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The More Training, the More Willingness? A Positive Spillover Effect Analysis of Voluntary Behavior in Environmental Protection

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Abstract: Volunteers trained in environmental science are the backbone of environmental protection. Therefore, it is necessary to study the pro-environmental behaviors of volunteers trained in environmental science and guide them to actively participate in pro-environmental actions. Compared with other kind of volunteers, volunteers trained in environmental science have more expertise on the premises, can this expertise strengthen their willingness to volunteer? Taking a group of university alumni trained in environmental science in city H as an example (N = 2349), this study investigates the potential mechanism of the positive spillover effect of volunteers trained in environmental science behavior. The volunteers in this sample showed the phenomenon of “the more training, the more willingness”: the degree to which environmental protection volunteers received environmental science education strengthened alumni’s willingness to participate. This paper uses the theory of planned behavior as a theoretical framework and serial mediation model as a methodology to investigate the factors that affect the willingness to participate in environmental protection volunteer services. This study identifies two paths from volunteer behavior to willingness: (1) profession → identity → willingness; and (2) profession → identity → pleasure → willingness. It is believed that the main intermediary variable of environmental protection volunteer participation is the sense of identity gained from receiving environmental protection education. Therefore, it is necessary to emphasize that the sense of identity is internalized into cognition and transformed into positive emotions, so as to promote the participation willingness of environmental protection volunteers.

Keywords: volunteer behavior; participation willingness; environmental science alumni; collective action; serial mediation model; positive spillover effect



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1. Introduction

Volunteers trained in environmental science are the backbone of environmental protection. In environmental voluntary activities, volunteers who have received professional training in environmental science play a key role in professional environmental protection work [1,2]. Therefore, volunteers trained in environmental science are recognized by countries around the world as a more important force than other environmental volunteers in More training environmental volunteer fields (such as soil remediation, wildfire suppression, etc.) [3,4].

However, volunteers trained in environmental science and other volunteers have different willingness to participate. The marginal utility of these volunteers to acquire professional knowledge is smaller, and the willingness to participate is theoretically lower [5–8]. Therefore, how to motivate volunteers trained in environmental science to participate in environmental protection is a major topic in the current research on environmental volunteer systems in various countries. A number of academic studies have explored the relationship between volunteer willingness and voluntary service behavior in depth [9,10]. However,

there are few studies on volunteers trained in environmental science, especially volunteers who already have a high level of professional knowledge.

Some recent research has identified a phenomenon known as “behavioral spillover”. The definition of “behavior spillover” in environmental protection volunteer behavior is: Volunteers’ past environmental behavior is expected to influence their future environmental behavior [11,12]. Behavioral spillover, predicated on a ubiquitous empirical observation, posits that heightened frequency of participation in environmental conservation activities is positively correlated with elevated willingness and enthusiasm for environmental preservation. As an instance, a Danish experimental study found that university students who evinced a proclivity towards low-carbon products were more disposed towards pro-environmental behaviors, such as utilizing public transport and recycling [13]. In this study, we found that there is also a phenomenon of “the More training, the More Willingness” in environmental protection volunteers. Therefore, it is fitting to use “behavioral spillover” as a theoretical framework for analyzing environmental protection volunteer willingness to volunteers trained in environmental science.

What mechanisms promote the behavioral spillover of environmental protection volunteering? Scholars’ researches generally include the following contents. Lin and Xu discussed the spillover effect factor of environmental protection behavior from the aspects of the policy intervention model, environmental behavior attributes, and individual characteristics of residents [14]. Moreover, identity fortification tactics tend to enhance the likelihood of target mobilization and behavioral uniformity mechanisms. This is owing to the fact that when individuals adopt a particular behavior, it could potentially become an integral aspect of their identity, thereby influencing subsequent choices and behaviors. Consequently, identity reinforcement strategies, which bolster the centrality of a particular behavior to one’s self-concept, are likely to strengthen the connection between an individual’s behavior and their personal values and beliefs [13,15,16]. Furthermore, economic incentivization schemes pose a challenge to the occurrence of favorable spillover effects, since individuals may deliberately construe policy adherence behavior as constituting their extant contribution to environmental preservation. This strategic behavior arises from the fact that economic incentives may induce individuals to perceive environmental conservation actions as being driven solely by the promise of financial gain, rather than an intrinsic commitment to the cause. Consequently, the efficacy of economic incentive strategies is often hampered by the inability to foster a sense of internal motivation and personal engagement in the targeted individuals [17–20]. Individuals possessing robust personal ecological norms, alongside those with more advanced chronological age, tend to be predisposed towards favorable spillovers, thereby circumventing potential cognitive dissonance. This observation is attributable to the fact that individuals who possess deeply ingrained ecological norms are more likely to adopt environmentally sustainable practices in a consistent manner, thereby experiencing positive spillovers [21–23].

For this study, our first goal was to explore the question: Does higher professionalism lead to a greater willingness to follow up with environmental protection volunteerism? (Whether there is behavioral overflow in environmental protection volunteerism activities) Therefore, we contemplated selecting as research subjects a group of university alumni with professional training in environmental science. Incorporating the Theory of Collective Action [23], alongside the Theory of Planned Behavior [24], and Theory of Cognitive Balance [25], we aimed to provide a comprehensive understanding of the factors influencing individuals’ willingness to participate in environmental protection volunteerism. The Theory of Collective Action suggests that individuals are more likely to engage in collective efforts when they perceive that their actions will contribute to the achievement of a common goal, and when they believe that the benefits of their actions will outweigh the costs. In the context of environmental protection volunteerism, this theory can help explain how individuals’ perceptions of the effectiveness and importance of their actions may influence their willingness to participate in such activities. The second goal of this study is to clarify whether cognitive and emotional factors play a mediating role in the internal mechanism

of behavioral spillover, and then strengthen the willingness of environmental protection volunteers to participate in the follow-up. By integrating the Theory of Collective Action throughout the content of this passage, we can examine how individuals' beliefs about the collective benefits of environmental protection volunteerism may interact with cognitive and emotional factors to influence their willingness to engage in these activities.

In conclusion, this study aims to investigate the relationship between higher professionalism and willingness to participate in environmental protection volunteerism, as well as the mediating role of cognitive and emotional factors in this relationship. By incorporating the Theory of Collective Action, Theory of Planned Behavior, and Theory of Cognitive Balance, we hope to provide a comprehensive understanding of the factors that influence individuals' engagement in environmental protection volunteerism and the potential for behavioral spillover.

2. Hypotheses and Model

Propounded by Icek Ajzen, the Theory of Planned Behavior (TPB) represents a progressive successor to the Theory of Reasoned Action (TRA) advanced by Ajzen and Fishbein, offering valuable insights into the dynamics of behavioral transformation [24]. TPB posits that human behavior is a function of intentional planning and has found extensive application in uncovering the factors and intrinsic associations that engender environmental voluntarism [26–30]. The TPB construct stipulates that behaviors which are not completely within the purview of individual control are influenced by behavioral intent, as well as being limited by actual conditions that affect control, such as personal capability, accessibility of opportunities, and resources to execute the behavior [31]. When control conditions are optimal, behavioral intent has a direct impact on decisional conduct.

When juxtaposed with TPB, the Theory of Cognitive Balance (TCB) delineates the mechanism of social psychology formation and transformation more specifically, highlighting that individuals invariably aspire towards cognitive coherence and uniformity. The theory segregates the cognitive process into constituent cognitive elements like beliefs, thoughts, emotions, attitudes, and actions, and maintains a balance and concordance within the cognitive system, implying that any imbalances would require some of the cognitive elements to alter once more to re-establish system equilibrium [25]. Using the aforementioned theoretical underpinnings of TPB and TCB, we shall posit the following conjectures.

2.1. Past Professional Training and Participation Willingness

For environmental protection voluntary behavior, well-professional training participants will have an impact on future professional training due to changes in internal or external mechanisms during participation activities [32]. At the outset of implementing environmental governance measures, there may be limited participation by volunteers. However, through the use of a professional training mechanism, environmental governance measures can be boosted, thus increasing the inclination of individuals to undertake eco-friendly practices and improve their engagement in environmental activities [33]. In specific environmental volunteer activities, the endogenous mechanisms of enthusiasm and willingness for environmental protection activities are not different. For example, in environmental protection volunteerism, environmental protection is an important public issue that requires the active participation of local residents in order to curb the spread of environmental protections and protect their homes. Therefore, professional training becomes the endogenous mechanism for volunteers to participate in activities [34,35]. In addition, people who have a better education are more likely to include themselves in the identity of “environmentalists”, so identity may become an internal factor [36–38]. Therefore, this paper puts forward the core hypothesis:

Hypothesis 1. *Professional training (especially in environmental science) has a positive effect on participation willingness in environmental protection volunteers.*

2.2. The Mediating Role of Voluntary Identity

Compared with other environmental protection volunteers, volunteers trained in environmental science tend to form a social identity of environmental protection during the training period. They will not only think that they are practitioners of environmental protection, but also that environmental protection is their job responsibility. Thus, engaging in environmental protection and its affiliated activities through volunteerism is a course of action that leads to attaining identity. This conduct originates not only from the volunteer's personal awareness in practical deeds, but also encompasses their direct engagement with other members of the collective and government, culminating in the perception and incentivization of prestige [39,40]. For example, the research on identity in environmental protection behaviors shows that the government provides corresponding identity and commendations, and sets an example in the environmental protection movement, so that more people will pay attention to environmental protection activities and realize the importance of environmental protection. Therefore, the higher the degree of training volunteers received in environmental science, the stronger the sense of identity they gained. This concept is consistent with Icek Ajzen's TPB hypothesis [24]. Therefore, we propose the second hypothesis:

Hypothesis 2. *Professional training (especially in environmental science) has a positive effect on voluntary identity.*

According to TPB [24], the manifestation of behavior often relies on the cognitive state of the subject. Identity, as a critical component affecting the cognitive state of the subject, exerts a notable influence on willingness to engage in social conduct. A study by Henry showed that in the southern United States, counties that favor grazing have higher murder rates than counties that favor agriculture, which is due to the tendency of people with low identity cultures to be aggressive when confronted with insults. It is a strategy to protect their sense of social value [41]. Moreover, the self-directed drive of recognition perception can mold more persistent and enduring sustainable intentions [42]. Identity is widely considered to be an important factor in promoting volunteers' participation in pro-environmental actions, and this factor is considered a consensus in contemporary Chinese and Western environmental volunteering practices [43–46]. However, the mechanisms linking environmental protection volunteerism to identity have never been empirically tested, especially in environmental protection volunteerism. Based on this, we propose the third hypothesis:

Hypothesis 3. *Voluntary identity has a positive effect on participation willingness.*

When individuals have a higher professional training in environmental science, they will acquire a stronger environmentalist identity and ultimately a greater sense of identity in practice. In simple terms, professional training in environmental science can stimulate individuals' perceived accessibility and legitimacy to achieve environmental goals through the acquisition of identity. In turn, this can increase their willingness to take environmental action. This "professional training → identity → willingness" relationship is similar to that observed in many pro-environmental behaviors and intentions, as discussed in previous studies [13,22,47,48]. We therefore propose a fourth hypothesis, namely that the relationship among professional training, identity, and willingness is a key driver that motivates individuals to engage in environmental behavior.

Hypothesis 4. *Voluntary identity mediates the relationship between professional training (especially in environmental science) and participation willingness.*

2.3. The Mediating Role of Voluntary Emotion

The manner in which a personal environmental knowledge level can significantly influence their attitudes, and this, in turn, can lead to changes in those attitudes. Moreover, the behavior displayed by individuals in a group not only reflects their attitudes but can also shape them. Thus, there is a clear causal relationship between attitude and knowledge. In the context of environmental protection behavior, numerous scholars have highlighted the positive impact of knowledge in such activities on the happiness and well-being of individuals. This can be attributed to several factors, such as the sense of collective responsibility and consciousness that environmental knowledge foster. Additionally, environmental knowledge in collective self-expression through action and access to social support and value recognition can further enhance subjective well-being [49,50]. Building on this perspective, we hypothesize that a similar relationship exists in the context of environmental protection, a unique form of environmental protection volunteering. Therefore, we propose the fifth hypothesis to investigate this relationship.

Hypothesis 5. *Professional training (especially in environmental science) has a positive impact on voluntary emotion (positive).*

The value perception theory and TPB theory both postulate that human individuals' psychological factors are actively involved in an uncertain environment [51]. Studies on environmental volunteering have further confirmed that volunteers' emotions not only influence their personal intentions but also bring about behavioral changes [52–54]. Positive emotions have been observed to stimulate volunteers to actively and consciously participate in environmental protection voluntary behavior. Conversely, negative emotions have been found to suppress volunteers' willingness to participate, causing them not only to be reluctant to participate in subsequent environmental protection volunteer activities but also reducing their enthusiasm for current volunteer activities [17]. Drawing on this evidence, we propose the sixth hypothesis:

Hypothesis 6. *Voluntary emotion (positive) has a positive impact on participation willingness.*

By integrating the interrelationship between Hypotheses 1, 5, and 6, we posit that the communal aspect of environmental volunteering endows volunteers with a unique emotional communication conduit. In the milieu of collective action, positive emotions of enjoyment can propagate among the volunteers, and be transmuted into the endogenous incentive for them to actively participate in environmental protection endeavors, ultimately materializing into practical actions. This conjecture corresponds to the discoveries of the "behavior spillover" theory of environmental protection involvement, which holds true in many pro-environmental actions like climate change, forest preservation, and grassland management, where scholars have established that positive emotions of enjoyment enhance volunteers' propensity to subsequently partake in volunteering activities [55–57]. Hence, the same assumption could be valid for environmental protection volunteerism. Based on this, we posit the seventh hypothesis:

Hypothesis 7. *Voluntary emotion (positive) mediates the relationship between professional training (especially in environmental science) and participation willingness.*

2.4. Serial Mediation Effect of Voluntary Identity and Voluntary Emotion

The study of the interplay between identity and emotion has become an integral area of contemporary social psychology. Identity, as a social construct, serves as a powerful influence on individual attitudes and behavior. Within a community, social identity serves as a guiding force that promotes adherence to shared norms and values related to environmental conservation. When community members demonstrate social approval for actions that align with these norms, such as recycling, reducing waste, or conserving resources,

it reinforces the importance of environmental protection within the group. This positive reinforcement not only strengthens individuals' commitment to environmental behaviors but also encourages others to follow suit [58,59]. On the other hand, social identity also acts as a regulatory mechanism by imposing social sanctions on those who violate environmental norms. By holding individuals accountable for their actions that harm the environment or deviate from the community's expectations, social identity discourages behaviors that undermine collective efforts for environmental protection. These sanctions can range from social disapproval or exclusion to more formal mechanisms, such as fines or penalties, depending on the severity of the norm violation [60–62]. Within the context of environmental protection volunteerism, individuals engage in a series of activities that result in the accumulation of identity, which in turn shapes their awareness and attitude. Empirical studies have demonstrated that identity has a considerable impact on emotions. Hans and his colleagues conducted research to explore the link between adherence to identity norms and emotional responses to insults. They found that participants who strongly adhered to identity norms perceived more anger in subsequent stimuli after being insulted compared to non-insulted participants who strongly held these norms [63,64]. Furthermore, in the domain of pro-environmental activities, the influence of identity on emotions is also evident. The anticipated sense of guilt resulting from identity plays a significant mediating role in enhancing willingness to participate in environmental protection behaviors [65]. Based on these observations, we advance the eighth hypothesis:

Hypothesis 8. *Voluntary identity has a positive impact on voluntary emotion (positive).*

The hypotheses of this study, specifically Hypotheses 1, 4, 7, and 8, suggest a plausible association among behavior, identity, emotion, and willingness. In fact, TCB has long posited that Identity-attitude-practice represents a continuum of behavioral patterns. This implies that an individual must undergo the process of identity and attitude formation before exhibiting any behavioral change [66]. Therefore, the willingness to engage in a certain activity is predicated on the attitude adopted and relies on identification [67]. As proposed by TCB [25], an individual's identity could trigger a change in attitude, which ultimately manifests as his willingness to participate in environmental protection activities. This sequence could be referred to as a “professional training → identity → pleasure → willingness” path. Drawing from the aforementioned analysis, we formulate the ninth hypothesis:

Hypothesis 9. *Voluntary identity and voluntary emotion (positive) plays a chain-mediating role between professional training (especially in environmental science) and participation willingness.*

In light of the aforementioned nine hypotheses, we can devise both parallel and sequential mediation models and construct a conceptual map of the models in this study (see Figure 1).

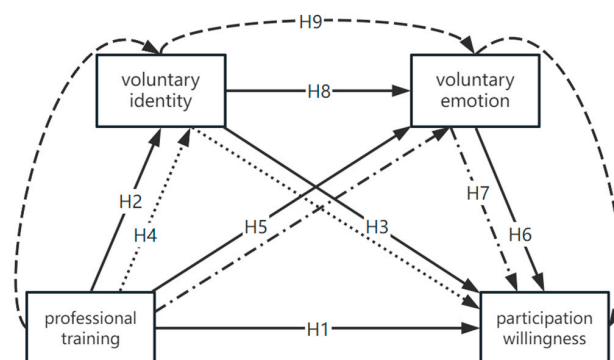


Figure 1. Model Concept Map of Hypothetical Relationship.

3. Methods and Data

The present investigation aims to assess the nine hypotheses proposed in the previous section using statistical analyses such as the parallel and serial mediation models. The former model assumes that the mediation variables do not influence one another, while the latter model assumes that they do. For data processing, we employ SPSS22.0 and the SPSS macro program developed by Hayes et al. [68], and utilize the Bootstrap 5000 structural equation model. Bootstrap is a resampling method that allows us to estimate a distribution function (denoted as $T(F)$) for a given statistical property (e.g., expectation, variance, confidence interval) based on a set of observed data. This distribution function may be unknown or non-existent, so we need to create a pseudo-dataset by resampling the original data and then compute the desired probability distribution of $T(F)$. This involves three steps: randomly sampling with replacement, estimating the mediating effect from the drawn samples, and computing confidence intervals for the mediating effect (based on $N = 5000$ estimates of the mediating effect). Notably, in environmental volunteering research, it is common to assess the chain mediation effect through the Bootstrap method [69–71].

This paper aims to investigate the factors that influence the participation of environmental volunteers trained in environmental science in China. We participated in the voluntary activity of waste sorting in City H as a research case. City H was one of the first Chinese cities to implement waste sorting voluntary activities. In this study, university alumni volunteers who have experienced professional training in environmental science in City H were taken as the research objects. A total of 2349 volunteer questionnaires were collected, and the number of required volunteers was obtained from 13 districts and counties in City H through stratified sampling. A total of 25 questionnaire items were used in the study, and 2303 effective observations were obtained by using the list deletion method for the observations with 5 or more missing items or obvious wrong answers. In addition, the study utilized face-to-face interviews with subjects to minimize potential confounds that could affect the reliability and validity of the questionnaire results. Therefore, the study had a high-quality sample.

According to the research of Lacasse, K et al. [12,16,72], this research incorporates the nine hypotheses outlined in the Section 2 into the questionnaire items. In this regard, the present study features the following items: First, regarding previous professional training, participants were asked to indicate whether they had a degree related to environmental science, and what was their highest degree? The possible responses included (1) No environmental science-related degree; (2) Environmental science-related degree and the highest degree is a bachelor's degree; (3) Environmental science-related degree and the highest degree is a master's degree; (4) Environmental science-related degree and the highest degree is a doctorate degree; (5) Possess a degree related to environmental science, have a doctorate degree and continue to engage in environmental science research after PhD graduation. Second, inquiring into their willingness to participate in environmental protection volunteer activities in the future, participants were asked to respond to the following item: "Do you want to participate in environmental protection volunteer activities in the future?" The possible responses included (1) Not willing; (2) Relatively unwilling; (3) Moderately; (4) Relatively willing; and (5) Willing. Third, participants were asked to describe their sense of responsibility for environmental volunteering to determine their identity. Possible responses include (1) Not related to me; (2) Relatively irrelevant; (3) Moderately; (4) Relatively related; (5) Highly related. Finally, the participants were asked to express their feelings about participating in the environmental protection voluntary process. In response to the item "Do you feel fulfilled and pleasure in participating in the environmental protection voluntary process?" the possible responses ranged from (1) Very boring; (2) Relatively boring; (3) No feeling; (4) Relatively amusing; to (5) Very amusing (See Table 1).

Table 1. Questions Items of Questionnaire.

Indexes	Questions	Items
Previous professional training	Whether you have a degree related to environmental science, and what was their highest degree?	(1) No environmental science-related degree (No), (2) Environmental science-related degree (Yes) and the highest degree is a bachelor's degree; (3) Yes and the highest degree is a master's degree; (4) Yes and the highest degree is a doctorate degree; (5) Yes and have a doctorate degree and continue to engage in environmental science research after PhD graduation.
Willingness to participate	Do you want to participate in environmental protection volunteer activities in the future?	(1) Not willing; (2) Relatively unwilling; (3) Moderately; (4) Relatively willing; and (5) Willing.
Responsibility and Identity	Do you think environmental volunteering is your responsibility?	(1) Not related to me; (2) Relatively irrelevant; (3) Moderately; (4) Relatively related; (5) Highly related.
Feelings about participating	Do you feel fulfilled and pleasure in participating in the environmental protection voluntary process?	(1) Very boring; (2) Relatively boring; (3) No feeling; (4) Relatively amusing; to (5) Very amusing.

Pearson correlation analysis revealed significant positive correlations between professional training and participation willingness ($r = 0.798$, $p < 0.01$), volunteer identity ($r = 0.909$, $p < 0.01$), and voluntary emotion (positive) ($r = 0.711$, $p < 0.01$). Volunteer identity also exhibited significant positive correlations with participation willingness ($r = 0.883$, $p < 0.01$) and voluntary emotion (positive) ($r = 0.863$, $p < 0.01$), while voluntary emotion (positive) was significantly positively correlated with participation willingness ($r = 0.867$, $p < 0.01$). These results suggest that the study's hypotheses have been preliminarily verified. Thus, the study holds significant research value for subsequent parallel mediation and serial mediation models.

4. Results

The present study aimed to investigate the relationship between the test variables and the mediation effect, while controlling for the demographic characteristics of the sample, such as gender, age, and income. To this end, we conducted an empirical analysis and the results are presented in Tables 2 and 3.

Table 2. Direct Effect of Professional training on Participation Willingness.

Effect	SE	t	p	95% Confidence Interval	
				Lower Limit	Upper Limit
0.137	0.019	7.407	0.000	0.174	0.101

Table 3. Intermediary Test Results of Indirect Effect of Professional training on Participation Willingness.

Path	Effect	BootSE	95% Confidence Interval	
			Lower Limit	Upper Limit
TOTAL	0.529	0.016	0.499	0.56
Ind1 *	0.257	0.016	0.225	0.288
Ind2	−0.163	0.01	−0.184	−0.144
Ind3	0.436	0.018	0.401	0.471

* The three paths that do not directly affect (intermediary) are: (1) Ind1: professional training → identity → willingness; (2) professional training → pleasure → willingness; (3) professional training → identity → pleasure → willingness.

Table 2 shows that the professional training has a significant direct impact on environmental protection voluntary participation willingness. The observed effect of professional training and participation willingness is 0.137, which is statistically significant at the 0.001 level. This finding indicates that the higher the degree of receiving professional training in environmental science, the higher the willingness to participate in follow-up

volunteer activities. Thus, the validity of Hypothesis 1 is confirmed, which serves as the cornerstone of the subsequent hypothesis analysis. Hypothesis 1 posits the direct impact of professional training on participation willingness in environmental protection volunteerism, and its confirmation provides the basis for subsequent hypothesis testing. The outcome of the analysis sheds light on the significant role of professional training in influencing the propensity to engage in voluntary activities. The reported findings are consistent with the results of previous research that underscore the importance of professional training in promoting volunteerism.

This study aimed to examine the mediating effects of professional training, voluntary identity, and voluntary emotion on the relationship between environmental protection voluntary professional training and participation willingness. The sample was controlled for demographic characteristics such as gender, age, and income, and the results of the mediation analysis are presented in Tables 2 and 3. The findings in Table 2 demonstrate that there is a positive and direct relationship between environmental protection voluntary professional training and participation willingness, with an effect size of 0.137, which is statistically significant at the 0.001 level. This result supports Hypothesis 1, which is the central hypothesis of this study and provides the basis for subsequent analyses. The results presented in Table 2 reveal the mediating effects of the three mediating paths, where the first mediating path (professional training → identity → willingness) has a statistically significant positive effect size of 0.529 at the 0.001 level. This suggests that environmental protection volunteer professional training has a positive impact on voluntary identity, which, in turn, increases the willingness of volunteers to participate. Thus, Hypothesis 4 is valid. Conversely, the second mediating path (professional training → pleasure → willingness) has a negative effect size of -0.163 , which is statistically significant at the 0.001 level. This implies that environmental protection volunteer professional training has a negative impact on volunteer happiness, resulting in lower participation willingness. Therefore, Hypothesis 7 is deemed invalid. The third mediating path (professional training → identity → pleasure → willingness) has a positive effect size of 0.436, which is statistically significant at the 0.001 level. This finding indicates that voluntary identity and voluntary emotion have a positive mediating effect on the relationship between professional training and participation willingness. Thus, Hypothesis 9 is supported. The analysis of Hypotheses 4, 7, and 9 shows that professional training in environmental science does not necessarily produce positive emotions for volunteers participating in environmental protection volunteering, and may even lead to negative emotions. This may be due to burnout from repeated work. However, the sense of identity obtained through participating in environmental protection volunteer services can indirectly trigger positive emotions, and ultimately affect the willingness to participate.

In addition to the four hypotheses discussed earlier, we also investigated the paths associated with the remaining five hypotheses, as illustrated in Figure 2. The path coefficient of professional training and voluntary identity is 0.909, which is statistically significant at the 0.001 level, indicating that the higher the degree of participation in receiving professional training in environmental science, the stronger the identity of the volunteers. Thus, Hypothesis 2 is valid. The path coefficient of voluntary identity and participation willingness is 0.335, which is statistically significant at the 0.001 level, demonstrating that the stronger the volunteers' sense of identity, the greater their willingness to participate in future environmental protection activities. Therefore, Hypothesis 3 is also valid. On the other hand, the path coefficient of professional training and voluntary emotion is -0.280 , which is statistically significant at the 0.001 level, indicating that the higher the degree of professional training for volunteers, the more likely they are to have negative emotions in volunteer activities. Thus, Hypothesis 5 is not supported. However, the path coefficients of voluntary emotion and participation willingness are 0.584, which is statistically significant at the 0.001 level, revealing that volunteers with a higher sense of happiness are more likely to participate in future environmental protection volunteer activities. Therefore, Hypothesis 6 is confirmed. Lastly, the path coefficients of voluntary identity and voluntary

emotion are 0.250, which is statistically significant at the 0.001 level, indicating that identity boosts volunteers' positive emotions. Thus, Hypothesis 8 is supported. Ultimately, all nine hypotheses were verified. Table 4 shows the validation of the nine hypotheses.

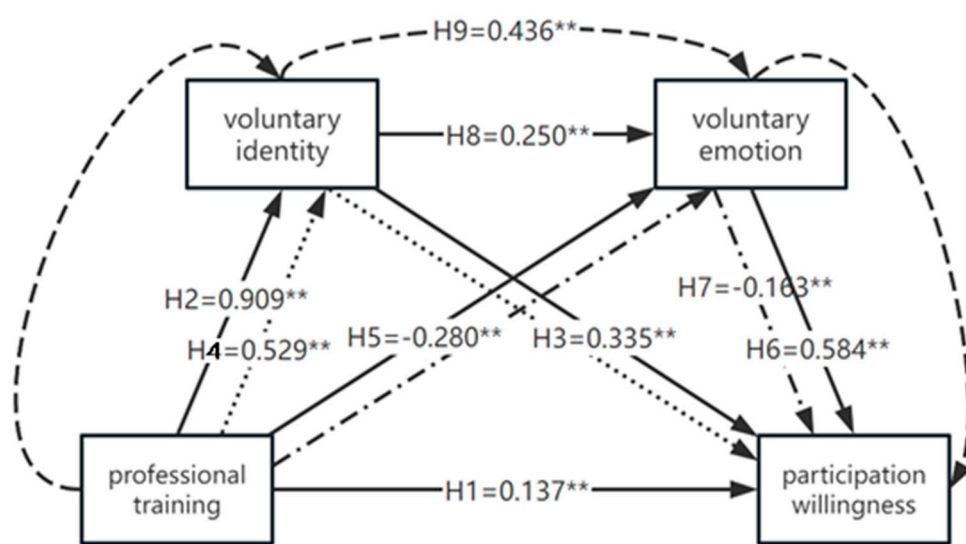


Figure 2. Validation of the Research Model. ** refers to $p < 0.05$.

Table 4. The Validation of the Nine Hypotheses.

No.	Hypotheses	Validation
1	Professional training (especially in environmental science) has a positive effect on participation willingness in environmental protection volunteers.	Valid
2	Professional training (especially in environmental science) has a positive effect on voluntary identity.	Valid
3	Voluntary identity has a positive effect on participation willingness.	Valid
4	Voluntary identity mediates the relationship between professional training (especially in environmental science) and participation willingness.	Valid
5	Professional training (especially in environmental science) has a positive impact on voluntary emotion (positive).	Invalid
6	Voluntary emotion (positive) has a positive impact on participation willingness.	Valid
7	Voluntary emotion (positive) mediates the relationship between professional training (especially in environmental science) and participation willingness.	Invalid
8	Voluntary identity has a positive impact on voluntary emotion (positive).	Valid
9	Voluntary identity and voluntary emotion (positive) play a chain-mediating role between professional training (especially in environmental science) and participation willingness.	Valid

5. Discussion

The present investigation serves to confirm the salubrious spillover effects of environmental protection volunteerism and sheds light on the indispensable contribution of voluntary identity and voluntary emotion to engendering such effects. These findings underscore the primacy of self-identity in instigating individuals to engage in environmental protection volunteerism [12,16,72]. Through the validation of nine hypotheses, this study evinces the import of autonomous motivation, environmental protection control goals, sense of group belonging, environmentalist labels, and identities in engendering positive

spillover effects of environmental protection volunteerism. To be more precise, this inquiry yields three theoretical contributions. Firstly, it demonstrates that the spillover effect of environmental protection volunteerism is not a straightforward process of augmenting willingness to participate, but rather encompasses a series of intricate mediators and mediating mechanisms, with personal identity and positive emotions playing indispensable roles. Secondly, the study exposes the existence of not only affirmative but also unfavorable spillover effects (e.g., professional training → emotion) in environmental protection voluntary conduct, which can be ameliorated or adjusted via mediator intervention. Thirdly, unlike the dominant approach that emphasizes a solitary explanatory pathway, this paper adopts a comprehensive perspective of the multifarious mechanism underlying the “more training, more willingness” phenomenon by introducing various mediators, such as parallel and serial identification and emotion.

Drawing on the aforementioned findings, it is our contention that the government ought to adopt an effective intervention strategy to galvanize volunteers’ proclivity to participate in environmental protection volunteer activities. As far as the negative spillover effect is concerned, in environmental protection volunteering activities, because highly trained people no longer need to acquire knowledge through participating in volunteering activities, volunteering becomes a boring “repetitive job”. This is the determining factor for the appearance of negative emotions in this type of volunteer. This inference is in line with the observations of scholars who identify the curtailment of personal benefit as the principal cause of negative spillover [21]. Thus, the government should foster individual self-motivation in environmental protection volunteer activities by offering incentives, support measures, medical safeguards, and the like, rather than compelling or pressuring volunteers to partake in activities [73]. Moreover, the government should broadly disseminate the social value and normative objectives of environmental protection volunteerism to activate volunteers’ environmental protection volunteerism goals [74]. By doing so, the individual’s identity label and behavioral identity can resonate with the professional-issued identity, thereby engendering a positive spillover effect [13,15,16]. We emphasize that the objective of government intervention is not to coerce volunteers to participate in environmental protection volunteerism, but to inculcate identity and identity in volunteers’ consciousness and mobilize their enthusiasm for participation.

Collective action theory can provide further insights into the spillover effects of environmental protection volunteerism. According to collective action theory, individuals are more likely to engage in collective action when they perceive a sense of group identity and shared goals [75,76]. Identity also functions as a regulatory mechanism by imposing social sanctions on those who violate environmental norms. When individuals engage in actions that harm the environment or deviate from the community’s expectations, social identity holds them accountable. These sanctions can range from social disapproval or exclusion to more formal mechanisms, depending on the severity of the norm violation. Collectively, the processes of social approval and social sanctions foster a sense of collective responsibility and cooperation among community members. By aligning individual behaviors with shared norms, social identity promotes a sense of belonging and encourages mutual support in pursuing environmental protection goals. This collective action orientation not only enhances the effectiveness of environmental conservation initiatives but also contributes to the resilience and sustainability of communities [58–60]. This theory aligns with the findings of this study, which suggest that a sense of group belonging and environmentalist labels can engender positive spillover effects in environmental protection volunteerism. Identity exerts a powerful influence on individuals’ attitudes and behaviors. In the context of environmental conservation, identity within a community serves as a guiding force that encourages adherence to shared norms and values [44,45,62]. Furthermore, collective action theory suggests that the success of collective action is contingent upon the ability of individuals to overcome collective action problems, such as free-riding and coordination issues [77,78]. In the context of environmental protection volunteerism, these problems may arise when volunteers trained in environmental science perceive their professional

knowledge as being undervalued or underutilized in group activities. To overcome these problems, it is important for the government to foster a sense of collective efficacy and shared responsibility among volunteers, emphasizing the importance of each individual's contribution to the group's success [79,80]. By doing so, volunteers trained in environmental science may be more willing to participate in group activities and contribute their professional knowledge to the collective effort.

In summary, collective action theory can provide valuable insights into the spillover effects of environmental protection volunteerism, emphasizing the importance of group identity, shared goals, and overcoming collective action problems. By adopting an effective intervention strategy that fosters individual self-motivation and collective efficacy, the government can mobilize volunteers' enthusiasm for participation and engender positive spillover effects in environmental protection volunteerism. The objective of government intervention should not be to coerce volunteers to participate in environmental protection volunteerism, but to inculcate identity and mobilize their enthusiasm for participation.

6. Conclusions

Despite the prevalence of intervention studies focusing on target behaviors, the potential spillover effects on other outcomes are often neglected [11]. To address this gap, this study delves into the underlying mechanisms that drive the positive spillover effect of environmental protection volunteerism in the university alumni group trained in environmental science. Drawing on the theory of planned behavior and the theory of cognitive balance, the study employs a parallel mediation model and a serial mediation model to elucidate how cognitions impact emotions and willingness to participate in environmental protection volunteerism. Notably, the findings reveal that previous professional training of environmental protection volunteers enhances their future willingness to volunteer. Specifically, the study identifies two paths from volunteer behavior to willingness: (1) professional training → identity → willingness; and (2) professional training → identity → pleasure → willingness. These results underscore the critical role of identity as the primary mediator of environmental protection volunteer participation, highlighting the need to translate identity into tainted attitudes that promote environmental protection volunteers' participation willingness.

Despite the valuable insights provided by this study, there are certain limitations that should be acknowledged. First, the study focuses specifically on the university alumni group trained in environmental science, which may limit the generalizability of the findings to other populations or contexts. It would be beneficial for future research to explore the spillover effects of environmental protection volunteerism in different demographic groups and settings. Second, the study relies on self-reported measures, which may be subject to social desirability bias and may not always accurately reflect participants' actual behaviors or motivations. Future studies could incorporate objective measures or observational data to provide a more comprehensive understanding of the relationships between cognitions, emotions, and volunteer behavior. Building on the limitations mentioned above, several avenues for future research can be identified. Firstly, conducting similar studies in diverse populations and contexts would help establish the generalizability of the findings. For instance, comparing the spillover effects of volunteerism between different age groups, cultural backgrounds, or occupational settings could provide valuable insights into the underlying mechanisms that drive volunteer behavior. Secondly, future research should aim to investigate the influence of social norms and self-efficacy on volunteer behavior and participation willingness. Understanding how societal expectations and individuals' beliefs in their own abilities affect their decision to engage in environmental protection volunteerism can further enhance our understanding of volunteer motivation and participation.

This study holds several significant implications for policymakers, practitioners, and researchers interested in promoting environmental protection volunteerism. By highlighting the importance of identity as a mediator of volunteer participation, the study emphasizes the need for strategies that foster a sense of identity and belonging among

volunteers. Policymakers can leverage this knowledge by implementing measures that support volunteers' identities and provide resources to enhance their self-motivation. Given the significance of these findings, policymakers and practitioners can leverage them to promote volunteerism. In particular, the study highlights the importance of identity volunteers as a means to motivate them to participate in environmental protection activities. Rather than coercing or stressing volunteers to participate, policymakers can provide identity, support measures, and medical security to encourage individual self-motivation. Publicizing the social value and normative goals of environmental protection volunteerism can also activate volunteers' environmental protection volunteerism goals, resulting in positive spillover effects. The aim of government intervention should not be to compel volunteers to participate, but rather to internalize identity and identity in their cognition and mobilize their enthusiasm for participation. Despite these insights, future research should seek to determine the generalizability of these findings to other environmental protection contexts and populations. Additionally, future studies could examine the role of other factors, such as social norms and self-efficacy, in predicting volunteer behavior and participation willingness.

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