings indicate that hypotheses H1, H3, H4, H5, and H7 were statistically supported, while hypotheses H2, H6, and H7 failed to achieve statistical significance and were consequently rejected. These outcomes demonstrated remarkable consistency across the aggregate sample (n=347) as well as when segregated by gender into female (n=197) and male (n=150) cohorts.

The analysis reveals pronounced gender differentials in receptivity toward digital forest bathing interventions. Female participants exhibited inherent skepticism regarding the efficacy of digital nature experiences, irrespective of other variables. Conversely, male participants demonstrated conditional acceptance of digital forest bathing, contingent upon their predisposition toward traditional nature immersion. Notably, however, male participants with strong affiliations to authentic forest bathing experiences (characterized by outdoor engagement preferences) demonstrated reluctance to advocate digital alternatives within their social networks.

A compelling finding transcending gender demarcations was that participants reporting positive experiential outcomes from digital forest bathing consistently engaged in recommendation behaviors, suggesting that perceived efficacy serves as a powerful mediator of subsequent advocacy.

From a commercial wellness innovation perspective, these findings yield several strategic implications:

1. The cultivation of initial receptivity toward digital forest bathing appears to function as a

critical antecedent to subsequent acceptance and utilization patterns.

2. Educational interventions emphasizing empirically validated health benefits may catalyze interpersonal recommendation networks, thereby facilitating organic diffusion through social ecosystems.
3. Gender-differentiated implementation strategies merit consideration. While male participants with pre-existing affinities for traditional nature immersion may represent viable conversion candidates for digital alternatives, female participants' inherent skepticism suggests that therapeutic benefit messaging may prove more efficacious than attempting to leverage traditional forest bathing as a transitional pathway.

This gender-specific reception pattern suggests that resource optimization for wellness enterprises might favor direct digital forest bathing experience campaigns rather than preliminary investment in traditional forest bathing exposure, particularly when female demographic segments constitute primary target populations. The findings thus indicate that developing experiential campaigns highlighting the immediate therapeutic benefits of digital forest bathing may represent an economically efficient market penetration strategy.

Table 8
Hypotheses test result

Number	Hypothesis	Hypotheses test results
H1	'Positive evaluations of the effects of forest bathing' have a significant influence on 'recommendation for DX forest bathing'.	Accepted
H2	'Affinity for actual forest bathing' have a significant influence on 'recommendation for DX forest bathing'.	Rejected
H3	'Positive evaluations of the effects of forest bathing' have mutual relation between 'affinity for actual forest bathing'.	Accepted
H4	'Positive evaluations of the effects of forest bathing' have a significant influence on perceived stress reduction effect.	Accepted
H5	'Affinity for actual forest bathing' have a significant influence on 'perceived stress reduction effect'.	Accepted
H6	'Perceived stress reduction effect' has a significant influence on 'recommendation for DX forest bathing'.	Rejected
H7	'Positive evaluations of the effects of forest bathing' have indirect effect through 'perceived stress reduction effect to recommendation for DX forest bathing'.	Accepted
H8	'Affinity for actual forest bathing' have indirect effect through 'perceived stress reduction effect' to 'recommendation for DX forest bathing'.	Rejected

However, we should consider the following discussion. The skepticism observed among female respondents toward digital forest bathing (DFB) in our study presents an interesting contrast to the findings of Li et al. (2025), which demonstrated significant positive impacts of traditional forest bathing on female participants with depression or depressive tendencies. This apparent contradiction highlights a critical gap in the current approach to digital wellness solutions.

While Li et al.'s research reinforces the therapeutic value of nature immersion for women's mental health, our findings suggest that the digital translation of these benefits faces gender-specific barriers to acceptance. This disconnect represents not merely an implementation challenge but an opportunity to bridge traditional and digital approaches through more nuanced design considerations.

To effectively bridge this gap, future research and development of digital forest bathing experiences should focus on identifying the specific elements of traditional forest bathing that female participants find most therapeutic (as documented by Li et al.) and explore innovative ways to authentically translate these elements into digital formats. This might involve multisensory approaches that go beyond visual and auditory stimulation, incorporation of interactive elements that foster a sense of agency similar to physical forest experiences, and possibly hybrid approaches that use digital tools to enhance, rather than replace, connection with actual natural environments.

Understanding this gender disparity in acceptance is crucial not only for improving the efficacy of digital wellness solutions but also for ensuring equitable access to nature's therapeutic benefits in our increasingly urbanized and digitalized world.

Conclusion

Overall Outputs

This study has explored the efficacy and acceptance of digital forest bathing (DFB) as a modern adaptation of traditional Shinrin-yoku practices through structural equation modeling. Our analysis of 347 participants revealed significant gender differences in the perception and recommendation of DFB experiences. Female participants displayed general skepticism toward DFB regardless of their affinity for traditional forest bathing, while male participants demonstrated more flexible attitudes, accepting DFB as a viable alternative, though outdoor enthusiasts among them were less likely to recommend DFB to others. Importantly, participants who perceived positive effects from DFB consistently recommended it to others, regardless of gender.

These findings have illuminated three critical factors for the successful implementation of digital wellness solutions: (1) fostering initial affinity with DFB experiences, (2) educating users about health benefits to encourage word-of-mouth promotion, and (3) developing gender-specific marketing approaches that acknowledge the different receptivity patterns between men and women. These insights provide a foundation for both understanding consumer behavior in digital wellness contexts and developing effective business strategies for stress-reduction services in our increasingly digitalized society.

Theoretical and Practical Contributions

From a theoretical perspective, this research extends our understanding of how traditional nature-based practices can be translated into digital formats, contributing to the emerging body of knowledge on digital wellness solutions. By identifying the mediating role of perceived stress reduction in the acceptance and recommendation of DFB, we have enriched the theoretical framework regarding technology acceptance in wellness contexts. Additionally, our findings on gender differences contribute to the literature on gender-specific

responses to digital nature experiences, challenging the notion of universal approaches to digital wellness interventions.

Practically, this study offers valuable insights for wellness practitioners, digital health developers, and business strategists. For wellness practitioners, our findings suggest tailored approaches to introducing DFB based on client gender and prior nature experiences. For digital health developers, the results highlight the importance of designing DFB experiences that emphasize tangible stress reduction benefits, particularly when targeting female users. For business strategists, our research suggests that cost-effective wellness business approaches should prioritize direct DFB experience campaigns over promoting traditional forest bathing, especially when targeting female audiences. This targeted approach may significantly enhance market penetration and user acceptance of digital wellness solutions.

Limitations and Further Research Opportunities

Despite its contributions, this study has several limitations that present opportunities for future research. First, our sample, while reasonably diverse, may not represent all demographic segments or cultural contexts. Future studies should explore how cultural backgrounds and geographic locations influence DFB acceptance and effectiveness. Second, our research focused primarily on self-reported perceptions rather than objective physiological measurements of stress reduction. Further research incorporating biometric data would strengthen the evidence base for DFB's stress-reduction effects.

Additionally, our cross-sectional design captures attitudes at a single point in time. Longitudinal studies examining how DFB acceptance and effectiveness evolve over repeated exposures would provide valuable insights into its long-term viability as a wellness solution. Another promising avenue for research is exploring how different sensory elements within DFB experiences (visual, auditory, interactive components) contribute to overall effectiveness. Finally, investigating the potential of combining traditional and digital forest bathing experiences in complementary ways could lead to innovative hybrid approaches that maximize wellness benefits while addressing accessibility limitations.

As digital wellness solutions continue to evolve, understanding how to effectively translate nature's benefits into digital formats remains a critical research frontier with significant implications for public health, business innovation, and environmental connection in our increasingly digital world.

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