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The Impact of University Students' Environmental Awareness on Pro-Environmental Behavior --Based on a Survey of University Students in Chongqing

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Abstract

Based on comprehensive social survey data from several universities in Chongqing, this study uses multiple linear regression analysis and structural equation modeling to explore the influence mechanism of environmental awareness on university students' environmental protection behaviors. Environmental awareness is divided into four dimensions: environmental concern, environmental risk perception, environmental efficacy, and personal norms. The direct and indirect effects of these dimensions on private and public sphere pro-environmental behaviors are examined separately. The results indicate that environmental concern directly affects university students' private and public sphere environmental protection behaviors. Environmental risk perception has a significant positive driving effect on private sphere environmental protection behaviors, while personal norms have a significant negative impact on private sphere environmental protection behaviors. Environmental efficacy and personal norms have significant negative effects on public sphere environmental protection behaviors.

Keywords: Environmental Awareness, Pro-environmental behaviors, Value-Belief-Norm Theory (VBN), University Student

1. Introduction

In today's era, global environmental issues such as climate change, resource scarcity, and biodiversity loss are becoming increasingly severe, presenting significant challenges to the sustainable development of the Earth's ecosystems and human society. In such a context, exploring the factors that influence individual environmental protection behavior is of critical practical significance for promoting environmental protection actions across society. In recent years, there has been growing academic and practical interest in the relationship between environmental awareness and environmental protection behavior, and research on this relationship has gradually increased. Existing studies mainly focus on the following aspects (Zhang, 2021; Shi & Yu, 2024；Li, 2020; Zhang & Song, 2019): first, exploring the direct impact of environmental awareness on environmental protection behavior, that is, how individuals' environmental cognition, emotions, and values translate into specific environmental actions; second, studying the mediating variables between environmental awareness and environmental protection behavior, such as the role of psychological factors like personal values and self-efficacy; and third, analyzing the differences between different groups (such as corporate employees, community residents, farmers, etc.) in the relationship between environmental awareness and environmental protection behavior. However, existing research has certain limitations. On one hand, most studies focus on the general public or specific professional groups, with fewer studies on university students. Yet, university students are the backbone of future society, with strong social and communication abilities, and their environmental awareness and behavior can influence a wider population through channels such as social networks. Therefore, research on environmental awareness and behavior in university students is of great significance. On the other hand, existing studies tend to focus on the impact of one or a few environmental

awareness dimensions on environmental protection behavior, and there is a lack of systematic and in-depth exploration of the complex relationships between the various dimensions of environmental awareness and their relationship with environmental protection behavior. This has led to an incomplete and inaccurate understanding of the mechanisms underlying university students' environmental protection behavior (Bai, 2017).

To address the two shortcomings of previous research, Stern's VBN theory not only provides a more comprehensive explanation of these shortcomings but also allows further development. Therefore, this study draws on the VBN theory to examine the impact of environmental awareness on the environmental protection behavior of university students. Stern classified value orientations into ecological values, altruistic values, and egoistic values (Stern, 2000). Values influence the formation of beliefs, which include ecological worldview (environmental values), environmental behavior outcomes, and responsibilities (Zhang, Hu & Wang, 2017). Values, through beliefs and personal norms, affect environmental behavior. Once beliefs are activated, personal norms are also activated, prompting the transformation of environmental intentions into actual behavior (Yang, Ye, Tang, et al., 2023). Based on the VBN theory, this study divides environmental awareness into four dimensions: the value dimension, represented by environmental concern, reflects an individual's attention to and concern about environmental issues; the belief dimension includes environmental risk perception and self-efficacy, the former being the cognition of environmental risks, and the latter being confidence in the effectiveness of environmental protection actions; the normative dimension, represented by personal norms, reflects internal environmental ethical standards and a sense of responsibility. Therefore, this study focuses on university students in Chongqing, and through a comprehensive consideration of these four dimensions of environmental awareness, it aims to deeply analyze the impact mechanism of environmental awareness on university students' environmental protection behavior. The goal is to address the shortcomings of existing research and provide more targeted and effective theoretical support and practical guidance for promoting environmental protection education and practices among university students. Based on the above analysis, the research framework of this paper is shown in Figure 1.

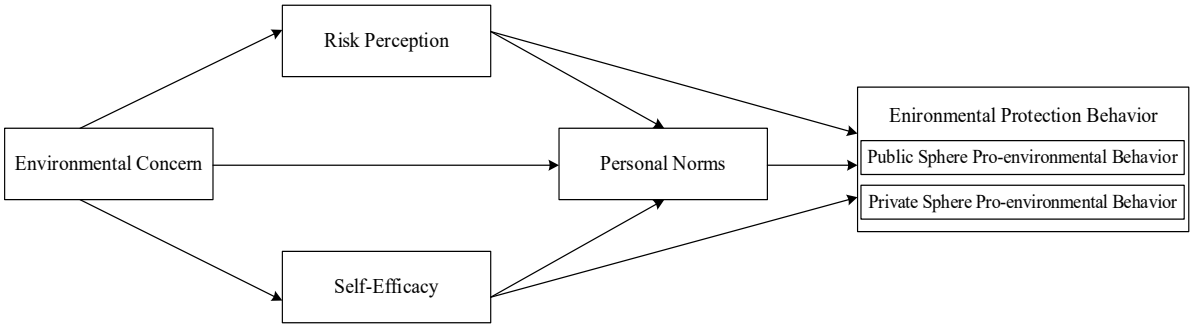

Figure 1. Analysis framework of the impact of environmental awareness on environmental protection behavior

2 Literature Review and Research Hypotheses

2.1 Environmental Concern and Environmental Protection Behavior

Previous studies have found that university students with high levels of environmental concern are more likely to engage in pro-environmental behaviors, such as water conservation and reducing energy consumption (Schultz, 2001). When students are highly concerned about environmental issues, they regard environmental protection as an important personal value and adopt various pro-environmental behaviors in daily life to practice this value (He, 2019). At the same time, this concern also drives them to actively participate in public environmental protection activities, thus promoting the achievement of broader environmental protection goals (Zhang, Ma, & Hu, 2024). However, some studies have pointed out that although some university students express concern about environmental issues, they may not actively translate this concern into pro-environmental behaviors due to a lack of environmental knowledge or constraints related to personal habits and economic factors (Zhang, Fang & Chen, 2024; Wu & Shen, 2016; Liu & Wu, 2013). Therefore, it is necessary to further explore the mediating variables that affect the transformation of environmental concern into environmental protection behavior in order to better understand this relationship. In summary, environmental concern has a potentially positive impact on university students' pro-environmental behaviors, but this relationship is constrained by various factors. Based on this, the following two hypotheses are proposed:

Hypothesis 1a: The higher the level of environmental concern among university students, the higher their involvement in private sphere pro-environmental behaviors.

Hypothesis 1b: The higher the level of environmental concern among university students, the higher their involvement in public sphere pro-environmental behaviors.

2.2 Environmental Risk Perception, Self-Efficacy, and Environmental Protection Behavior

Environmental risk perception influences environmental protection behavior by increasing an individual's awareness of the necessity of such behaviors, thereby affecting their behavioral intentions and actual behaviors. It has a significant positive impact on university students' pro-environmental behaviors (Liu, 2024; Li, 2024). When students' perception of environmental risks increases, they are more likely to recognize the seriousness and urgency of environmental issues, thus being more inclined to engage in pro-environmental behaviors (Bai, 2017). Self-efficacy, on the other hand, reflects an individual's confidence in their ability to effect positive environmental outcomes through their actions (Zhang, 2023). By enhancing an individual's confidence in their own abilities, self-efficacy facilitates the transformation of environmental protection intentions into actual behavior. Individuals with high self-efficacy believe that their environmental protection actions can make a positive impact on the environment, which increases their motivation to engage in such behaviors (Zhang & Song, 2019). Most existing studies focus on environmental values to explore factors influencing

environmental protection behavior (Zhang, 2023; Sun, Qu, & Ye, 2024; Zhang & Du, 2024). However, the complex relationships between environmental risk perception, self-efficacy, and environmental protection behavior have not been systematically and deeply explored, leading to an incomplete and inaccurate understanding of the mechanisms behind university students' pro-environmental behaviors. In conclusion, both environmental risk perception and self-efficacy play significant positive roles in driving university students' private and public sphere pro-environmental behaviors. Based on this, the following two hypotheses are proposed:

Hypothesis 2a: Both environmental risk perception and self-efficacy positively drive university students' private sphere pro-environmental behaviors.

Hypothesis 2b: Both environmental risk perception and self-efficacy positively drive university students' public sphere pro-environmental behaviors.

2.3 Personal Norms and Environmental Protection Behavior

Previous research has found a positive correlation between personal norms and environmental protection behavior (Chen, 2024). Specifically, university students with higher levels of personal norms are more likely to engage in various pro-environmental behaviors in their daily lives, such as waste sorting and reducing energy consumption, and are more willing to participate in environmental protection public service activities (Riaz, Gul, & Lee, 2023). In addition, they are more actively involved in public sphere pro-environmental behaviors (Bao & Yan, 2020). When university students have higher levels of personal norms, they regard environmental protection as a moral responsibility, thereby adhering to this norm in their daily lives by engaging in behaviors such as choosing green travel options, in order to promote broader environmental protection goals. In summary, personal norms influence university students not only in terms of specific behaviors but also in terms of their moral sense of responsibility for environmental protection and active participation in social environmental protection activities. Therefore, cultivating personal norms among university students not only helps to enhance their environmental awareness and behaviors but also contributes to the achievement of broader environmental protection goals. Based on the above analysis, the following two hypotheses are proposed:

Hypothesis 3a: The higher the level of personal norms among university students, the higher their involvement in private sphere pro-environmental behaviors.

Hypothesis 3b: The higher the level of personal norms among university students, the higher their involvement in public sphere pro-environmental behaviors.

2.4 The Indirect Impact of Environmental Concern on Environmental Protection Behavior

Environmental concern, environmental risk perception, self-efficacy, and personal norms are interrelated and mutually influential, collectively affecting university students' pro-environmental behaviors. Environmental values reflect public concern for the environment. When individuals are highly concerned about environmental issues, they are more likely to seek

information related to environmental risks, thereby increasing their level of environmental risk perception (Bao & Yan, 2020). University students who express high concern for environmental issues are more willing to acquire knowledge and information about environmental risks. This heightened environmental risk perception further enhances their willingness to engage in pro-environmental behaviors (Huang, 2024). Additionally, university students who are highly concerned about environmental issues engage in a series of pro-environmental behaviors that enhance their self-efficacy, making them more willing to adopt green lifestyles. They believe their efforts can contribute to environmental improvement (Bao & Yan, 2022; Liu & Zheng, 2018). This high level of self-efficacy motivates them to adopt more pro-environmental behaviors in their personal lives and to organize and participate in environmental protection activities. Furthermore, environmental concern influences university students' personal norms. When individuals are highly concerned about environmental issues, they view environmental protection as a moral responsibility, thus exhibiting higher levels of personal norms (Huang, 2024). This high level of personal norms motivates them to engage in personal pro-environmental behaviors such as waste sorting and reducing energy consumption (Yao, 2024), and also drives them to promote social-level environmental protection actions. Based on the above analysis, the following two hypotheses are proposed:

Hypothesis 4a: University students' environmental concern can indirectly affect their private sphere pro-environmental behaviors through environmental risk perception, self-efficacy, and personal norms.

Hypothesis 4b: University students' environmental concern can indirectly affect their public sphere pro-environmental behaviors through environmental risk perception, self-efficacy, and personal norms.

3. Data Sources, Variable Measurement, and Analytical Methods

3.1 Data Sources

The data for this study were collected from a survey conducted among students from key universities, regular undergraduate colleges, and higher vocational colleges in the main urban area of Chongqing. Two universities were selected from each category of institution for the survey. After screening and organizing the data, a total of 444 valid questionnaires were obtained.

3.2 Variable Measurement

3.2.1 Dependent Variable

Environmental protection behavior is the dependent variable in this study. The survey included 14 questions related to pro-environmental behaviors. The response options for each item were "never," "rarely," and "frequently," which were coded as 1, 2, and 3, respectively. A higher score indicates that the students engage in pro-environmental behaviors more frequently. Principal

component analysis was used, and the Cronbach's alpha for items 1-7 was 0.6950, with a KMO value of 0.7572. For items 8-14, the Cronbach's alpha was 0.8836, with a KMO value of 0.8949. Both the reliability and validity were high, meeting the conditions for factor analysis. Through exploratory factor analysis, items 1-7 were labeled as public sphere pro-environmental behaviors, and items 8-14 were labeled as private sphere pro-environmental behaviors.

3.2.2 Independent Variables

Environmental awareness is the main independent variable in this study. A 15-item scale was designed to measure environmental concern. Each item had five response options: strongly agree, agree, undecided, disagree, and strongly disagree, which were coded as 5, 4, 3, 2, and 1, respectively. All options were reverse-scored. Principal component analysis of these 15 items revealed that the Cronbach's alpha was 0.8691, with a KMO value of 0.8843, indicating high reliability and validity, and meeting the conditions for factor analysis. The items were aggregated into an environmental concern index, where a higher value indicates a stronger level of environmental concern among the students.

Environmental risk perception tested the students' awareness of 13 types of environmental risks. The five response options were: not severe, not very severe, neutral (undecided), somewhat severe, and very severe, which were coded as 1, 2, 3, 4, and 5, respectively. The Cronbach's alpha for this scale was 0.9588, with a KMO value of 0.9522, demonstrating high reliability and validity. Through exploratory factor analysis, all pollution risks were grouped into one factor, named environmental risk perception. A higher value indicates a greater level of environmental risk perception among the students.

The self-efficacy scale included 7 items, with the response options being strongly agree, undecided, disagree, and strongly disagree, which were coded as 5, 4, 3, 2, and 1, respectively. The Cronbach's alpha was 0.8980, with a KMO value of 0.8854, indicating high reliability and validity. Through exploratory factor analysis, all items were aggregated into a self-efficacy factor. A higher value indicates a stronger confidence and positive attitude towards environmental efficacy among the students.

The personal norms scale included 9 items. The response options were strongly agree, agree, undecided, disagree, and strongly disagree, which were coded as 5, 4, 3, 2, and 1, respectively. The Cronbach's alpha was 0.8691, with a KMO value of 0.9160, showing high reliability and validity. Through exploratory factor analysis, all items were aggregated into a personal norms index. A higher value indicates a higher level of personal norms among the students.

Descriptive analyses of the dependent variables, independent variables, and control variables are presented in Table 1.

3.3 Statistical Analysis Methods

The statistical analysis methods used in this study consist of two main parts. First, multiple linear

regression analysis was conducted to examine the impact of environmental concern, environmental risk perception, self-efficacy, and personal norms on students' environmental protection behavior. Second, structural equation modeling (SEM) was performed using the SEM command in Stata software, and mediation analysis was employed to reveal the mechanisms through which the four dimensions of environmental awareness influence two types of environmental protection behavior, as well as the differences in the influence mechanisms of environmental awareness on these behaviors.

Table 1. Descriptive analysis of key variables

Variables	N	Mean	Standard Deviation	Min	Max
Control Variables					
Gender	444	0.412	0.493	0	1
Age	444	22.937	2.381	15	27
Education Level	444	15.324	1.822	6	19
Place of Household Registration	444	3.131	0.712	1	4
Dependent Variables					
Private Sphere Environmental Behavior	444	16.975	2.733	7	21
Public Sphere Environmental Behavior	444	14.408	3.778	8	24
Independent Variables					
Environmental Risk Perception	444	51.572	10.400	13	65
Environmental Efficacy	444	14.858	4.027	7	21
Personal Norms	444	24.678	4.668	11	33
Environmental Concern	444	32.313	6.043	15	45

4. Research Results

4.1 Analysis of the Driving Effect of Environmental Awareness on Private Environmental Protection Behavior

4.1.1 Direct Driving Effect of Environmental Awareness on Private Environmental Protection Behavior

This study primarily employs multiple linear regression analysis to examine the driving effect of four dimensions of environmental awareness on private environmental protection behavior. The results are detailed in Table 2. As shown in the table, the overall significance of the eight models is less than 0.01, indicating that all eight models pass the test.

Model 1 is the baseline model, which only includes control variables. The results show that the level of private environmental protection behavior in males is lower than that of females. College students from urban areas have lower levels of private environmental protection behavior compared to those from rural areas. College students with higher levels of education exhibit higher levels of private environmental protection behavior. The age variable does not have a significant impact on private environmental protection behavior.

Model 6 incorporates all variables simultaneously for analysis. The analysis results of each independent variable show that the coefficient of environmental concern increased from 0.007 in Model 2 to 0.064 ($P<0.01$) in Model 6, indicating that environmental concern has a significant positive effect on private environmental protection behavior, and Hypothesis 1a is supported. The coefficient of environmental risk perception increased from 0.056 in Model 3 to 0.061 ($P<0.001$), suggesting that environmental risk perception still has a significant positive driving effect on private environmental protection behavior. The impact of self-efficacy on private environmental protection behavior remains insignificant, indicating that compared to self-efficacy, college students` perception of environmental risk is more likely to enhance their private environmental protection behavior, and Hypothesis 2a is not supported. The coefficient of personal norms decreased from -0.069 in Model 5 to -0.091 ($P<0.01$), with the significance increasing, indicating that personal norms continue to negative drive college students' private environmental protection behavior, and Hypothesis 3a is not supported.

Although the direct effect of environmental concern on private environmental protection behavior is highly significant in Model 6, the total effect of environmental concern on private environmental protection behavior is not significant in Model 2. Therefore, the above data analysis does not conclusively determine whether environmental concern has an impact on private environmental protection behavior. Environmental concern may also exert an indirect effect on private environmental protection behavior through other variables. This study will further investigate environmental concern as an independent variable and the other three dimensions as mediating variables. By constructing a mediation effect model, the study aims to systematically analyze the pathways of environmental concern`s effect on private environmental

protection behavior and comprehensively clarify the action patterns of the multiple mediation mechanisms.

Table 2. Multiple regression analysis of the driving effect of environmental awareness on private sphere environmental protection behavior

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
gender	-0.616*	-0.617*	-0.474+	-0.629*	-0.656*	-0.535*
	（0.261）	（0.261）	（0.257）	（0.261）	（0.260）	（0.255）
age	0.012	0.011	-0.004	0.015	0.005	-0.022
	（0.054）	（0.054）	（0.053）	（0.054）	（0.054）	（0.053）
Education level	0.122+	0.124+	0.135+	0.115	0.107	0.125+
	（0.074）	（0.074）	（0.072）	（0.074）	（0.074）	（0.072）
Place of Household Registration	-0.357+	-0.359+	-0.254	-0.336+	-0.353+	-0.253
	（0.191）	（0.191）	（0.188）	（0.191）	（0.189）	（0.186）
Environmental Concern		0.007				0.064**
		（0.021）				（0.024）
Environmental Risk Perception			0.056***			0.061***
			（0.012）			（0.012）
Environmental Efficacy				-0.052		-0.019
				（0.032）		（0.037）

Personal Norms					-0.069*	-0.091**
					（0.027）	（0.033）
Intercept	16.191***	15.959***	13.082***	16.955***	18.296***	13.925***
	（1.818）	（1.938）	（1.902）	（1.875）	（1.994）	（2.114）
N	444	444	444	444	444	444
R^2	0.035	0.035	0.079	0.041	0.048	0.105
P	0.004	0.008	0.000	0.003	0.001	0.000

Note. $^{+}$ P < 0.1, * P < 0.05, ** P < 0.01, *** P < 0.001, the data in parentheses represents the standard error.

4.1.2 Mediating Effect of Environmental Concern on Private Environmental Protection Behavior

Table 3 analyzes the total effect, direct effect, and mediating effect of environmental concern on private environmental protection behavior. The data shows that environmental concern has no significant total effect on private environmental protection behavior (b = 0.008, P>0.1), which is consistent with the conclusion of Model 2 in Table 2. The direct effect of environmental concern on private environmental protection behavior is relatively significant (b = 0.064, P<0.05). Environmental risk perception, environmental efficacy, and personal norms, as mediating variables, have a highly significant overall mediating effect (b = -0.056, P<0.001). The analysis results confirm the previous theoretical model and analytical framework, indicating that environmental risk perception, environmental efficacy, and personal norms have a significant negative mediating effect between environmental concern and private environmental protection behavior. Environmental concern indirectly and negatively influences private environmental protection behavior through the mediating pathways of the three dimensions. Hypothesis 4a was not validated.

Table 3. Decomposition of the driving effect of environmental concern on private sphere environmental protection behavior

Effect Name	b	SE	Z	P	95% Confidence Interval	
					Upper	Lower
Total Effect	0.008	0.026	0.280	0.778	-0.034	0.048
Direct Effect	0.064	0.030	2.120	0.034	0.005	0.123
Mediating Effect	-0.056	0.015	-3.730	0.000	-0.086	-0.027

4.2 Analysis of the Driving Effect of Environmental Awareness on Public sphere Environmental Protection Behavior

4.2.1 Direct Driving Effect of Environmental Awareness on Public sphere Environmental Protection Behavior

This study still uses multiple linear regression analysis to examine the driving effect of the four dimensions of environmental awareness on public sphere environmental protection behavior. The results of the analysis are shown in Table 4.

Model 1 is the baseline model, which includes only the control variables. The results show that the four control variables—gender, age, education level, and household registration—have no significant impact on public sphere environmental protection behavior.

Model 6 included all variables for analysis. The analysis results of each independent variable show that the coefficient of environmental concern for public environmental protection behavior increased from -0.001 in Model 2 to 0.057 ($P<0.1$), indicating a positive impact of environmental concern on public environmental protection behavior, thus confirming Hypothesis 1b. The coefficient of environmental risk perception decreased from -0.015 in Model 3 to -0.016 ($P>0.1$), and the effect of environmental risk perception on public environmental protection behavior remains insignificant. Environmental efficacy has a significantly negative driving effect on public environmental protection behavior ($b = -0.126$, $P<0.05$), suggesting that the level of environmental efficacy among university students does not enhance their public environmental protection behavior, thus Hypothesis 2b was not validated. The coefficient of personal norms on public environmental protection behavior also changed from -0.105 in Model 5 to -0.084 ($P<0.1$), and personal norms still negatively affect university students' public environmental protection behavior, meaning Hypothesis 3b was not confirmed.

Although the direct effect of environmental concern on public sphere environmental protection behavior is significant in Model 6, the total effect of environmental concern on public sphere environmental protection behavior is not significant in Model 2. Therefore, the above data analysis does not provide a precise conclusion about whether environmental concern impacts public sphere environmental protection behavior. Environmental concern may also indirectly influence public sphere environmental protection behavior through other variables (Wen & Ye, 2014). Similar to private sphere environmental protection behavior, this study needs to use environmental concern as the independent variable and the remaining three dimensions as mediating variables to construct a mediation effect model.

Table 4. Multiple regression analysis of the driving effect of environmental awareness on public sphere environmental protection behavior

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
gender	0.349	0.349	0.312	0.314	0.287	0.217
	（0.365）	（0.365）	（0.367）	（0.361）	（0.363）	（0.364）
age	-0.112	-0.112	-0.108	-0.106	-0.123	-0.118
	（0.076）	（0.076）	（0.076）	（0.075）	（0.075）	（0.075）
Education level	0.042	0.041	0.038	0.023	0.018	0.012
	（0.103）	（0.104）	（0.104）	（0.103）	（0.103）	（0.103）
Place of Household Registration	-0.388	-0.387	-0.414	-0.332	-0.381	-0.377
	（0.266）	（0.267）	（0.268）	（0.264）	（0.264）	（0.265）
Environmental Concern		-0.001				0.057+
		（0.030）				（0.034）
Environmental Risk			-0.015			-0.016

Perception						
			（0.018）			（0.018）
Environmental Efficacy				-0.138**		-0.126*
				（0.044）		（0.053）
Personal Norms					-0.105**	-0.084+
					（0.038）	（0.047）
Intercept	17.409***	17.454***	18.217***	19.439***	20.635***	20.940***
	（2.540）	（2.708）	（2.718）	（2.599）	（2.782）	（3.014）
N	444	444	444	444	444	444
R^2	0.014	0.014	0.016	0.035	0.031	0.048
P	0.183	0.285	0.227	0.007	0.018	0.005

Note. + P < 0.1, * P < 0.05, ** P < 0.01, *** P < 0.001, the data in parentheses represents the standard error.

4.2.2 Mediation Effect Test of Environmental Concern on Public sphere Environmental Protection Behavior

Table 5 analyzes the total effect, direct effect, and mediating effect of environmental concern on public environmental protection behavior, with environmental concern as the independent variable. The data shows that environmental concern has no significant total effect on public environmental protection behavior (b = -0.001, P>0.1), which is consistent with the conclusion of Model 2 in Table 4. The direct effect of environmental concern on public environmental protection behavior is not significant (b = 0.057, P>0.1). Environmental risk perception, environmental efficacy, and personal norms, as mediating variables, have a significant overall mediating effect (b = -0.058, P<0.01). The analysis results are largely consistent with the previous research hypotheses, indicating that environmental risk perception, environmental efficacy, and personal norms have a significant negative mediating effect between environmental

concern and private environmental protection behavior. Environmental concern indirectly and negatively influences public environmental protection behavior through the mediating pathways of the three dimensions. Hypothesis 4b was not validated.

Table 5. Decomposition of the driving effect of environmental concern on public sphere environmental protection behavior

Effect Name	b	SE	Z	P	95% Confidence Interval	
					Upper	Lower
Total Effect	-0.001	0.031	-0.050	0.963	-0.002	0.123
Direct Effect	0.057	0.039	1.450	0.146	-0.200	0.133
Mediating Effect	-0.058	0.022	-2.670	0.008	-0.101	-0.015

5. Conclusion and Recommendations

5.1 Research Conclusions

1). Environmental concern mainly affects university students' private and public environmental protection behaviors. Environmental concern, through the mediating roles of environmental risk perception, environmental efficacy, and personal norms, can have an indirect negative impact on students' environmental protection behaviors.

2). Environmental risk perception has a significant positive driving effect on private environmental protection behaviors, while personal norms have a significant negative impact on private environmental protection behaviors. The stronger the environmental risk perception, the more likely students are to engage in private environmental protection behaviors; the stronger the personal norms, the lower the level of private environmental protection behaviors.

3). Environmental efficacy and personal norms have significant negative effects on public environmental protection behaviors. The stronger the environmental efficacy, the lower the level of students' public environmental protection behaviors; the stronger the personal norms, the lower the level of public environmental protection behaviors.

5.2 Policy Recommendations

1). Enhancing university students' environmental awareness and risk perception: By strengthening education and publicity about environmental issues, students' attention to the environment can be increased. This can be achieved through organizing lectures, activities, and other means to help students understand the severity of environmental risks and stimulate their enthusiasm for participating in environmental protection actions. At the same time, specific cases can be presented to show the positive effects of environmental protection actions, enhancing students' sense of responsibility and motivation.

2). Optimizing university students' personal behavioral norms and collective actions: By advocating for social norms that promote a green lifestyle, university students can adjust their personal habits and encourage the widespread adoption of environmental protection behaviors. Organizing collective environmental protection activities will raise students' awareness of participating in public environmental protection projects, enhance their sense of environmental efficacy, and help them realize the importance and impact of collective actions.

3). Enhancing the perceived effectiveness of students' environmental protection behaviors: University students have not fully engaged in social development, and their sense of environmental efficacy may not directly reflect their confidence in their own environmental protection behaviors. By showcasing specific results from environmental protection actions, students can see that their actions can have a real impact. Participating in actions like waste sorting, water and electricity conservation, etc., will allow students to see how their efforts can bring about change, thereby boosting their confidence in environmental protection and positively promoting their environmental protection behaviors.

5.3 Research Limitations and Future Research

The limitation of this study is that it only focused on university students from several universities in Chongqing, which may not fully represent all Chinese university students. Future research could use broader survey data to analyze the causal relationship between environmental awareness and environmental behaviors among contemporary Chinese university students.

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Declarations

Competing Interests and Funding:

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Financial Interests

The authors declare they have no financial interests.

Compliance with Ethical Standards

Ethical Approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent

Informed consent was obtained from all individual participants included in the study.

Data Availability

The datasets generated during the current study are available from the corresponding author on reasonable request.

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