Factors Influencing Public-Sphere Pro-Environmental Behavior among Mongolian College Students: A Test of Value–Belief–Norm Theory

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Abstract: Value–belief–norm (VBN) theory provides a valuable framework for identifying the social-psychological determinants of various types of pro-environmental behavior. However, limited empirical study has tested the applicability of VBN theory in the western minority areas of China. Given Mongolian college students’ crucial role in promoting the sustainable development of the Inner Mongolia Autonomous Region (IMAR) of China, this study investigates how VBN clusters of variables, namely, values, the new environmental paradigm (NEP) and pro-environmental personal norms (PPN), influence Mongolian college students’ self-reported public-sphere pro-environmental behavior (PSPB). The subjects were 1034 Mongolian college students from three large public universities in Hohhot. A structural equation model (SEM) and bootstrapping analyses revealed that: (1) altruistic values have a significant positive influence on PSPB, egoistic values negatively influence PSPB, and biospheric values have no significant influence on PSPB; (2) egoistic values negatively predict NEP and biospheric values positively predict NEP, whereas altruistic values have no direct impact on NEP; (3) NEP has a positive influence on PPN; (4) PPN has a significant positive impact on PSPB; and (5) biospheric and egoistic values have an indirect effect on PSPB through NEP and PPN. The findings provided evidence for the cross-cultural applicability of VBN theory in a Mongolian college student sample. Theoretical and practical implications were discussed, and recommended directions for future research were suggested.

Keywords: value-belief-norm (VBN) theory; public-sphere pro-environmental behavior (PSPB); values; new environmental paradigm (NEP); pro-environmental personal norms (PPN); Mongolian college students

1. Introduction

It is widely acknowledged that environmental problems are mainly rooted in human behavior [1–3]. How to change people’s behavior and construct a harmonious relationship between nature and human beings has been an unanswered question in various disciplines. In social science, the endeavors of sociologists and psychologists may be divided into two basic lines of research [4]. One of these research lines has focused on identifying the sociodemographic factors related to pro-environmental behavior, such as gender [5], age [6], place of residence [7], ethnicity [8], income [9] and education [10]. Another line has focused on the influences of social-psychological determinants,
such as the influence of values, norms, attitudes, sense of control, personality and place attachment on pro-environmental behavior and has been tested over the last 40 years [11].

At the same time, theoretical frameworks in sociology and social psychology have been widely utilized by researchers to build a logical connection between various social-psychological constructs and pro-environmental behavior. One of the most representative theoretical models may be the value–belief–norm (VBN) theory proposed by Stern and colleagues [12,13] based on the norm-activation model (NAM), the value-basis theory and the new environmental paradigm (NEP) perspective [14–17]. The VBN theory proposes that individuals’ values drive beliefs and, in turn, norms which directly motivate individuals’ pro-environmental behavior. Empirical research repeatedly provides empirical support for the predictive power of VBN clusters of variables on various pro-environmental behavioral indicators. Therefore, it has received substantial recognition and is widely used to test the relationships among individual values, attitudes and beliefs, and various types of pro-environmental behavior.

The university setting may be seen as an effective place to promote individual pro-environmental behavior through the connection of values, beliefs, personal norms and external action. College students, whose values and beliefs are in a transitional state, are a unique group to test and expand VBN theory [18]. However, studies of college students’ pro-environmental behavior and its antecedents within the VBN framework have mainly been conducted in Western contexts. In recent years, increasing numbers of studies have addressed this topic in China given growing awareness of worsening environmental conditions in the last decade. Most of these pioneering studies were conducted in developed areas of China, such as Beijing, Shanghai, Guangzhou, and Nanjing, and focused on students’ pro-environmental behavior in the private sphere [19–21]. Little empirical research exists on minority college students in the undeveloped western areas of China.

The Inner Mongolia Autonomous Region (IMAR), the national strategic energy base and ecological barrier of China, spans three districts from the north-west to the north-east and north of the country and plays a vital role in ensuring the energy and ecological security of the nation. Since the adoption of the Western Development Strategy in 1999, a critical political decision by the central government of China to promote the economic and social development of the 12 western provinces and municipalities, the GDP of IMAR experienced rapid growth from 2000 to 2010 through large-scale resource development and utilization. However, this economic boom did not materially benefit the local people but instead dampened their future due to the problem of environmental deterioration, including grassland degradation, air and water pollution [22], which has seriously threatened regional sustainable development and public health.

Mongolian college students, the reserve forces of local construction in IMAR, have an important voice and impact on the sustainable development of the local economy, society and environment. They benefit from the development while suffering from the damage of environmental deterioration, which motivates their strong demand for environmental improvement. The promotion of their active participation in public-sphere pro-environmental behavior (PSPB) may effectively alleviate or even solve environmental problems in IMAR, since PSPB can indirectly change the behaviors of many people and organizations by influencing public policies [13]. For example, in the spring of 2011, environmental damage from mining triggered Mongolian college students’ involvement in massive protests and conflicts. To quell the widespread protests in IMAR, the government adopted more stringent and explicit environmental policies to regulate the local mining industry [23,24]. There is an urgent need to understand the influences of different social-psychological antecedents on Mongolian college students’ PSPB and to promote their participation in PSPB rationally from the actors’ perspectives based on a comprehensive theory framework.

Therefore, the purpose of the present study is to examine whether the causal chain of the VBN model can also be applied to PSPB in a sample of Mongolian college students, thus providing cross-cultural evidence for the generalization of VBN theory. Furthermore, with a comprehensive understanding about what motivates Mongolian college students to engage in PSPB, this study can
provide practical guidance for the design of environmental education for youth and for environmental policy decisions.

2. Theoretical Background and Hypotheses

2.1. Value–Belief–Norm (VBN) Theory

The VBN theory was proposed by Stern and colleagues [12,13] and systematically integrates the norm-activation model (NAM) theory [14,15] in social psychology, the value-basis theory [16] in environmental psychology, and the new environmental paradigm (NEP) perspective [17] in environmental sociology. Social-psychological variables in the VBN model, namely, values, beliefs, norms, and pro-environmental behavior, constitute a causal chain in which each variable directly affects the next and may also directly affect variables farther down the chain. The integration mechanism of VBN theory is described as follows.

The basic premise of the NAM theory is that moral or personal norms are direct determinants of pro-environmental behavior [25], and norms and behaviors are grounded in values concerned with the welfare of others (altruistic values), the welfare of oneself (egoistic values), and the welfare of the biosphere (biospheric values) according to value-basis theory [26]. As an ecological worldview, NEP is not as general or stable as values. Stern et al. [27] developed a connection between NEP and NAM with the argument that NEP is a generalized environmental belief or a sort of “folk ecology” that may play a mediating role in the relationship between generalized values and specific attitudes, beliefs, behavioral intentions, and behavior. Applications of the VBN vary in the way belief is measured, and most studies focus on general environmental beliefs [18]. In addition, some researchers consider NEP an indicator of the awareness of consequences in NAM in testing the relationship between social-psychological factors and pro-environmental behavior [28]. Since its proposal, VBN has been widely employed to explain many specific pro-environmental behaviors in the private or public sphere, such as green consumer behavior [29–32], biodiversity conservation [33,34], travel behavior [35–37], sustainability behavior [18,38], recycling [39,40], energy conservation [41–46], transport modes [47–49], and support for pro-environmental policies [50–53]. Because of value orientations, the new environmental paradigm (NEP) and pro-environmental personal norms (PPN) are vital predictors of pro-environmental behavior in the VBN framework [54]. This study focuses on the connection among three types of values, NEP, PPN, and public-sphere pro-environmental behavior (PSPB) among Mongolian college students. Based on VBN theory, the framework for empirical analysis in this study is demonstrated in Figure 1.

![Figure 1. Research framework.](image-url)
2.2. Public-Sphere Pro-Environmental Behavior (PSPB)

Scholars have used various terms to describe behaviors that benefit the environment. The literature includes a large number of terms that are similar to pro-environmental behavior, including environmentally significant behavior [13], responsible environmental behavior [55], ecological behavior [56], and environmentally conscious behavior [57]. Regarding the definition of pro-environmental behavior, Stern [13] noted that it can be described in two aspects, namely, behavioral impact and behavioral intention. The former emphasizes the direct changes made by human beings on the environment, whereas the latter stresses the purpose and goal of environmental protection. To understand and change target behaviors, it is necessary to adopt an intention-oriented definition that focuses on people’s beliefs and motives. Following Stern [13], pro-environmental behavior should be defined as human activities that generate intention that relates to environment protection or environmental deterioration prevention.

Generally, researchers have treated pro-environmental behavior as multi-dimensional. Similar to the multiple terminologies and definitions used, the classification of pro-environmental behavior also varies. For example, Sia et al. [55] classified pro-environmental behavior into five categories (persuasion, consumer action, ecological management, political action and legal action). Smith-Sebasto and D’Costa [58] divided it into six dimensions (civic action, educational action, financial action, legal action, physical action and persuasive action). Karp [59] proposed three dimensions of pro-environmental behavior (good citizen behavior, environmental activism and healthy consumer behavior). Stern [13] proposed four types of pro-environmental behavior, namely, environmental activism, non-activist behaviors in the public sphere, private-sphere environmentalism and other environmentally significant behaviors (such as influencing the actions of organizations). In recent studies, Lavelle et al. [60] divided pro-environmental behavior into chronic behavior and occasional behavior, and then MacDonald and She [61] categorized it into curtailting, political and efficiency behavior. Although the types of pro-environmental behavior are quite diverse, the basic connotation of these types is similar to that reflected in public-sphere or private-sphere pro-environmental behavior [62]. Public-sphere pro-environmental behavior involves practical behaviors by which individuals can protect the environment through their own individual efforts (time and energy) to directly influence environmental quality. Public-sphere pro-environmental behavior refers to actions that cause environmental impacts indirectly through the public domain [63].

Compared to other classifications, one major advantage of the public-private classification is that it can cover a wide range of behaviors without being limited by the developmental level and cultural differences of a society. Therefore, the public-private classification is widely used in empirical studies conducted not only in developed countries but also in developing countries, such as countries in Latin America, the Philippines [64], Egypt [65] and China [62,66,67]. For instance, Xiao and Hong [66] used data from the Chinese General Social Survey (CGSS) in 2003 to test gender differences in the pro-environmental behavior of urban residents in China with this classification. However, with regard to the impact of social psychological factors on pro-environmental behavior, previous studies have mainly concentrated on the private sphere, and attention to PSPB is relatively lacking. Thus, this paper specifically focuses on the influence that social psychological variables exert on the PSPB of Mongolian college students.

2.3. Values

Values are conceptualized as important life goals or standards that serve as guiding principles in a person’s life [68]. Values are different from beliefs because values play a role as an organizational system in one’s life and are viewed as determinants of attitudes and behaviors [69]. Schwartz [70,71] developed a broad model for classifying the dimensions of values, with 56 value items representing 10 universal value types. These 10 value types can be further reduced to 4 value categories: openness to change, conservatism, self-transcendence, and self-enhancement. Researchers repeatedly found that self-transcendence and self-enhancement in general values were closely related to pro-environmental
attitudes, intentions and behavior [59,72–74]. For example, by means of quantitative research, Jia et al. [75] revealed that self-transcendence moral values positively predicted environmental actions of university students in a mid-sized American university, which was supported by their following narrative research.

Stern and colleagues [16,76,77] extracted three different values that might affect pro-environmental beliefs and behavior from Schwartz’s universal values, namely, egoistic values (i.e., values focusing on maximizing individual outcomes), social-altruistic values (i.e., values reflecting concern for the welfare of others), and biospheric values (i.e., values emphasizing the environment and the biosphere). Studies have shown that egoistic, altruistic and biospheric values can be clearly distinguished empirically [78,79]. A large number of studies have examined the relationship between these three values and pro-environmental behavior [29,79–82]. For example, Jansson et al. [29] found that biospheric values determine consumers’ willingness to curtail the negative effects of car use and determine the willingness to use a so-called environmentally friendly car. De Groot and Steg [80] also found that students who strongly endorsed egoistic values were less likely to prefer a car that performed highly on environmental aspects, whereas altruistic and, especially, biospheric values were positively related to the environmental performance of the car. In a recent study, Whitley et al. [18] revealed that these three values play a stable function in predicting college students’ sustainable behavior in the public sphere. More specifically, they found that college students who adhered to biospheric and altruistic values were more likely to engage in PSPB, such as supporting environmental protection policy, whereas those who adhered to egoistic values were less likely to engage in such behavior. Therefore, the following hypotheses are proposed:

H1a: Biospheric values have a significant positive influence on PSPB.
H1b: Altruistic values have a significant positive influence on PSPB.
H1c: Egoistic values have a significant negative influence on PSPB.

Value–belief–norm (VBN) theory assumes that the three types of values have a direct and positive influence on general beliefs. This assumption has received support from many empirical studies. For instance, Steg et al. [83] found that the higher the scores on the biospheric value orientations, the higher the new environmental paradigm (NEP), whereas egoistic values negatively related to NEP. Similar results were also shown in two studies conducted by De Groot and Steg [79]. In study 1, the contribution of altruistic values to the explanation of NEP was small but significant, but this result was not replicated in study 2. However, both study 1 and study 2 found a significant contribution of biospheric and egoistic values to the explanation of NEP. In a recent survey of paddy farmers in Malaysia, Chua et al. [54] demonstrated that three values were important predictors of NEP. Specifically, egoistic and altruistic values exerted small effects, whereas biospheric values exerted medium effects on NEP. Although the existing literature fails to provide robust evidence for the connection of altruistic values and NEP, taking the cultural and social differences of samples into consideration, we expect that all three types of values have direct impacts on NEP. Therefore, the following hypotheses are developed:

H2a: Biospheric values have a significant positive impact on NEP.
H2b: Altruistic values have a significant positive impact on NEP.
H2c: Egoistic values have a significant negative impact on NEP.

2.4. New Environmental Paradigm (NEP)

NEP is the fundamental worldview and mind-set that people have toward the environment and emphasizes the harmonious interaction between humans and nature [17]. In accordance with VBN theory, beliefs have a direct influence on individual norms. Specifically, individuals who hold general beliefs about environmental welfare are more likely to develop pro-environmental personal norms (PPN) [16]. With the framework of VBN theory, several studies have examined the direct link between
NEP and PPN. For example, Chua et al. [54] discovered that NEP had a significant positive influence on PPN in a sample of paddy farmers. In a sample consisting of students, faculty and staff from Michigan State University, Yeboah and Kaplowitz [84] also found that NEP exerted a positive and significant effect on PPN. Based on these findings, the direct relationship between the NEP and PPN of Mongolian college students will be tested in this research. We propose the following hypothesis:

**H3:** NEP has a significant positive effect on PPN.

### 2.5. Pro-Environmental Personal Norms (PPN)

PPN are the sense of moral obligation to behave pro-environmentally [54]. In the chain model of VBN, PPN are the ultimate predictor of pro-environmental behavior. There is ample empirical evidence that PPN contribute significantly to behaviors performed with pro-environmental intent. Among these studies, some researchers have tested the predictive effects of PPN on various types of public-sphere pro-environmental behavior (PSPB). Steg et al. [83] found that PPN explained almost 30% of the variance in the acceptability of energy policies. More specifically, the stronger the PPN, the more people supported policies aimed at reducing CO$_2$ emissions. In a recent study on the determinants of urban residents’ environmental complaints in China, Zhang et al. [85] demonstrated that the PPN of citizens could influence environmental complaint intention positively and significantly. In the university environment, researchers have also found that the PPN of college students are a positive predictor of support for environmental policies [18]. Thus, this study proposes the following hypothesis:

**H4:** PPN positively and directly affect PSPB.

### 2.6. The Mediation Effects among Variables

Value–belief–norm theory postulates the causal order of values, general belief, and norms that influence specific behavior [12,13]. In other words, values may have an indirect effect on specific pro-environmental behavior through the multiple mediation of intervening variables in the causal chain of the VBN model. Most researchers have been interested in testing the indirect effects in part of the causal chain. For example, Nordlund and Garvill [74] revealed that PPN mediated the path from general values and environmental values to pro-environmental behavior. Chua et al. [54] found that NEP functioned as a mediator in the relationship between biospheric values and PPN as well as between egoistic values and PPN. Although only a few studies have contributed to examining direct and mediating effects in the entire causal chain with small sample sizes from countries in Europe and Latin America [36,83], we still anticipate that there exist multiple mediating relationships within the whole chain model of VBN in this study. Accordingly, the following hypotheses are suggested:

**H5a:** Values indirectly influence PPN through NEP.

**H5b:** Values indirectly influence PSPB through NEP and PPN.

**H5c:** NEP indirectly influences PSPB through PPN.

### 3. Methodology

#### 3.1. Sample

Participants in this study were Mongolian undergraduates at three public universities located in Hohhot, the capital of Inner Mongolia. Survey questionnaires were administered to a total of 1200 students enrolled in social science elective courses to create a comparable sample. At the end of the courses, questionnaires were distributed to students by the research assistants. Participation was voluntary and anonymous, and informed consent was given by students. A total of 1118 questionnaires were returned. After removing questionnaires in which more than 15% of the questions were not
answered on any scale, 1034 valid responses were ultimately used for data analysis. The final sample included 687 females (66.4%) and 347 males (33.6%). In terms of the type of home town, 587 students (56.8%) came from urban areas and 447 students (43.2%) came from rural or pastoral areas. A total of 227 students reported monthly family income of less than 1000 RMB (22%), 387 students reported family income between 1000 RMB and 4000 RMB (37.4%), 203 students reported family income between 4000 RMB and 7000 RMB (19.6%), and 217 students reported family income above 7000 RMB (21%).

3.2. Measurement

The questionnaire was composed of two parts. Part one required participants to provide their socio-demographic information, including gender and type of home town. Part two was the measurement of values, NEP, PPN and PSPB. All of the construct measures were adapted from previous literature. We reworded some items to better fit Mongolian college students’ real experiences.

For the dependent variable, PSPB was measured using five items adapted from the public-sphere dimension of the pro-environmental behavior scale developed by Xiao and Hong [66]. Participants were asked to describe how often they had performed 5 different PSPB in the past year. All items were answered on a five-point Likert type scale from “never” (1) to “always” (5).

For the measurement of values, a 12-item value scale revised by Steg et al. [83] was used to measure college students’ egoistic (four items), altruistic (four items), and biospheric (four items) value orientations [71]. The participants were asked to rate to what degree each of the 12 values functioned as a guiding principle in their life on a five-point Likert-type scale ranging from “not important” (1) to “very important” (5).

Four items of the Chinese version of the NEP scale were adapted from Wu et al. [86] to evaluate students’ general beliefs toward the environment in three aspects, namely, humans’ ability to upset the balance of nature, the existence of limits to growth, and humans’ right to rule over the rest of nature [17]. Responses were given on a five-point Likert-type scale ranging from “strongly disagree” (1) to “strongly agree” (5).

Four items used in previous research studies conducted by Gärling et al. [87] were used to assess students’ PPN. The participants were asked to respond to what extent they agreed with the statements targeting PPN, and each of the items was rated on a 5-point Likert-type scale ranging from “strongly disagree” (1) to “strongly agree” (5).

Table 1 displays the means, standard deviations, skewness and kurtosis of measured variables and items. As shown in Table 1, the mean of the variables ranged from 2.748 to 4.532, the standard deviation ranged from 0.594 to 1.175, the absolute values of skewness ranged from 0.002 to 1.445, and the absolute value of kurtosis ranged from 0.023 to 2.429. Skewness values were lower than 3 and kurtosis values were lower than 10 in this research, which indicated that the research data met the requirement of a multivariate normal distribution and subsequent data analyses could be conducted [88].
with the maximum-likelihood estimation method (see Supplementary Materials). CFA, SEM and bootstrapping analyses were performed using the Amos 23 software package was adopted because it allows the establishment and estimation of complex causal relationships among windows. AGFI, CFI, IFI and TLI should be higher than 0.90, and SRMR and RMSEA should be smaller than \(0.08\) \[90\]. Finally, we used bootstrapping method (5000 bootstrap samples) to test the serial multiple mediation effects within the causal chain of the VBN model to predict pro-environmental behavior. A 95% bias-corrected bootstrap confidence interval that does not include zero would provide evidence of significant indirect effects. Compared to the Sobel test or causal steps approach, bootstrapping procedures have better statistical power while reducing the possibility of Type 1 error \[91\]. 3.3. Data Analysis The data analysis was a three-step progress. First, the reliability and validity of the instruments were evaluated. Cronbach’s \(\alpha\) coefficient was used to assess the internal consistency reliability of the scales, and confirmatory factor analysis (CFA) was conducted to test the convergent validity and discriminant validity of the scales \[89\]. Second, structural equation modeling (SEM) was performed to test the hypothesized relationships among three types of values, new environmental paradigm (NEP), pro-environmental personal norms (PPN) and pro-environmental behavior (PSPB). The SEM method was adopted because it allows the establishment and estimation of complex causal relationships among multiple latent variables while controlling measurement errors. The indices that measured the model’s goodness-of-fit included the ratio of chi-square to the degree of freedom (\(\chi^2/df\)), goodness-of-fit index (GFI), adjusted goodness-of-fit index (AGFI), comparative fix index (CFI), incremental fit index (IFI), Tucker–Lewis index (TLI), standardized root mean square residual (SRMR), and root mean square error of approximation (RMSEA). For an index to be acceptable, \(\chi^2/df\) should not exceed 5, GFI, AGFI, CFI, IFI and TLI should be higher than 0.90, and SRMR and RMSEA should be smaller than 0.08 [90]. Finally, we used bootstrapping method (5000 bootstrap samples) to test the serial multiple mediation effects within the causal chain of the VBN model to predict pro-environmental behavior. A 95% bias-corrected bootstrap confidence interval that does not include zero would provide evidence of significant indirect effects. Compared to the Sobel test or causal steps approach, bootstrapping procedures have better statistical power while reducing the possibility of Type 1 error [91]. Descriptive statistics, correlation analysis and a reliability test were conducted with SPSS 23 for windows. CFA, SEM and bootstrapping analyses were performed using the Amos 23 software package with the maximum-likelihood estimation method (see Supplementary Materials).
4. Results

4.1. The Measurement Model

Based on the two-step procedure recommended by Anderson and Gerbing [89], CFA was first utilized to assess the fitness of the measurement model to research data before examining the structural relationships among variables. The measurement model included six latent variables and 25 observed variables. In CFA, latent variables were allowed to be freely correlated with each other, and observed variables were specified to load only on their respective latent factors. The result of CFA showed that the measurement model fit the data well ($\chi^2 = 960.924$; $df = 260$; $\chi^2/df = 3.696$; GFI = 0.926; AGFI = 0.907; CFI = 0.925; IFI = 0.926; TLI = 0.925; SRMR = 0.049; RMSEA = 0.051 [90% CI: 0.048, 0.055]). In addition, the factor loadings of all items were significant and above the standard value of 0.450 [90], ranging from 0.476 to 0.886, providing support for convergent validity. Figure 2 presents the results of the CFA.

We further tested the fitness of two alternative models, including a four-factor model (items of egoistic, altruistic, and biospheric values were loaded together on one latent construct) and a one-factor model (all items were loaded together on one latent construct). The results of CFA showed that for the four-factor model: $\chi^2 = 2802.536$, $df = 269$; $\chi^2/df = 10.418$; GFI = 0.730; AGFI = 0.752; CFI = 0.795; IFI = 0.731; TLI = 0.699; SRMR = 0.092; RMSEA = 0.095 [90% CI: 0.092, 0.099], and for the one-factor model: $\chi^2 = 5022.907$, $df = 275$; $\chi^2/df = 18.265$; GFI = 0.669; AGFI = 0.609; CFI = 0.493; IFI = 0.495; TLI = 0.447; SRMR = 0.127; RMSEA = 0.129 [90% CI: 0.120, 0.132]. The fit index of both alternative models failed to meet the recommended criteria [90]. The results of the chi-square statistic also demonstrated that the measurement model fit the data better than the four-factor model ($\Delta \chi^2 = 1841.612$, $df = 9$, $p < 0.001$) or the one-factor model ($\Delta \chi^2 = 4061.983$, $df = 15$, $p < 0.001$) did. These results offered evidence of the discriminant validity of the measurement model. After the CFA analysis, Cronbach’s $\alpha$ coefficients were computed to evaluate the internal reliability of the measures. The results showed that the Cronbach’s $\alpha$ coefficients of the scales ranged from 0.625 to 0.916, greater than the threshold of 0.6 [92]. Standard factor loading of all items and reliability estimates for the scales are listed in Table 2.

![Figure 2. The six-factor confirmatory factor analysis (CFA) results of the measurement model.](image-url)
Table 2. The standard factor loading of items and the reliability of the scales.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Measurement Items</th>
<th>Factor Loading</th>
<th>Cronbach’s α</th>
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<tr>
<td>Egoistic values (EV)</td>
<td>EV1</td>
<td>0.771</td>
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<td></td>
<td>EV2</td>
<td>0.680</td>
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<td></td>
<td>EV3</td>
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<td>EV4</td>
<td>0.659</td>
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<tr>
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<td></td>
<td>AV2</td>
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<td></td>
<td>AV3</td>
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<td>AV4</td>
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<td></td>
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</tbody>
</table>

As shown in Table 3, most of the correlation coefficients among variables were significant and had the anticipated sign. Specifically, public-sphere pro-environmental behavior (PSPB) was positively related to altruistic values, biospheric values, and pro-environmental personal norms (PPN), as expected. The expected relations between new environmental paradigm (NEP) and egoistic values, altruistic values and biospheric values were significant. However, a significant correlation was not observed between egoistic values and PSPB. Overall, the path model proposed in this study warrants further analyses.

Table 3. Results of correlations analysis.

<table>
<thead>
<tr>
<th>Variables</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Egoistic values</td>
<td>–</td>
<td>–</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Altruistic values</td>
<td>0.246***</td>
<td>–</td>
<td>–</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Biospheric values</td>
<td>0.179***</td>
<td>0.641***</td>
<td>–</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. New environmental paradigm</td>
<td>–0.110***</td>
<td>0.106**</td>
<td>0.152***</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>5. Pro-environmental personal norms</td>
<td>0.047</td>
<td>0.188***</td>
<td>0.250***</td>
<td>0.117***</td>
<td>–</td>
</tr>
<tr>
<td>6. Public-sphere pro-environmental behavior</td>
<td>–0.013</td>
<td>0.245***</td>
<td>0.238***</td>
<td>0.052</td>
<td>0.132***</td>
</tr>
</tbody>
</table>

*** p < 0.001, ** p < 0.01.

4.2. Structural Model

SEM analysis was conducted to test the hypothesized relationships among values, NEP, PPN and PSPB. The analysis revealed that the initial hypothesized model demonstrated good fit to the data: \( \chi^2 = 1024.439; \text{df} = 264; \chi^2/\text{df} = 3.880; \text{GFI} = 0.920; \text{AGFI} = 0.901; \text{CFI} = 0.919; \text{IFI} = 0.919; \text{TLI} = 0.908; \text{SRMR} = 0.062; \text{RMSEA} = 0.053 \, [90\% \text{CI}: 0.049, 0.056] \). Next, the statistical significance of the path coefficients among the variables was examined. Except for the path from altruistic values to NEP and
the path from biospheric values to PSPB, the other hypothesized paths were statistically significant. First, egoistic values ($\beta = -0.132$, $t = -3.229$, $p < 0.01$), altruistic values ($\beta = 0.310$, $t = 4.048$, $p < 0.001$), and PPN ($\beta = 0.101$, $t = 2.204$, $p < 0.05$) have significant effects on PSPB. Second, egoistic values ($\beta = -0.213$, $t = -5.097$, $p < 0.001$) and biospheric values ($\beta = 0.139$, $t = 2.085$, $p < 0.05$) have significant effects on NEP. Lastly, the effects of NEP ($\beta = 0.192$, $t = 4.123$, $p < 0.001$) on PPN are statistically significant. The effect of altruistic values ($\beta = 0.116$, $t = 1.554$, $p > 0.05$) on NEP and the effect of biospheric values on PSPB ($\beta = 0.022$, $t = 0.324$, $p > 0.05$) are not significant.

The initial model was revised by removing the two non-significant paths. The revised model also indicated a good fit to the research data: $\chi^2 = 1026.918$; $df = 266$; $\chi^2/df = 3.861$; GFI = 0.920; AGFI = 0.902; CFI = 0.919; IFI = 0.919; TLI = 0.908; SRMR = 0.063; RMSEA = 0.053 [90% CI: 0.049, 0.056]. The result of the chi-square statistical test shows that no significant difference exists between the initial model and revised model ($\Delta\chi^2 = 2.479$, $\Delta df = 2$, $p > 0.05$), proving that the revised model explains the data well. Therefore, this revised model was selected as the final model to explain further results. Figure 3 demonstrates the SEM results of the revised model.

Table 4 summarizes the unstandardized and standardized path coefficients among variables in the final model and presents corresponding statistical significances. Specifically, the effect of altruistic values on PSPB is $\beta = 0.330$ ($t = 6.798$, $p < 0.001$). The effects of egoistic values on PSPB and NEP are $\beta = -0.135$ ($t = -3.320$, $p < 0.001$) and $\beta = -0.192$ ($t = -4.890$, $p < 0.001$), respectively. The effect of biospheric values on NEP is $\beta = 0.224$ ($t = 5.840$, $p < 0.001$). The effect of NEP on PPN is $\beta = 0.192$ ($t = 4.124$, $p < 0.001$). Lastly, the effect of PPN on PSPB is $\beta = 0.104$ ($t = 2.285$, $p < 0.05$). Therefore, the hypotheses of H1b, H1c, H2a, H3 and H4 are supported, whereas H1a and H2b are not supported.
Table 4. Path coefficient estimate of the revised model.

<table>
<thead>
<tr>
<th>Path</th>
<th>Unstandardized Coefficient (B)</th>
<th>Standardized Coefficient (β)</th>
<th>S.E.</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>AV → PSPB</td>
<td>0.390</td>
<td>0.330 (***)</td>
<td>0.057</td>
<td>6.798</td>
</tr>
<tr>
<td>EV → PSPB</td>
<td>−0.120</td>
<td>−0.135 (***)</td>
<td>0.036</td>
<td>−3.200</td>
</tr>
<tr>
<td>EV → NEP</td>
<td>−0.191</td>
<td>−0.192 (***)</td>
<td>0.039</td>
<td>−4.890</td>
</tr>
<tr>
<td>BV → NEP</td>
<td>0.268</td>
<td>0.224 (***)</td>
<td>0.046</td>
<td>5.840</td>
</tr>
<tr>
<td>NEP → PPN</td>
<td>0.153</td>
<td>0.192 (***)</td>
<td>0.037</td>
<td>4.124</td>
</tr>
<tr>
<td>PPN → PSPB</td>
<td>0.117</td>
<td>0.104 (*)</td>
<td>0.051</td>
<td>2.285</td>
</tr>
</tbody>
</table>

EV = egoistic values; AV = altruistic values; BV = biospheric values; NEP = new environmental paradigm; PPN = pro-environmental personal norms; PSPB = public-sphere pro-environmental behavior. *** p < 0.001, * p < 0.05.

Bootstrapping analysis was performed to rigorously test the mediating relationships existing in the causal chain of VBN model. The results indicated that both egoistic values (indirect effect = −0.041, p < 0.001) and biospheric values (indirect effect = 0.027, p < 0.05) yield an indirect effect through new environmental paradigm on pro-environmental personal norms. Both egoistic values (indirect effect = −0.004, p < 0.05) and biospheric values (indirect effect = 0.003, p < 0.05) have an indirect influence on PSPB through the mediation of NEP and PPN. However, the indirect effects of altruistic values on PPN and on PSPB are not significant. Thus, the hypotheses of H5a and H5b are only partially supported. Finally, NEP has a significant indirect effect on PSPB through PPN (indirect effect = 0.019, p < 0.05). Hence, the hypothesis of H5c is verified. Table 5 demonstrates the results of mediation test using bootstrapping.

Table 5. Mediation test using bootstrapping.

<table>
<thead>
<tr>
<th>Path</th>
<th>Indirect Effect</th>
<th>95% Bias-Corrected CI</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>AV → NEP → PPN</td>
<td>0.022</td>
<td>−0.003 to 0.061</td>
<td>0.083</td>
</tr>
<tr>
<td>EV → NEP → PPN</td>
<td>−0.041</td>
<td>−0.072 to −0.019</td>
<td>0.000</td>
</tr>
<tr>
<td>BV → NEP → PPN</td>
<td>0.027</td>
<td>0.002 to 0.071</td>
<td>0.031</td>
</tr>
<tr>
<td>AV → NEP → PPN → PSPB</td>
<td>0.002</td>
<td>0.000 to 0.009</td>
<td>0.063</td>
</tr>
<tr>
<td>EV → NEP → PPN → PSPB</td>
<td>−0.004</td>
<td>−0.011 to −0.001</td>
<td>0.012</td>
</tr>
<tr>
<td>BV → NEP → PPN → PSPB</td>
<td>0.003</td>
<td>0.000 to 0.010</td>
<td>0.034</td>
</tr>
<tr>
<td>NEP → PPN → PSPB</td>
<td>0.019</td>
<td>0.004 to 0.044</td>
<td>0.016</td>
</tr>
</tbody>
</table>

EV = egoistic values; AV = altruistic values; BV = biospheric values; NEP = new environmental paradigm; PPN = pro-environmental personal norms; PSPB = public-sphere pro-environmental behavior.

5. Discussion

The aim of the present study was to test the cross-cultural applicability of the VBN theory in a Mongolian college student sample. We investigated the structural relationships among the VBN clusters of variables, namely, egoistic values, altruistic values, biospheric values, NEP, PPN and PSPB in this study.

Using SEM analysis, our study confirmed that: (1) altruistic values have a significant positive influence on PSPB, whereas egoistic values were found to have negative effects on PSPB; (2) egoistic values significantly and negatively affected NEP, while biospheric value significantly and positively predicted NEP; (3) NEP was found to have a significant impact on PPN; (4) PPN could significantly and positively influence PSPB; and (5) there exists multiple mediation in the VBN chain model. Although no significant relationship exists between altruistic values and NEP and between biospheric values and PSPB, the findings were basically in line with the causal chain relationship described in VBN theory and provided new evidence for the applicability and generalization of the VBN theory model in explaining PSPB.
First, this study highlighted the direct influence of values on PSPB. Egoistic values had a significant negative influence on PSPB, whereas altruistic values had a significant positive influence on PSPB and were the strongest predictor of PSPB based on the size of the standardized coefficients (see Table 3). The results are supported by previous studies [18,93], implying that college students whose lives are guided by their own welfare are reluctant to perform PSPB. In contrast, students who consider the welfare of other people the leading principle in their lives are more likely to engage in PSPB. Although college students scored the highest on the biospheric values scale, a significant direct influence of biospheric values on PSPB was not found. Apparently, altruistic values are more powerful for promoting PSPB than biospheric values are in this study. This may be because Mongolian educated elites mainly link environmental issues to ethnic politics and identity [24]. For example, when college students participated in the 2011 protests in IMAR, they expressed their strong discontent regarding the serious environmental and economic injustice to the local people and culture [23,24] but not directly regarding the damage to the natural environment itself.

Second, NEP could be positively predicted by biospheric values and could be negatively predicted by egoistic values. This finding suggests that individuals who value the welfare of the biosphere tend to form favorable perspectives about human–environmental relations and a higher level of concern about the natural environment. However, contrary to our expectation and a basic presumption of VBN theory, we did not find that altruistic values have a significant effect on NEP. This finding is supported by several previous studies that indicated that altruistic value orientations did not make a significant contribution to the explanation of NEP [76,83,94]. The major reason for the non-significant path between altruistic values and NEP may be the statistical artifact [79]. In other words, biospheric and altruistic values were strongly inter-correlated with a correlation coefficient of 0.641 ($p < 0.001$) (see Table 1), which makes it less likely for biospheric and altruistic values to contribute uniquely to the explanation of PSPB.

Third, this study found that NEP has a significant positive impact on PPN. This finding is consistent with VBN and NAM theory [13,70], which assert that individuals’ moral obligations to protect the environment can be activated by their positive view of human–nature interrelationships and awareness of ecological crises. More specifically, NEP acts as a filter between value orientations and behavior norms when people are facing or dealing with information about the relationship between humans and nature. If the information is in line with one’s value orientations, pro-environmental norms and other specific pro-environmental beliefs are more likely to be generated [16].

Fourth, our findings demonstrated that PPN has a significant positive influence on PSPB. This means that PPN plays an important role in linking general environmental belief and PSPB. This result is in accordance with theorists’ viewpoint that specific pro-environmental behavior may occur as a direct response to personal moral obligation related to such behavior [13,14]. This finding is also supported by previous studies conducted both in Western countries and in China [74,85,95,96]. However, it is worth noting that PPN is the weakest predictor of PSPB among the variables that have direct impacts on PSPB in this research. One possible explanation may be the difference in the predictive power of PPN on different types of pro-environmental behavior. Specifically, PPN appears to be powerful in explaining low-cost behavior but less successful when behavior is constrained by economic and behavioral factors, such as time, money, and effort [95]. PSPB is generally viewed as a purer and more active form of pro-environmental behavior than behavior in the private sphere because it requires much greater personal cost or sacrifice [97].

Finally, this study revealed that both biospheric values and egoistic values have an indirect influence on PSPB through the mediation of NEP and PPN. This result points to the fact that students who adhere to biospheric values tend to be more concerned about the environment, have a higher level of moral obligation of behaving pro-environmentally, and have a stronger intention to be involved with the PSPB, whereas those who adhered to egoistic values are less likely to care about the environment, perceive a lower level of moral obligation to protect the environment, and have a weaker willingness to perform PSPB. However, the mediation of NEP and PPN in the relationship between altruistic
values and PSPB is not significant in this research. This finding is slightly different from previous studies [48,83] which found that all three types of values have indirect effects on pro-environmental behavior through NEP and PPN. Just as we have described above, the reason may be that Mongolian college students tend to link environmental issues with the well-being of their ethnic group directly.

6. Conclusions and Future Directions

This study examined the role of clusters of social-psychological predictors on public-sphere pro-environmental behavior of Mongolian college students based on the value–belief–norm model. Our findings have both theoretical and practical implications.

Theoretically, we focused for the first time on empirically testing the applicability of VBN in an undeveloped minority area of China. The VBN theory framework has been widely used to explain various types of pro-environmental behavior in different groups with Western cultural backgrounds. This research further extends the scope of the application and generalization of VBN theory and provides valuable and validated framework and measurements for the future research in China. By contrast with previous literature, this research provides in-depth insights into the direct relationships between values and pro-environmental behavior, thus highlighting the crucial role of values in the VBN model in predicting the environmentalism of a young generation in minority areas of China. In addition, this study provides robust and precise evidence for both the direct and indirect effects in the causal linkage of the VBN model by conducting SEM and bootstrapping analysis rather than the Sobel tests adopted in previous researches.

Our findings also have important practical implications for educational program design and environmental policy-making in Inner Mongolia. Given the direct and mediation effects of VBN clusters of variables on PSPB verified in this study, students’ PSPB can be promoted directly by strengthening students’ altruistic values and personal norms. Universities should relate the contents and objects of educational programs more to the well-being of society. For example, a course topic about “coal mining caused grassland degradation” may not directly influence students’ behavior. However, an alternative topic “coal mining caused loss and damage to the livelihood of the Mongolian herders” may strengthen their intention to engage in PSPB. This is not to say that the biospheric values are not important; on the contrary, biospheric values can exert critical influence on PSPB through people’s general beliefs about environmental welfare and personal norms to perform environmentally. Therefore, it is important to foster students’ awareness of the contemporary environmental crisis and cultivate their sense of responsibility to behave pro-environmentally. Specifically, universities should increase their cooperation with local governments, communities, industries and non-governmental organizations (NGOs) in providing various forms of education for students, such as community-based [98], project-based [99] and problem-based learning [100] which can serve as a relevant forum for students to learn the adverse outcomes of environmental problems on the nature, society, community and people around them and to activate their personal norms to act in an environmentally friendly way. With regard to designing and implementing environmental policies, policy-makers should take the welfare of local people and their unique ethnic customs and cultures into consideration. Furthermore, it is also critical for the policy-maker to listen to the students’ opinions [101], thus enhancing students’ confidence in solving environmental problems and promoting the formation of personal norms toward environmental protection.

There are several limitations that should be considered in future studies. First, the results cannot be generalized to Mongolian college students in all types and levels of institutes of higher education because the sample students were from three major public universities in IMAR. Additionally, China is the largest developing country with multi-ethnic groups that face severe environmental problems. Future studies should consider various samples of other major ethnic minorities in China, such as the Zhuang, Uyghur, Tibetan, and Hui, thus providing further cross-cultural evidence or supplementing theories used to explain the driving factors of pro-environmental behavior. Second, we collected data by self-reported surveys during one period. Thus, these data may not reflect the contribution
of student development during higher education to changes in students’ values, beliefs, norms and behavior in a four-year period [102]. Hence, future studies are advised to adopt a longitudinal design to evaluate the causal relationships among variables in the VBN framework. Finally, China is the largest developing country with the world’s largest population, fastest-growing economy and unprecedented pressure from environmental degradation. In addition, Chinese social culture is different from Western countries and even differs from its neighbors, Korea and Japan. Therefore, future research should consider the unique cultural factors and cultural conflicts in China. For example, original Mongolian nomadic cultures maintain a value orientation of harmonious co-existence between humans and nature [103]. The way these cultures and values influence local people’s environmental beliefs, attitudes and behaviors should be further explored, which will produce additional theoretical and practical findings.

**Supplementary Materials:** The following are available online at http://www.mdpi.com/2071-1050/10/5/1384/s1.

**Author Contributions:** X.L. and Y.Z. conceived and designed the research; X.L. and J.W. conducted the survey; X.L. and Y.Z. analyzed the data and wrote the paper. J.W. contributed to the paper’s revisions.

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**Conflicts of Interest:** The authors declare no conflict of interest.

**References**


43. Fornara, F.; Pattitoni, P.; Mura, M.; Strazzera, E. Predicting intention to improve household energy efficiency: The role of value-belief-norm theory, normative and informational influence, and specific attitude. *J. Environ. Psychol.* 2016, 45, 1–10. [CrossRef]


60. Lavelle, M.J.; Rau, H.; Fahy, F. Different shades of green? Unpacking habitual and occasional pro-environmental behavior. *Glob. Environ. Chang.* 2015, 35, 368–378. [CrossRef]
79. De Groot, J.L.M.; Steg, L. Value orientations to explain beliefs related to environmental significant behavior: How to measure egoistic, altruistic, and biospheric value orientations. *Environ. Behav.* **2008**, *40*, 330–354. [CrossRef]
82. Van Doorn, J.; Verhoef, P.C. Drivers of and barriers to organic purchase behavior. *J. Retail.* **2015**, *91*, 436–450. [CrossRef]


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