

Article

The Importance of Environmental Knowledge for Private and Public Sphere Pro-Environmental Behavior: Modifying the Value-Belief-Norm Theory

Genovaitė Liobikienė ^{1,2,*}  and Mykolas Simas Poškus ³

¹ Department of Environmental Sciences, Vytautas Magnus University, LT-44404 Kaunas, Lithuania

² Lithuanian Institute of Agrarian Economics, LT-01113 Vilnius, Lithuania

³ Institute of Psychology, Mykolas Romeris University, LT-08303 Vilnius, Lithuania;
mykolas_poskus@mruni.eu

* Correspondence: genovaite.liobikiene@vdu.lt or genute77@gmail.com; Tel.: +370-6474-127

Received: 7 May 2019; Accepted: 14 June 2019; Published: 16 June 2019



Abstract: The promotion of pro-environmental behavior is regarded as very important in solving environmental problems. The Value-Belief-Norm (VBN) theory usually emphasizes internal factors; however, we have transformed this theory by including the environmental knowledge as an external factor. The results showed that action-related environmental knowledge was related to the ecological worldview and directly influenced the private sphere behavior. The ecological worldview, which in this paper was operationalized as environmental concern, had a direct effect on public sphere behavior and an indirect effect on private behavior through awareness of behavioral consequences. Thus, in this paper we revealed how specific environmental knowledge influenced pro-environmental behavior. We also suggest that it is important to educate people about local and global environmental problems, about the impact of behavior on the environment not only in private but also in the public sphere, and to foster the ecocentrism, as well. In addition, we revealed the meaning and necessity of education for environmental citizenship.

Keywords: environmental knowledge; environmental concern; pro-environmental behavior; Value-Belief-Norm theory; environmental education

1. Introduction

Increasing concern about global and local environmental problems and issues has led to the substantial efforts by policymakers and non-governmental organizations to promote pro-environmental behavior. Over the last century, the pro-environmental behavior was extensively analyzed according to various behavioral theories. One of the primary theories, called the theory of planned behavior, was suggested by Ajzen [1]. This theory encompasses attitudes, subjective norms, and the impact of perceived behavioral control factors on the intention for pro-environmental behavior. While the theory of planned behavior is one of the most popular models of predicting and explaining behavior [2], the authors of the theory do not claim it to be without flaws nor even complete [3]. One of the proposed extensions of the theory is to include habitual behavior into the model [4], thus capturing a more complete understanding of the antecedents of frequently reoccurring behaviors. Additionally, the theory of planned behavior is not specifically structured to recognize moral support for environmental action and does not offer a psychological construct to support morally-grounded pro-environmental behavior [5,6]. The Value-Belief-Norm (VBN) theory suggested by Stern [7] exactly emphasizes morality. VBN theory incorporates the value and norm components from the Norm Activation Model (NAM) [8–10] and the New Environmental Paradigm (NEP) [11], which encompasses

general beliefs and concerns about the environment and the need for actions to address environmental problems. Both the NAM and VBN models of pro-environmental behavior emphasize the value basis of pro-environmental behavior and how values translate into internalized norms which compel individuals to act pro-environmentally [9,12,13]. A great number of studies have applied VBN theory when analyzing sustainable travel mode choice [14–16].

VBN theory suggests that values influence beliefs, which are operationalized through environmental worldview, which in turn influences awareness of behavioral consequences, an assumption of responsibility which leads to personal norms regarding behavior, and, finally, predicts behavior. Values are rather constant and difficult to change [17–24], so this theory is not very informative for environmental policy. Therefore, we suggest that by substituting values with environmental knowledge, VBN theory could be suitable for analyzing the influence of environmental education on pro-environmental behavior. Education for pro-environmental behavior entails not only having specific knowledge, but also the necessary understanding why one should act upon that knowledge, thus including a salient moral component. Authors analyzing the impact of environmental knowledge on pro-environmental behavior usually apply the theory of reasoned action [25–29], knowledge-belief-norms theory [10], or knowledge-attitude-practice [30–35] approaches. However, according to Otto et al. [36], knowledge about environmental problems fosters internal motivation to behave pro-environmentally. By applying VBN theory, our study revealed the impact of environmental knowledge on pro-environmental behavior through an ecological worldview, awareness of behavioral consequences, and environmental responsibility.

The promotion of environmental knowledge is viewed as a fundamental component of environmental education [37,38]. Analyzing the impact of environmental knowledge on pro-environmental behavior is therefore very important, because environmental information and education are the main tools suggested by researchers and practically implemented. Environmental education is an indispensable requirement to promote sustainable consumption and pro-environmental behavior [39]. To the best of our knowledge, none of the research works referring to VBN have analyzed the role of environmental knowledge in the ecological worldview, awareness of behavioral consequences, responsibility, and pro-environmental behavior yet. Thus, we hope that our paper will fill the gap by focusing on the analysis not of general environmental knowledge but of action-related knowledge. According to Otto and Pensini [37], individuals must know what type of actions to take in order to behave in a more environmentally friendly manner. Other authors have also confirmed that action-related environmental knowledge is of the utmost importance in seeking to promote pro-environmental behavior [11,40–43].

Furthermore, researchers have argued that pro-environmental behavior is not a one-dimensional construct, but that separate types of behaviors have different causal factors [42,44–51]. Stern [7] stated that pro-environmental behavior could be divided into two broad types: private and public sphere. The purchase, use, and disposal of personal and household products that have environmental impact are attributed to the private sphere pro-environmental behavior. Environmental activism, as well as the support of public policies are attributed to the public sphere pro-environmental behavior [7]. Private sphere or general pro-environmental behavior has been extensively analyzed [11,27,41,44,52–55] because this behavior is directly related to environmental impact [4,56,57]. Meanwhile, public sphere behavior has attracted less attention. The determinants of private and public sphere pro-environmental behavior were analyzed by Chen [58], Ertz, Karakas, and Sarigöllü [59], Huang [60], Kilbourne and Pickett [61], Pisano and Lubell [37], and Tam and Chan [50,51], and none of these studies referred to VBN theory. Both public and private behaviors need to receive equal attention, because both types of behaviors can contribute to reducing environmental impact. In both public and private sphere actions—by saving water or electricity and by actively participating in various environmental initiatives—citizens can contribute directly and indirectly to solving environmental problems.

Public sphere behavior could be attributed to conscious behavior, while private behavior could be attributable to habitual behavior [30,54,62,63]. It is therefore also important to analyze whether citizens

who are more environmentally committed and actively participate in green movements also behave in a more pro-environmental mode in their private life.

2. Conceptual Model

2.1. Private and Public Sphere Pro-Environmental Behavior

Authors analyzing pro-environmental behavior have examined different determinants and separate types of pro-environmental behavior. Stern [7] was one of the first authors who stated that distinct types of pro-environmental behavior exist. He suggested the prime classification of pro-environmental behavior by separating it into public and private sphere behavior. Behaviors as environmental activism, support or acceptance of environmental policy, or public sphere pro-environmental behavior, are typical of environmentally-committed people. These behaviors affect the environment mostly indirectly by influencing environmental policy and can change the behaviors of many people and organizations. Meanwhile, private sphere behavior is related to ordinary behavior, such as purchasing, travel, use of natural resources, and disposal of waste. These behaviors directly affect the environment [4,56,57,64].

Moreover, private sphere pro-environmental behavior can be largely habitual. People behave according to their past experiences and habits when, for example, choosing how to travel or how they consume energy [30,54,62,63]. Therefore, the main difference between public and private sphere behavior is that one type of behavior (private) can be largely attributed to habitual behavior, while the other (public) is attributable to conscious behavior. They also differ in level of engagement and commitment. Taken into account the habitual component of private behavior and the active component of public pro-environmental behavior, it would be reasonable to assume that, publicly, the pro-environmental individuals would also behave congruently in private, while privately the pro-environmental individuals might not necessarily participate in pro-environmental activism. Thus, the implied link between these two behaviors is that engagement in public pro-environmental behavior will predict private pro-environmental behavior.

As a matter of fact, diverse combinations of causal factors should distinctly determine private and public behavior, as well. Ertz et al. [59] found that attitudes had a similar impact on both behaviors, meanwhile contextual factors influenced public and private sphere behavior differently. Tam and Chan [51] revealed that generalized trust decreased and remained significant only for public sphere behavior, while in their other study [65] the effect of future orientation was significant on public behavior but not on private behavior, because public behavior did not have an immediate environmental impact.

Huang [60] showed that environmental self-efficacy and use of global warming media positively influenced both public and private behavior, while environmental belief determined only public behavior. Chen [58] also revealed that private behavior is limited in addressing environmental problems unless combined with collective public change. Kilbourne and Pickett [61] found that environmental concern equally conditions both public and private pro-environmental behavior. Therefore, separate factors influenced these behaviors differently. The first hypothesis of this paper is:

Hypothesis 1 (H1): *Public sphere behavior positively influences private sphere behavior.*

2.2. The Impact of Environmental Knowledge and Ecological Worldview on Pro-Environmental Behavior

Environmental knowledge is defined as 'an ability to identify the symbols, concepts and behavior patterns related to environmental protection according to the received environmental information' [66]. Zsóka et al. [43] and Taufique et al. [67] referred to environmental knowledge as knowledge and awareness of environmental problems and possible solutions to those problems. The latter definition reveals that environmental knowledge is multidimensional. Additionally, Barber et al. [25],

Dodd et al. [68], and Martin and Simintiras [69] reported that environmental knowledge can be distinguished into objective (factual) and subjective knowledge. Frick et al. [70] suggested separating environmental knowledge into three groups: (i) systemic knowledge (knowledge about the existence of environmental problems); (ii) action-related knowledge (knowledge about the impact of behavior on the environment); and (iii) effectiveness knowledge (knowledge about tools for how to decrease environmental impact).

A number of researchers [26,53,66,71–75] analyzed the impact of systemic knowledge on behavior. Meanwhile, the other types of knowledge, such as action-related knowledge, have received less attention [10,55,76,77]. Therefore, in the present study, we chose to investigate action-related knowledge.

The ecological worldview in VBN theory is measured using the NEP scale, which was suggested by Dunlap et al. [11]. The authors used a shorter version of the NEP scale, redefining this factor as environmental concern [44,45,78]. Environmental concern is conceptualized as a measure that shows the degree to which people are concerned about environmental problems and dangers to the earth and for ‘the harmony of nature’ [79,80]. Therefore, the ecological worldview and environmental knowledge can also be attributed to the consequences of environmental education and information since environmental education does not simply transmit the facts, but their relevance, as well. Environmental education involves various methods of teaching for individuals to become more knowledgeable about the environment and environmental issues [30,36,81,82]. Government and non-profit organizations successfully work to educate people to evaluate their ecological worldview and concern for the environment, and also exert pressure to accept greater responsibility for the environmental impact [83,84].

Authors in the studies suggested that knowledge may enhance concern and awareness for environmental problems [10,85]. However, the relationship between action-related environmental knowledge and an ecological worldview has not been analyzed yet; rather, authors focused more on the relationship between knowledge and attitude or problem awareness [10,25,26,29–35,86]. An ecological worldview, however, is highly related to being concerned with the environment, and there have been several studies that investigated the link between environmental concern and environmental knowledge. Bamberg and Möser [87] declared that increased knowledge about the environment leads to greater environmental concern, while Arisal and Atalar [71] found that knowledge about environmental problems has an insignificant impact on environmental concern. Ellen et al. [88] showed that individuals with greater knowledge had greater environmental concern and deeper belief that changes in their behavior can contribute to solving environmental problems. Zhao et al. [42] also found a strong relationship between environmental concern and knowledge. Kwon et al. [84] revealed that respondents who are more concerned are more likely to be familiar with various green ratings. Seth et al. [89] and Misra and Panda [90] stated that the greater the level of knowledge held by individuals, the greater their concern. In the present study we also assume that environmental knowledge should influence the ecological worldview. Based on VBN theory, we suggest that the ecological worldview is important for awareness of behavioral consequences and propose the following hypotheses:

Hypothesis 2 (H2): *Environmental knowledge positively influences ecological worldview;*

Hypothesis 3 (H3): *Ecological worldview positively influences the awareness of behavioral consequences.*

Environmental knowledge is an important factor in leading to pro-environmental behavior [36,69]. However, authors analyzing the impact of environmental knowledge on pro-environmental behavior have found inconsistent results [91]. Some studies that examined systems or knowledge of environmental issues found an insignificant relationship between knowledge and pro-environmental behavior [54,62,74,92]. Ahmad and Ariffin [30] and Mahat et al. [93] stated that environmental knowledge does not necessarily result in pro-environmental actions. The results of Paço and Lavrador [26] pointed to the lack of relationship between knowledge and behavior. Frick et al. [70] and

Otto and Pensini [36] showed that the relationship between knowledge and pro-environmental behavior was significant but weak. Meanwhile, Lee [94], Mobley et al. [95], Mostafa [73], and Oguz et al. [75] all revealed that people who have greater knowledge of environmental problems or issues are more inclined to behave in a more pro-environmental way. Such inconsistent findings reveal that fostering singular knowledge seems to have a low effect [36,96]. Thus, it is important to consider the type of environmental knowledge, as well.

Analyzing the impact of different types of environmental knowledge on behavior, Liobikienė et al. [77] found that action-related knowledge influences pro-environmental behavior the most in comparison to other types of environmental knowledge. For example, merely knowing that planes contribute to climate issues does not suggest a preferable alternative. However, if one knows that planes pollute more than trains, one has a clear heuristic when choosing a mode of transportation. Action-related knowledge, functioning as heuristic, could reduce cognitive load needed to make decisions, thus potentially having a direct effect on behavior. Cappetta and Magni [40] and Ting and Cheng [41] stated that people who know about behavior outcomes are more confident and inclined to behave accordingly. Zhao et al. [42] also found that knowledge about green consumption impacts the usage behavior. Zsóka et al. [43] stated that the understanding of causes of environmental problems is a particularly crucial factor of pro-environmental behavior. Kitzmuller [97] argued that pro-environmental actions are only possible if people know what they can or could do. Thus, there is evidence that action-related knowledge that enables individuals to make concrete and informed decisions might more easily be translatable into behavior. Therefore, the following hypotheses are proposed:

Hypothesis 4 (H4): *Action-related environmental knowledge positively influences private sphere behavior;*

Hypothesis 5 (H5): *Action-related environmental knowledge positively influences public sphere behavior.*

Taking into account that ecological worldview is related to environmental concern, researchers found that environmental concern is directly related to pro-environmental behavior, such as green purchasing, waste recycling, and energy saving [42,70,82,98–101]. Kilbourne and Pickett [61] stated that when concern about environmental problems increases, people should be more willing to make changes in their own behavior. Moreover, the aforementioned researchers found that environmental concern positively and directly influences behaviors in both private and public spheres. Binder and Blankenberg [102] showed that environmental concern increases the likelihood of volunteering and becoming a member of an environmental organization. Thus, it is proposed that:

Hypothesis 6 (H6): *Ecological worldview positively influences private sphere behavior;*

Hypothesis 7 (H7): *Ecological worldview positively influences public sphere behavior.*

However, other studies found that even when people had a high level of environmental concern, they did not behave in a pro-environmental mode [44,52,103]. Whitmarsh and O'Neill [104] also did not find any effect of environmental concern on energy consumption. Kennedy et al. [105] revealed the concern-behavior gap: the gap between concern and behavior could occur due to economic reasons, the lack of ability (time, capacity) to perform pro-environmental behavior, and ingrained habits. Gifford [106] and Tam and Chan [51] explained this gap with reference to psychological barriers. Having a high level of environmental concern might be insufficient to change behavior, so it is important to consider contextual conditions, as well.

2.3. Impact of Awareness of Behavioral Consequences and Environmental Responsibility on Pro-Environmental Behavior

Awareness of behavioral consequences and responsibility are directly related factors in VBN theory. De Groot and Steg [107], Hansla et al. [18], and Steg et al. [108] stated that awareness of consequences is a necessary factor to environmental responsibility. In a meta-analysis, Klöckner [4] also found that awareness of consequences and responsibility are related factors. Additionally, Liobikienė and Juknys [20] reported a large correlation coefficient between the awareness of behavioral consequences and environmental responsibility. It also appears that when people believe their behavior has an environmental impact, they can become more willing to engage in pro-environmental behavior [4,58]. This leads to the following hypotheses:

Hypothesis 8 (H8): Awareness of behavioral consequences positively influences environmental responsibility;

Hypothesis 9 (H9): Awareness of behavioral consequences positively influences private sphere behavior; and

Hypothesis 10 (H10): Awareness of behavioral consequences positively influences public sphere behavior.

However, Liobikienė and Juknys [20] revealed the gap between the awareness of consequences and actual behavior due to obstacles, such as lack of knowledge, money, or time. It is, therefore, not enough only to be aware of the environment and behavior, but it is also important to have the ability to exhibit pro-environmental behavior.

Environmental responsibility is the only variable in VBN theory that has a direct path toward behavior [7]. The growth of the perception of responsibility significantly increases a person's readiness to engage in pro-environmental behavior [20,55,109,110]. Clark et al. [111] also stated that environmental responsibility enables individuals to act for the environmental protection. Zhu et al [112] also revealed that different levels of perceived responsibility influence one's conservation intention. Thus, the last hypotheses are:

Hypothesis 11 (H11): Environmental responsibility positively influences private sphere behavior;

Hypothesis 12 (H12): Environmental responsibility positively influences public sphere behavior.

Thus, based on the literature review the proposed model is presented in Figure 1.

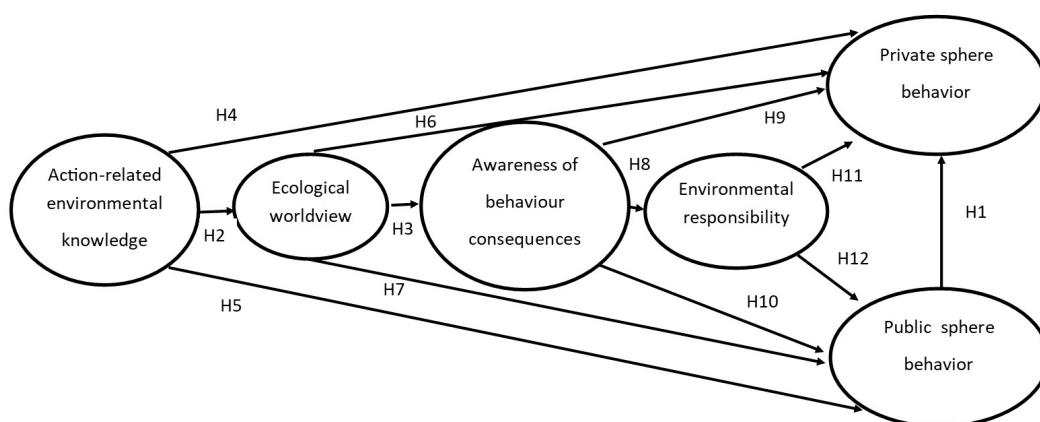


Figure 1. Proposed model.

3. Materials and Methods

3.1. Survey Participants

To ascertain Lithuanian citizens' environmental knowledge, ecological worldview, awareness of behavioral consequences, environmental responsibility, and private and public sphere behavior, a representative survey was conducted between the 12th and 26th of October 2013. First of all, to improve and refine the instrument, an online pilot survey was carried out by recruiting participants through social media and through contacting several organizations of students and labor unions. The final survey was carried out by a market research company, which questioned 1007 respondents face-to-face. Interviewees were selected using the quota sampling method based on the proportion size of population by age, gender, and place of residence. The sample size included a sampling error of 3% at the significance level of 95%.

The demographic characteristics of the survey are presented in Table 1. Among the 1007 respondents, 45.7% were male and 54.3% were female. Citizens aged 15–74 years old were chosen as the target group. Regarding the age structure, 20.4% of respondents were 15–24 years old, 19.1% were 25–34 years old, about 18% were 35–44, 18% were 45–54 years old, 13% were 55–64 years old, and 12.1% were 65–74 years old. The majority of respondents were married and had completed secondary education.

Table 1. Demographic characteristics of survey participants.

	Number (N)	Percentage
Gender:		
Male	460	45.7
Female	547	54.3
Age:		
15–24	205	20.4%
25–34	192	19.1%
35–44	180	17.9%
45–54	177	17.5%
55–64	131	13%
65–74	122	12.1%
Marital status:		
Married	439	43.6%
Single	298	29.6%
Divorce	120	11.9%
Widower	93	9.2%
Cohabitan	57	5.7%
Education level:		
Primary school	71	7.1%
Basic education	139	13.8%
Total secondary education	313	31.1%
Post-secondary vocational education	204	20.3%
Further education	52	5.1%
Higher education	227	22.6%

3.2. Measurements

All constructs were measured by using a four-point Likert scale ranging from strongly disagree (never behave: 1) to strongly agree (always behave: 4). Six variables were investigated in our study: environmental knowledge, ecological worldview, awareness of behavioral consequences, environmental responsibility, private behaviors, and public behaviors. The scale of environmental knowledge was constructed referring to Frick et al. [70], who suggested items for evaluation of action-related knowledge to reveal the knowledge about the environmental impact of a specific behavior. Ecological worldview was measured using four items adapted from the revised NEP suggested by Dunlap et al. [78]. The shorter version of the NEP scale is frequently used by other authors, as well (see [44,79,113–115]). Scales for the awareness of environmental consequences and environmental responsibility were constructed by adopting items used by van Riper and Kyle [23] and Wang et al. [110]. The private and public sphere behaviors were measured by adapting the items suggested by Stern [7]. All items for all scales are presented in Table 2.

Table 2. Questionnaire items used in the survey, means, standard deviations (SD), reliability, and validity analysis. AVE = average variances extracted; CR = composite reliability.

	M	SD	Factor Loading	Cronbach's Alpha	CR	AVE
<i>Action-related environmental knowledge:</i>				0.73	0.73	0.53
All materials of ecologically certificated products are ecological.	2.50	1.13	0.82			
Travel by train is less polluting compared with travel by plane.	2.17	1.24	0.75			
Consumption of Lithuanian apples has less environmental impact than consumption of apples imported from the Netherlands.	2.23	1.23	0.72			
Semi-manufactured products have more environmental impact compared to conventional products.	2.23	1.21	0.7			
Dishwashers consume less water than washing dishes by hand.	2.86	1.18	0.68			
<i>Ecological worldview:</i>				0.79	0.7	0.50
The so-called ‘ecological crisis’ facing humankind is real.	2.06	0.94	0.70			
The earth is like a spaceship with very limited room and resources.	2.19	1.01	0.68			
The balance of nature is not enough to cope with the impact of modern industry.	2.06	0.98	0.73			
Only changing behavior will solve environmental problems.	2.03	0.98	0.71			
<i>Awareness of behavioral consequences:</i>				0.82	0.85	0.54
When humans interfere with nature it often produces disastrous consequences.	2.82	0.86	0.71			
Human behavior has had a big environmental impact.	2.83	0.86	0.67			
My existence and behavior are connected with nature.	2.91	0.92	0.82			
<i>Environmental responsibility:</i>				0.74	0.72	0.51
My personal contribution is very important to solving environmental problems.	1.95	0.9	0.69			
The public is responsible for the implementation of environmental protection.	1.90	0.75	0.71			
To guarantee the prosperity of future generations, responsibility, and rational consumption are essential.	1.80	0.75	0.73			
<i>Private sphere behavior:</i>				0.86	0.78	0.59
I save water at home.	3.11	0.94	0.757			
I switch off lights or electronic equipment if I am not using them.	2.70	1.07	0.816			
I separate waste.	2.39	1.03	0.73			
<i>Public sphere behavior:</i>				0.89	0.77	0.67
I collect information about environmental issues.	2.11	0.91	0.74			
I attend lectures presenting the topics related to environmental issues.	1.32	0.64	0.85			
I participate in ‘green’ actions and initiatives.	1.68	0.91	0.82			
I personally contribute to the organization of ‘green’ actions	1.32	0.69	0.85			
I am a member of a ‘green’ organization and participate in its activities.	1.08	0.43	0.84			

3.3. Proposed Model and Statistical Analysis

Confirmatory factor analysis was initially directed to the dimensionalities of the survey scales (environmental knowledge, ecological worldview, awareness of behavioral consequences, environmental responsibility, and private and public sphere behavior) with reflective measures, which examine the dimensionality of constructs by analyzing interrelationships among their hypothetical indicators [116]. The internal reliability of the scale items was calculated using Cronbach's alpha. To evaluate the internal consistency of factors in the model, composite reliability (CR) was assessed. The structural equation modelling technique was applied to test the proposed model presented in Figure 1. Confirmatory factor analysis and a structural equation model were applied via the statistical software Analysis of Moment Structure (AMOS) version 22.

4. Results

4.1. Descriptive Analysis

Lithuanian citizens are rather well informed about the impact of behavior on the environment. Particularly, respondents were well aware that dishwashers consume less water than washing dishes by hand. They were less aware that traveling by train is more environmentally friendly than traveling by plane. Considering the awareness of behavioral consequences, respondents are rather aware and understand that their behavior and existence are related to nature, and thus their behavior has an environmental impact. Meanwhile, in terms of ecological worldview, respondents agreed less often with statements about the ecological crisis, the balance of nature, and the limitations of the Earth. The level of environmental responsibility of the survey participants was very low, and respondents frequently agreed only partially that they are responsible and can contribute to the solutions for environmental problems (Table 2).

Table 2 presents results showing that Lithuanian citizens more frequently perform private pro-environmental behavior than public behavior. Respondents were frequently inclined to save water and electricity resources. Meanwhile, the pro-environmental public behavior was less common. For example, the majority of respondents are not members of 'green' organizations and never participate in their activities (Table 2). Similar results were observed by Balzkiene and Telesiene [117] in 2010. These results show that people are not very environmentally active and committed in Lithuania. It is, therefore, very important to involve people more in green organizations to enhance environmental citizenship, which can contribute to successful implementation of environmental policies.

4.2. Measurement Model Analysis

First, using confirmatory factor analysis, a six-factor multi-group measurement model of action-related environmental knowledge, ecological worldview, awareness of behavioral consequences, environmental responsibility, and private and public sphere behaviors was tested. The model showed a good fit to data: $\chi^2(194) = 595$ ($\chi^2/\text{df} = 3.07$; $p < 0.001$). The value of the comparative fit index (CFI) was 0.913, the normed fit index (NFI) was 0.9, and the Tucker–Lewis index (TLI) was 0.9. The root mean square error of approximation (RMSEA) was 0.045, thus lower than 0.08, indicating an adequate fit [118,119].

All the standardized factor loadings ranked from 0.67 to 0.85, revealing that threshold values exceeded 0.6. The average variances extracted (AVE) of latent contracts were ranked from 0.5 to 0.67 (Table 3). Thus, AVE exceeded the cut-off point value of 0.5, which showed that convergent validity was adequate [120]. The reliability of constructs and internal consistency of the factors in the model were also adequate. As can be seen in Table 2, Cronbach's alpha and CR for all the constructs exceeded the values of 0.7, which revealed strong reliability [121,122].

Table 3. Construct correlations.

	1	2	3	4	5
1. Action-related environmental knowledge					
2. Ecological worldview	0.528				
3. Awareness of behavioral consequences	0.184	0.55			
4. Environmental responsibility	0.471	0.412	0.017		
5. Private sphere behavior	0.219	0.182	0.327	-0.026	
6. Public sphere behavior	0.171	0.258	0.184	0.164	0.431

Table 3 presents zero-order correlations among the studied variables indicating that all variables were intercorrelated only modestly, and multicollinearity was absent in this study. Moreover, the results showed that ecological worldview, action-related environmental knowledge, and awareness of behavioral consequences are the most related variables. The more people are concerned about the environment, the more they have knowledge about the impact of their behavior on the environment and the more they are aware of the consequences. The correlation coefficient between private and public sphere pro-environmental behavior was one of the highest, as well, which reveals that these types of behavior are related.

4.3. Structural Model Analysis

The structural equation model was implemented to assess the proposed twelve hypotheses (Figure 1). This model was statistically equivalent to the measurements, as the constrained loadings and fit indices were identical: $\chi^2/df = 3.83$, $p < 0.001$; CFI = 0.9, RMSEA = 0.053. The results presented in Table 4 showed that pro-environmental public behavior significantly and positively influences private sphere behavior ($\beta = 0.817$, $p < 0.001$), thus supporting hypothesis H1. Moreover, the standardized beta coefficient of the structural model was the highest, which showed that pro-environmental public behavior influences private behavior the most.

Action-related environmental knowledge significantly and positively determined ecological worldview ($\beta = 0.381$, $p < 0.01$), and the latter variable significantly affected awareness of behavioral consequences ($\beta = 0.591$, $p < 0.01$). This supported hypotheses H2 and H3. These results showed that the more people know about the impact of their behavior on the environment, the more they are concerned about the environment and the more they are aware of the consequences of their behavior.

Action-related environmental knowledge has a positive and significant impact only on private sphere pro-environmental behavior ($\beta = 0.132$, $p = 0.002$) but not on public behavior ($\beta = 0.014$, $p = 0.406$). This supports hypothesis H4 but rejects hypothesis H5. An ecological worldview has a direct positive and significant impact only on pro-environmental public behavior ($\beta = 0.075$, $p = 0.012$) but not on private behavior ($\beta = -0.138$, $p = 0.05$). These results suggest that an ecological worldview and environmental knowledge directly influence both types of pro-environmental behavior differently (Table 4).

Furthermore, the results of the structural equation model showed that awareness of behavioral consequences significantly and positively influences environmental responsibility ($\beta = 0.12$, $p = 0.011$). This supports hypothesis H8 and suggests that the more people are aware of behavioral consequences, the more environmentally responsible they are. Considering pro-environmental behavior, the results showed that awareness of behavioral consequences positively and significantly had an impact on private behavior only ($\beta = 0.263$, $p < 0.001$), although an insignificant effect was observed on public behavior ($\beta = 0.032$, $p = 0.164$). This supports only hypothesis H9 and rejects hypothesis H10. Environmental responsibility significantly and positively influenced public behavior ($\beta = 0.053$, $p = 0.047$), supporting hypothesis H11. However, the impact of environmental responsibility on private sphere behavior was negative ($\beta = -0.141$, $p = 0.031$), which reveals that the more environmentally responsible respondents reported to be, the less likely they were to reduce water and electricity use and to separate waste.

Table 4. Path coefficients for the structural model.

Hypothesis	Paths	Estimate	S.E.	C.R.	p-Value
H1	Public sphere behavior → private sphere behavior	0.817	0.12	6.827	<0.001
H2	Action-related environmental knowledge → Ecological worldview	0.381	0.039	9.655	<0.001
H3	Ecological worldview → Awareness of behavioral consequences	0.591	0.057	10.438	<0.001
H4	Action-related environmental knowledge → Private sphere behavior	0.132	0.042	3.174	0.002
H5	Action-related environmental knowledge → Public sphere behavior	0.014	0.017	0.832	0.406
H6	Ecological worldview → Private sphere behavior	-0.138	0.07	-1.964	0.05
H7	Ecological worldview → Public sphere behavior	0.073	0.029	2.502	0.012
H8	Awareness of behavioral consequences → Environmental responsibility	0.12	0.047	2.528	0.011
H9	Awareness of behavioral consequences → Private sphere behavior	0.263	0.058	4.557	<0.001
H10	Awareness of behavioral consequences → Public sphere behavior	0.032	0.023	1.393	0.164
H11	Environmental responsibility → Private sphere behavior	-0.141	0.066	-2.156	0.031
H12	Environmental responsibility → Public sphere behavior	0.053	0.027	1.985	0.047

5. Discussion and Policy Implications

Human life and behavior can be private or public; however, the pro-environmental behavior not being an exception. Private and public behaviors have different levels of commitment and activism, appear in different areas, and have different environmental impacts. Considering that private behavior is directly related to the environmental outcomes, this type of behavior has been widely analyzed, while public behavior has received less attention. The performance of public sphere behavior shows the level of a citizen's environmental commitment, which is very important for successful implementation of environmental policies. It is worth emphasizing that Lithuanian citizens very rarely participate in environmental activities, and consequently, the level of environmental activism is very low in Lithuania. This may be due to the absence of strong communities and very low social activity. There are only 23 official non-governmental environmental organizations in Lithuania. Environmental initiatives are rather new in Lithuania, as well. For example, 'Let's Do It World', one of the first environmental initiatives, began only 10 years ago, and the number of participants in this initiative has been growing annually. Other initiatives, such as 'The Day Without a Car' and 'Earth Hour', were for the first time organized in Lithuania only five years ago. Thus, environmental activism in Lithuania is only at the initial phase. Furthermore, it must be noted that in all voluntary pro-environmental initiatives, young people have shown themselves as the most active and enthusiastic individuals, thus highlighting the importance of youth involvement in the pro-environmental action [123]. Therefore, it is very important to promote the public pro-environmental behavior in order to not only enhance the environmental citizenship, but also because it has great potential to translate into private pro-environmental behavior, as well. Engaging youth into the pro-environmental action could translate into more sustainable and long-lasting changes in societal trends in the long run, as well as behavioral spill-over from young people to the older generation, who are not as quick to adopt novel practices [123].

Researchers have suggested the promotion of environmental information and education as practical tools both to enhance the pro-environmental behavior and to contribute to the reduction of environmental impact [46]. The main aim of environmental education is to develop concern and awareness about the total environment and its problems. The commitment to work individually and collectively towards solutions for the current environmental problems and their prevention also falls among the most important aims of environmental education. Environmental knowledge and an ecological worldview (as an environmental concern) are the outcomes of environmental education, and thus can be shaped through educational means. Our results showed that action-related environmental knowledge positively influenced the ecological worldview, which had a positive impact on awareness of behavioral consequences. The more respondents know about the impact of their behavior on the environment, the more they are concerned about the environment and the more aware of the consequences of their behavior. However, according to Ünal et al [10], values are more predictive of problem awareness and behavior than knowledge. Therefore, looking forward, it is also important to present to society needs to accept ecocentrism. A great number of literature

argue that nature experiences (in bushland, forests and gardens, or with animals) in education foster ecocentrism [124–127].

We have also found that action-related environmental knowledge is directly related only to private behavior, and the result supports the findings of other authors (see [40–43,77,96]) that environmental knowledge is an important factor to enhance private pro-environmental behavior. Private pro-environmental behavior is also strongly predicted by public pro-environmental behavior, thus highlighting that if a person is engaged in pro-environmental initiatives publicly, then that person is most likely a pro-environmental individual in private, as well. However, for one to be considered an environmental citizen, one needs not only to behave pro-environmentally in public and at home but also to possess the necessary factual knowledge to make objective decisions and to understand the means through which one can accomplish desirable environmental outcomes [128]. Meanwhile, we did not find a significant relationship between public pro-environmental behavior and action-related environmental knowledge or the awareness of behavioral consequences. Only significant paths between public pro-environmental behavior and an ecological worldview or environmental responsibility are quite modest, thus indicating that, at least at the time of the survey, environmental activism in Lithuania was not motivated by the action-based knowledge nor that the individuals understood how some behaviors are harmful to the environment. Therefore, it is not enough to simply provide individuals with the relevant facts since objective facts themselves are (and should be) morally neutral. As Bonnett pointed out [129], only providing the facts and letting students draw conclusions on their own is a desirable, but not necessarily universally effective, approach when teaching about sustainability. Similarly, Kopnina [130] argues that environmental education should not shy away from having specific goals—among those goals being certain attitudes, beliefs, and even values of the students—, while we acknowledge that education for environmental citizenship should at least in part be oriented toward and based on ecocentric values. Furthermore, some promising new directions can be found in the work of Kahn [131], who suggests reconstructing critical pedagogy in light of disastrous ecological conditions. Fassbinder et al [132] argued that the most viable stream of research on education and ecological crisis is the literature on ecopedagogy concerned with mitigating the ecological and social crisis via pedagogical means. Thus, relevant knowledge about the environmental crisis and the environmental outcomes of various behaviors should be presented in a framework that strives to create an environmental citizen [128] who is both knowledgeable and empowered to strive for positive change using democratic processes [123]. However, having strong pro-environmental values but lacking the necessary factual knowledge to make evidence-based decisions could lead to misinformed activism and could be potentially harmful, e.g., opposing nuclear power or food from genetically modified organisms. Thus, the present study demonstrates that there is indeed a pressing need for systemic, standardized, and congruent education for environmental citizenship with a strong emphasis on ecocentrism and factual environmental knowledge.

6. Limitations and Future Directions

This paper used VBN theory to reveal that environmental education with an emphasis on action-based knowledge along with the promotion of pro-environmental values are the necessity for the pro-environmental private and public sphere behaviors and for fostering environmental citizenship. As does all research, the present study has some limitations. First, the direct impact of environmental education on pro-environmental behavior was not analyzed, but rather the consequences of environmental education were explored. This analysis could be useful for the preliminary disclosure of the situation. Therefore, future research should analyze the impact of environmental education on behavior directly.

Second, this paper only analyzed action-based environmental knowledge related to private sphere behavior, so future research should consider environmental knowledge related to public sphere behavior, as well. In essence, we suggest future research investigating the relevance of action-based knowledge to tailor action-based knowledge items to specific investigated behaviors rather than

investigating a relationship between general knowledge and general pro-environmental behavior. Such a study would be important because if people knew more about the positive consequences of participation in a ‘green’ movement for the implementation of environmental policy, they would be more likely to be active in pro-environmental actions in their public life.

Third, the determinants of public sphere pro-environmental behavior in Lithuania were analyzed, and it was uncovered that environmental citizenship in Lithuania is still in its early stages. While we used a representative sample of the Lithuanian population, we also believe that our findings could be generalized to neighboring countries which are similar in their socio-economic state, as well. That being said, to reveal whether environmental education and information are important for public sphere pro-environmental behavior, future research should consider countries with more pronounced environmental citizenship, such as Norway or Germany, where environmental activism is more common and people in general hold stronger pro-environmental values. It is very important to include the social aspect of environmental citizenship because strong communities are essential for the performance of public sphere pro-environmental behavior. Future research should, therefore, perform analysis across countries, including the social aspects of public sphere pro-environmental behavior and assess the level of action-based environmental knowledge among those countries and how this construct functions in predictive models.

Fourth, private pro-environmental behavior was analyzed in this paper, including different types of behavior, such as saving energy and recycling. Other authors have observed, however, that it is important to consider how different behaviors stem from different goals when analyzing the determinants of pro-environmental behavior [48,98,133]. Future research should separate these types of behavior and analyze the determinants of different private sphere behaviors, such as saving or purchasing behavior, which requires different degrees of effort and cost.

7. Conclusions

Perhaps because of the tangible outcomes of private pro-environmental behavior, it has received a lot of attention, and for good reason. However, the somewhat overlooked public pro-environmental behavior has a lot to add, as well, and plays an important role in environmental citizenship [130]. Public pro-environmental behavior has the potential to produce social change and to inspire individuals to adopt pro-environmental lifestyles, thus encouraging private pro-environmental behaviors, as well. Environmental activism is only budding in Lithuania, and there is a pressing need to provide systemic education for environmental citizenship through factual action-based knowledge, as well as through other means.

Action-based environmental knowledge and awareness of behavioral consequences both positively contribute to the prediction of private and public pro-environmental behavior. Ecological worldview and environmental responsibility, however, are negative predictors of private pro-environmental behavior in the present study. This paints a complex picture of what potentially motivates individuals in Lithuania to act pro-environmentally. It might be that factual knowledge plays a more significant role in promoting private pro-environmental behavior in the present sample than certain ecological beliefs, which implies that tailoring education to focus on action-based knowledge has great potential. Meanwhile, public pro-environmental behavior contributes most to predicting private pro-environmental behavior, but itself is not predicted by action-based knowledge. Thus, there seems to be a combination of knowledge—as well as value-based motivating factors—that encourage pro-environmental behavior. Therefore, environmental education should not only focus on information provision but also foster ecocentrism, for instance via nature experiences in education. Furthermore, the construction of critical pedagogy in the light of disastrous ecological conditions is necessary, as well. Education for environmental citizenship is aimed precisely at addressing both the knowledge and the values that are relevant to an environmental citizen.

Author Contributions: Both authors contributed equally in preparing this paper.

Funding: This research received no external funding.

Acknowledgments: We thank the anonymous reviewers for their constructive comments.

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

References

1. Ajzen, I. The theory of planned behavior. *Organ. Behav. Hum. Decis. Process.* **1991**, *50*, 179–211. [[CrossRef](#)]
2. Ajzen, I. The theory of planned behaviour: Reactions and reflections. *Psychol. Health* **2011**, *26*, 1113–1127. [[CrossRef](#)] [[PubMed](#)]
3. Fishbein, M.; Ajzen, I. *Predicting and Changing Behavior: The Reasoned Action Approach*; Taylor and Francis Group: New York, NY, USA, 2010.
4. Klöckner, C.A. A comprehensive model of the psychology of environmental behavior—A meta-analysis. *Glob. Environ. Chang.* **2013**, *23*, 1028–1038. [[CrossRef](#)]
5. Klöckner, C.A.; Blöbaum, A. A comprehensive action determination model—Toward a broader understanding of conservations behavior. *J. Environ. Psychol.* **2010**, *30*, 574–586. [[CrossRef](#)]
6. Sarkis, M.A., Jr. A comparative study of theoretical behavior change models predicting empirical evidence for residential energy conservation behaviours. *J. Clean. Prod.* **2017**, *141*, 526–537. [[CrossRef](#)]
7. Stern, P. Toward a coherent theory of environmentally significant behavior. *J. Soc. Issues* **2000**, *56*, 407–424. [[CrossRef](#)]
8. Schwartz, S.H. Normative influences on altruism. In *Advances in Experimental Social Psychology*; Berkowitz, L., Ed.; Academic Press: New York, NY, USA, 1977; Volume 10, pp. 221–279.
9. Nordfjærn, T.; Rundmo, T. Acceptance of disincentives to driving and pro-environmental transport intentions: The role of value structure, environmental beliefs and norm activation. *Transportation* **2018**. [[CrossRef](#)]
10. Ünal, A.B.; Steg, L.; Gorsira, M. Values Versus Environmental Knowledge as Triggers of a Process of Activation of Personal Norms for Eco-Driving. *Environ. Behav.* **2018**, *50*, 1092–1118. [[CrossRef](#)]
11. Dunlap, R.E.; Van Liere, K.D.; Mertig, A.G.; Jones, R.E. Measuring endorsement of the New Ecological Paradigm: A revised NEP scale. *J. Soc. Issues* **2000**, *56*, 425–442. [[CrossRef](#)]
12. van der Werff, E.; Steg, L. One model to predict them all: Predicting energy behaviours with the norm activation model. *Energy Res. Soc. Sci.* **2015**, *6*, 8–14. [[CrossRef](#)]
13. Onwezen, M.C.; Antonides, G.; Bartels, J. The norm activation model: An exploration of the functions of anticipated pride and guilt in pro-environmental behaviour. *J. Econ. Psychol.* **2013**, *39*, 141–153. [[CrossRef](#)]
14. Lind, H.B.; Nordfjærn, T.; Jørgensen, S.H.; & Rundmo, T. The value-belief-norm theory, personal norms and sustainable travel mode choice in urban areas. *J. Environ. Psychol.* **2015**, *44*, 119–125. [[CrossRef](#)]
15. Jakovcevic, A.; Steg, L. Sustainable transportation in Argentina: Values, beliefs, norms and car use reduction. *Transp. Res. Part F Psychol. Behav.* **2013**, *20*, 70–79. [[CrossRef](#)]
16. Nordfjærn, T.; Zavareh, M.F. Does the value-belief-norm theory predict acceptance of disincentives to driving and active mode choice preferences for children’s school travels among Chinese parents? *J. Environ. Psychol.* **2017**, *53*, 31–39. [[CrossRef](#)]
17. Brown, K.W.; Kasser, T. Are psychological and ecological well-being compatible? The role of values, mindfulness, and lifestyle. *Soc. Indic. Res.* **2005**, *74*, 349–368. [[CrossRef](#)]
18. Hansla, A.; Gamble, A.; Juliusson, A.; Göarling, T. The relationships between awareness of consequences, environmental concern, and value orientations. *J. Environ. Psychol.* **2008**, *28*, 1–9. [[CrossRef](#)]
19. Lee, K. The role of media exposure, social exposure and biospheric value orientation in the environmental attitude-intention-behavior model in adolescents. *J. Environ. Psychol.* **2011**, *31*, 301–308. [[CrossRef](#)]
20. Liobikienė, G.; Juknys, R. The role of values, environmental risk perception, awareness of consequences, and willingness to assume responsibility for environmentally-friendly behaviour: The Lithuanian case. *J. Clean. Prod.* **2016**, *112*, 3413–3422. [[CrossRef](#)]
21. Papagiannakis, G.; Lioukas, S. Values, attitudes and perceptions of managers as predictors of corporate environmental responsiveness. *J. Environ. Manag.* **2012**, *100*, 41–51. [[CrossRef](#)]
22. Stern, P.C.; Dietz, T.; Kalof, L.; Guagnano, G.A. Values, beliefs, and pro-environmental action: Attitude formation toward emergent attitude objects. *J. Appl. Soc. Psychol.* **1995**, *25*, 1611–1636. [[CrossRef](#)]

23. van Riper, C.J.; Kyle, G.T. Understanding the internal processes of behavioral engagement in a national park: A latent variable path analysis of the value belief- norm theory. *J. Environ. Psychol.* **2014**, *38*, 288–297. [CrossRef]
24. van der Werff, E.; Steg, L.; Keizer, K. The value of environmental self-identity: The relationship between biospheric values, environmental self-identity and environmental preferences, intentions and behaviour. *J. Environ. Psychol.* **2013**, *34*, 55–63. [CrossRef]
25. Barber, N.; Taylor, D.C.; Strick, S. Environmental Knowledge and Attitudes: Influencing the Purchase Decisions of Wine Consumers. In Int. CHRIE Conference-Refereed Track. Event 16 2009. Available online: <http://scholarworks.umass.edu/refereed/Sessions/Wednesday/16> (accessed on 31 July 2009).
26. Paço, A.; Lavrador, T. Environmental knowledge and attitudes and behaviours towards energy consumption. *J. Environ. Manag.* **2017**, *197*, 384–392.
27. Paul, J.; Modi, A.; Patel, J. Predicting green product consumption using theory of planned behaviour and reasoned action. *J. Retail. Consum. Serv.* **2016**, *29*, 123–134. [CrossRef]
28. Polonsky, M.J.; Garma, R.; Grau, S.L. Western consumers' understanding of carbon offsets and its relationship to behavior. *Asia Pac. J. Mark. Logist.* **2011**, *23*, 583–603. [CrossRef]
29. Polonsky, M.J.; Vocino, A.; Grau, S.L.; Garma, R.; Ferdous, A.S. The impact of general and carbon related environmental knowledge on attitudes and behaviour of US consumers. *J. Mark. Manag.* **2012**, *28*, 238–263. [CrossRef]
30. Ahamad, N.R.; Ariffin, M. Assessment of knowledge, attitude and practice towards sustainable consumption among university students in Selangor Malaysia. *Sustain. Prod. Consum.* **2018**, *16*, 88–98. [CrossRef]
31. Ariffin, M.; Wan Yacoob, W.N.A. Assessment of knowledge, attitude and practice of solid waste open burning in Terengganu, Malaysia. *EnvironmentAsia* **2017**, *10*, 25–32.
32. Babaei, A.A.; Alavi, N.; Goudarzi, G.; Teymouri, P.; Ahmadi, K.; Rafiee, M. Household recycling knowledge, attitudes and practices towards solid waste management. *Resour. Conserv. Recy.* **2015**, *102*, 94–100. [CrossRef]
33. Nordin, F.N.; Saliluddin, S.M. Knowledge, attitude and practices of recycling and its associated factors among undergraduate students in Universiti Putra Malaysia, Serdang. *Int. J. Publ. Health Clin. Sci.* **2016**, *3*, 154–170.
34. Razak, A.N.H.; Praveena, S.M.; Aris, A.Z.; Hashim, Z. Quality of Kelantan drinking water and knowledge, attitude and practice among the population of Pasir Mas, Malaysia. *Publ. Health* **2015**, *131*, 103–111. [CrossRef] [PubMed]
35. Yaziz, A.N.; Rahman, A.H. Knowledge, attitude and practice towards recycling activity among secondary school students at Hulu Langat, Selangor, Malaysia. In Proceedings of the 1st International Conference on Interdisciplinary Development Research, Chiangmai, Thailand, 17–18 September 2015.
36. Otto, S.; Kaiser, F.G. Ecological behavior across the lifespan: Why environmentalism increases as people grow older. *J. Environ. Psychol.* **2014**, *40*, 331–338. [CrossRef]
37. Otto, S.; Pensini, P. Nature-based environmental education of children: Environmental knowledge and connectedness to nature, together, are related to ecological behavior. *Glob. Environ. Chang.* **2017**, *47*, 88–94. [CrossRef]
38. Otto, S.; Neaman, A.; Richards, B.; Marió, A. Explaining the ambiguous relations between income, environmental knowledge, and environmentally significant behavior. *Soc. Nat. Resour.* **2016**, *29*, 628–632. [CrossRef]
39. Michelsen, G.; Fischer, D. Sustainability and education. In *Sustainable Development Policy: A European Perspective*; Hauff, M.V., Kuhnke, C., Eds.; Routledge: London, UK, 2017.
40. Cappetta, R.; Magni, M. Locus of control and individual learning: The moderating role of interactional justice. *Int. J. Train. Dev.* **2015**, *19*, 110–124. [CrossRef]
41. Ting, D.H.; Cheng, C.F.C. Measuring the marginal effect of pro-environmental behavior: Guided learning and behavioral enhancement. *J. Hosp. Leis. Sport Tour. Educ.* **2017**, *20*, 16–26. [CrossRef]
42. Zhao, H.-H.; Gao, Q.; Wu, Y.-P.; Wang, Y.; Zhu, X.D. What affects green consumer behaviour in China? A case study from Qingdao. *J. Clean. Prod.* **2014**, *63*, 343–351. [CrossRef]
43. Zsóka, Á.; Szerényi, Z.M.; Széchy, A.; Kocsis, T. Greening due to environmental education? Environmental knowledge, attitudes, consumer behavior and everyday pro-environmental activities of Hungarian high school and university students. *J. Clean. Prod.* **2013**, *48*, 126–138. [CrossRef]

44. Coelho, F.; Pereira, M.C.; Cruz, L.; Simões, P.; Barata, E. Affect and the adoption of pro-environmental behaviour: A structural model. *J. Environ. Psychol.* **2017**, *54*, 127–138. [[CrossRef](#)]
45. Lee, Y.-K.; Kim, S.; Kim, M.; Choi, J. Antecedents and interrelationships of three types of pro-environmental behavior. *J. Bus. Res.* **2014**, *67*, 2097–2105. [[CrossRef](#)]
46. Nässén, J. Determinants of greenhouse gas emissions from Swedish private consumption: Time-series and cross-sectional analysis. *Energy* **2014**, *66*, 98–106.
47. Pisano, I.; Lubell, M. Environmental behavior in cross-national perspective: A multilevel analysis of 30 countries. *Environ. Behav.* **2017**, *49*, 31–58. [[CrossRef](#)]
48. Poškus, M.S. Investigating pro-Environmental Behaviors of Lithuanian University Students. *Curr. Psychol.* **2018**, *37*, 225–233. [[CrossRef](#)]
49. Tabi, A. Does pro-environmental behavior affect carbon emissions? *Energy Policy* **2013**, *63*, 72–981. [[CrossRef](#)]
50. Tam, K.-P.; Chan, H.-W. Environmental concern has a weaker association with pro-environmental behavior in some societies than others: A cross-cultural psychology perspective. *J. Environ. Psychol.* **2017**, *53*, 213–223. [[CrossRef](#)]
51. Tam, K.-P.; Chan, H.-W. Generalized trust narrows the gap between environmental concern and pro-environmental behavior: Multilevel evidence. *Glob. Environ. Chang.* **2018**, *48*, 182–194. [[CrossRef](#)]
52. Landry, N.; Gifford, R.; Milfont, T.L.; Weeks, A.; Arnocky, S. Learned helplessness moderates the relationship between environmental concern and behavior. *J. Environ. Psychol.* **2018**, *55*, 18–22. [[CrossRef](#)]
53. Latif, S.A.; Omar, M.S.; Bidin, Y.H.; Awang, Z. Role of environmental knowledge in creating pro-environmental residents. *Procedia Soc. Behav. Sci.* **2013**, *105*, 866–874. [[CrossRef](#)]
54. Rhead, R.; Elliot, M.; Upham, P. Using latent class analysis to produce a typology of environmental concern in the UK. *Soc. Sci. Res.* **2018**, *74*, 210–222. [[CrossRef](#)]
55. Zareie, B.; Navimipour, N.J. The impact of electronic environmental knowledge on the environmental behaviors of people. *Comput. Hum. Behav.* **2016**, *59*, 1–8. [[CrossRef](#)]
56. Morren, M.; Grinsten, A. Explaining environmental behavior across borders: A meta-analysis. *J. Environ. Psychol.* **2016**, *47*, 91–106. [[CrossRef](#)]
57. Tukker, A.; Emmert, S.; Charter, M.; Vezzoli, C.; Sto, E.; Andersen, M.M.; Geerken, T.; Tischner, U.; LahLou, S. Fostering change to sustainable consumption and production: An evidence based view. *J. Clean. Prod.* **2008**, *16*, 1218–1225. [[CrossRef](#)]
58. Chen, M.-F. Self-efficacy or collective efficacy within the cognitive theory of stress model: Which more effectively explains people's self-report pro-environmental behavior? *J. Environ. Psychol.* **2015**, *42*, 66–75. [[CrossRef](#)]
59. Ertz, M.; Karakas, F.; Sarigöllü, E. Exploring pro-environmental behaviors of consumers: An analysis of contextual factors, attitude, and behaviors. *J. Bus. Res.* **2016**, *69*, 3971–3980. [[CrossRef](#)]
60. Huang, H. Media use, environmental belies, self-efficacy, and pro-environmental behavior. *J. Bus. Res.* **2016**, *69*, 2206–2212. [[CrossRef](#)]
61. Kilbourne, W.; Pickett, G. How materialism affects environmental beliefs, concern, and environmentally responsible behavior. *J. Bus. Res.* **2008**, *61*, 885–893. [[CrossRef](#)]
62. Ahmad, B.N.S.; Juhdi, N.; Awadz, S.A. Examination of environmental knowledge and perceived pro-environmental behavior among students of Universiti Tun Abdul Razak, Malaysia. *Int. J. Multidiscip. Thought* **2010**, *1*, 328–342.
63. Whitmarsh, L. Behavioural responses to climate change: Asymmetry of intentions and impacts. *J. Environ. Psychol.* **2009**, *29*, 13–23. [[CrossRef](#)]
64. Hertwich, E.G.; Peter, G.P. Carbon footprint of nations: A global, trade-linked analysis. *Environ. Sci. Technol.* **2009**, *43*, 6414–6420. [[CrossRef](#)]
65. Liu, X.; Vedliz, A.; Shi, L. Examining the determinants of public environmental concern: Evidence from national public survey. *Environ. Sci. Policy* **2014**, *39*, 77–94. [[CrossRef](#)]
66. Laroche, M.; Bergeron, J.; Barbaro-Forleo, G. Targeting consumers who are willing to pay more for environmentally friendly products. *J. Consum. Mark.* **2001**, *18*, 503–520. [[CrossRef](#)]
67. Taufique, K.M.R.; Siwar, C.; Chamhuri, N.; Sarah, F.H. Integrating general environmental knowledge and eco-label knowledge in understanding ecologically conscious consumer behavior. *Procedia Econ. Financ.* **2016**, *37*, 39–45. [[CrossRef](#)]

68. Dodd, T.H.; Laverie, D.A.; Wilcox, J.F.; Duhan, D.F. Differential effects of experience, subjective knowledge, and objective knowledge on sources of information used in consumer wine purchasing. *J. Hosp. Tour. Res.* **2005**, *29*, 3–19. [[CrossRef](#)]
69. Martin, B.; Simintiras, A.C. The impact of green product lines on the environment: Does what they know affect how they feel? *Mark. Intell. Plan.* **1995**, *13*, 16–23. [[CrossRef](#)]
70. Frick, J.; Kaiser, F.G.; Wilson, M. Environmental knowledge and conservation behaviour: Exploring prevalence and structure in a representative sample. *Pers. Individ. Differ.* **2004**, *37*, 1597–1613. [[CrossRef](#)]
71. Arisal, I.; Atalar, T. The exploring relationship between environmental concern, collectivism and ecological purchase intention. *Procedia Soc. Behav. Sci.* **2016**, *25*, 514–521. [[CrossRef](#)]
72. Cotton, D.; Shiel, C.; Paço, A. Energy saving on campus: A comparison of students' attitudes and reported behaviors in the UK and Portugal. *J. Clean. Prod.* **2016**, *129*, 586–595. [[CrossRef](#)]
73. Mostafa, M.M. A hierarchical analysis of the green consciousness of the Egyptian consumers. *Psychol. Mark.* **2017**, *24*, 445–473. [[CrossRef](#)]
74. Onder, R.; Kocaeran, A.A. Analysis of science teacher candidates' environmental knowledge, environmental behavior and self-efficacy through a project called "Environment and energy with professional science education". *Procedia Soc. Behav. Sci.* **2015**, *186*, 105–112.
75. Oguz, D.; Çakci, I.; Kavas, S. Environmental awareness of university students in Ankara, Turkey. *Afr. J. Agric. Res.* **2005**, *5*, 2629–2636.
76. Karimzadegan, H.; Meiboudia, H. Exploration of environmental literacy in science education curriculum in primary schools in Iran. *Procedia Soc. Behav. Sci.* **2012**, *46*, 404–409. [[CrossRef](#)]
77. Liobikienė, G.; Niaura, A.; Mandravickaitė, J.; Vabuolas, Ž. Does Religiosity influence environmental attitude and behaviour? The Case of Young Lithuanians. *Eur. J. Sci. Theol.* **2016**, *12*, 77–86.
78. Hartmann, P.; Apaolaza-Ibáñez, V. Consumer attitude and purchase intention toward green energy brands: The roles of psychological benefits and environmental concern. *J. Bus. Res.* **2012**, *65*, 1254–1263. [[CrossRef](#)]
79. Dunlap, R.E.; Jones, R.E. Environmental concern conceptual and measurement issues. In *Handbook of Environmental Sociology*; Dunlap, R.E., Michwlson, W., Eds.; Greenwood Publishing Group: Westport, CT, USA, 2002; pp. 44–524.
80. Rhead, R.; Elliot, M.; Upham, P. Assessing the structure of UK environmental concern and its association with pro-environmental behaviour. *J. Environ. Psychol.* **2015**, *43*, 175–183. [[CrossRef](#)]
81. Blanchet-Cohen, N.; Reilly, R.C. Teachers' perspectives on environmental education in multicultural contexts: Towards culturally-responsive environmental education. *Teach. Teach. Educ.* **2013**, *36*, 12–22. [[CrossRef](#)]
82. Cerri, J.; Testa, F.; Rizzi, F. The more I care, the less I will listen to you: How information, environmental concern and ethical production influence consumers' attitudes and the purchasing of sustainable products. *J. Clean. Prod.* **2018**, *175*, 343–353. [[CrossRef](#)]
83. First, I.; Khetriwal, D.S. Exploring the relationship between environmental orientation and brand value: Is there fire or only smoke? *Bus. Strategy Environ.* **2010**, *19*, 90103. [[CrossRef](#)]
84. Kwon, W.-S.; Englis, B.; Mann, M. Are third—Party green—Brown ratings believed? The role of prior brand loyalty and environmental concern. *J. Bus. Res.* **2016**, *69*, 815–822. [[CrossRef](#)]
85. Tobler, C.; Visschers, V.H.M.; Siegrist, M. Consumers' knowledge about climate change. *Clim. Chang.* **2012**, *114*, 189–209. [[CrossRef](#)]
86. Flamm, B. The impacts of environmental knowledge and attitudes on vehicle ownership and use. *Transp. Res.* **2009**, *14*, 272–279. [[CrossRef](#)]
87. Bamberg, S.; Möser, G. Twenty years after Hines, Hungerford and Tomera: A new meta-analysis of psycho-social determinants of pro-environmental behaviour. *J. Environ. Psychol.* **2007**, *27*, 14–25. [[CrossRef](#)]
88. Ellen, P.S.; Wiener, J.L.; Cobb-Walgner, C. The role of perceived consumer effectiveness in motivating environmentally conscious behaviors. *J. Public Policy Mark.* **1991**, *10*, 1002–1117. [[CrossRef](#)]
89. Seth, J.N.; Sethia, N.K.; Srinivas, S. Mindful consumption: A customer-centric approach to sustainability. *J. Acad. Mark. Sci.* **2011**, *39*, 21–39. [[CrossRef](#)]
90. Misra, S.; Panda, R.K. Environmental consciousness and brand equity. An impact assessment using analytical hierarchy process (AHP). *Mark. Intell. Plann.* **2017**, *35*, 40–61. [[CrossRef](#)]
91. Geiger, S.M.; Otto, S.; Diaz, J.S. A diagnostic Environmental Knowledge Scale for Latin America/Escala diagnóstica de conocimientos ambientales para Latinoamérica. *Psyecology* **2014**, *5*, 1–36. [[CrossRef](#)]

92. Fraj, E.; Martinez, E. Ecological consumer behavior: An empirical analysis. *Int. J. Consum. Stud.* **2017**, *31*, 2–33.
93. Mahat, H.; Hashim, M.; Nayan, N.; Saleh, Y.; Haron, S.M.S. Sustainable consumption practices of students through practice oriented approach of education for sustainable development. *Int. J. Acad. Res. Bus. Soc. Sci.* **2017**, *7*, 703–720. [CrossRef]
94. Lee, K. The green purchase behavior of Hong Kong young consumers: The role of peer influence local environmental involvement, and concrete environmental knowledge. *J. Int. Consum. Mark.* **2010**, *23*, 21–44. [CrossRef]
95. Mobley, C.; Vagias, W.M.; DeWard, S.L. Exploring additional determinants of environmentally responsible behaviour: The influence of environmental literature and environmental attitudes. *Environ. Behav.* **2010**, *42*, 420–447. [CrossRef]
96. Abrahamse, W.; Steg, L.; Vlek, C.; Rothengatter, T. A review of intervention studies aimed at household energy conservation. *J. Environ. Psychol.* **2005**, *25*, 273–291. [CrossRef]
97. Kitzmuller, C. Environmental Knowledge and Willingness to Change Personal Behaviour: An American-Austrian Comparisons of Energy Use. 2013. Available online: www.Uni-muenstede/imperia/md/content/transpose/_kitzmuller.Pdf. (accessed on 22 June 2013).
98. Hori, S.; Kondo, K.; Nogata, D.; Ben, H. The determinants of household energy-saving behavior: Survey and comparison in five major Asian cities. *Energy Policy* **2013**, *52*, 354–362. [CrossRef]
99. Tadesse, T. Environmental concern and its implication to household waste separation and disposal: Evidence from Mekelle, Ethiopia. *Resource Conserv. Recycl.* **2009**, *53*, 183–191. [CrossRef]
100. Urban, J.; Ščasný, M. Exploring domestic energy-saving: The role of environmental concern and background variables. *Energy Policy* **2012**, *47*, 69–80. [CrossRef]
101. Zibenberg, A.; Greenspan, I.; Katz-Gerro, T.; Handy, F. Environmental Behavior Among Russian Youth: The Role of Self-direction and Environmental Concern. *Environ. Manag.* **2018**, *62*, 295–304. [CrossRef]
102. Binder, M.; Blamkenberg, A.-K. Environmental concern, volunteering and subjective well-being: Antecedents and outcomes of environmental activism in Germany. *Ecol. Econ.* **2016**, *124*, 1–16. [CrossRef]
103. Hassan, A.; Noordin, T.A.; Sulaiman, S. The status on the level of environmental awareness in the concept of sustainable development amongst secondary school students. *J. Soc. Behav. Sci.* **2010**, *2*, 1276–1280. [CrossRef]
104. Whitmarsh, L.; O'Neill, S. Green identity, green living? The role of pro-environmental self-identity in determining consistency across diverse pro-environmental behavior. *J. Environ. Psychol.* **2010**, *30*, 305–314. [CrossRef]
105. Kennedy, E.H.; Beckley, T.M.; McFarlane, B.L.; Nadeau, S. Why we don't "walk the talk": Understanding the environmental values/behaviour gap in Canada. *Hum. Ecol. Rev.* **2009**, *16*, 151–160.
106. Gifford, R. The dragons of inaction: Psychological barriers that limit climate change mitigation and adaptation. *Am. Psychol.* **2011**, *66*, 290–302. [CrossRef]
107. De Groot, J.; Steg, L. Value orientations and environmental beliefs in five countries: Validity of an instrument to measure egoistic, altruistic and biospheric value orientations. *J. Cross-Cult. Psychol.* **2007**, *38*, 318–332. [CrossRef]
108. Steg, L.; Bolderdijk, J.W.; Keizer, K.; Perlaviciute, G. An integrated framework for encouraging pro-environmental behaviour: The role of values, situational factors and goals. *J. Environ. Psychol.* **2014**, *38*, 104–115. [CrossRef]
109. Liu, J.; Wang, R.; Yang, J.; Shi, Y. The relationship between consumption and production system and its implications for sustainable development of China. *Ecol. Complex.* **2010**, *7*, 212–216. [CrossRef]
110. Wang, P.; Liu, Q.; Qi, Y. Factors influencing sustainable consumption behaviors: A survey of the rural residents in China. *J. Clean. Prod.* **2014**, *63*, 152–165. [CrossRef]
111. Clark, C.F.; Kotchen, M.J.; Moore, M.R. Internal and external influences on pro-environmental behavior: Participation in a green electricity program. *J. Environ. Psychol.* **2003**, *23*, 237–246. [CrossRef]
112. Zhu, H.; Wong, N.; Huang, M. Does relationship matter? How social distance influences perceptions of responsibility on anthropomorphized environmental objects and conservation intentions. *J. Bus. Res.* **2019**, *95*, 62–70. [CrossRef]
113. Cordano, M.; Welcomer, S.A.; Scherer, R.F. An analysis of the predictive validity of the new ecological paradigm scale. *J. Environ. Educ.* **2003**, *34*, 22–28. [CrossRef]

114. Liu, X.; Zou, Y.; Wu, J. Factors influencing public-sphere pro-environmental behavior among mongolian college students: A test of Value-Belief-Norm theory. *Sustainability* **2018**, *10*, 1384. [CrossRef]
115. Xiao, C.; Dunlap, R.E.; Hong, D. Ecological Worldview as the Central Component of Environmental Concern: Clarifying the Role of the NEP. *Soc. Nat. Resour.* **2019**, *32*, 53–72. [CrossRef]
116. Brown, T.A. *Confirmatory Factor Analysis for Applied Research*; Guilford Press: New York, NY, USA, 2012.
117. Balzukiene, A.; Telesiene, A. Explaining private and public sphere personal environmental behavior. *Soc. Moksl.* **2012**, *4*, 7–19.
118. Bentler, P.M. Comparative fit indexes in structural models. *Psychol. Bull.* **1990**, *107*, 238–246. [CrossRef]
119. Byrne, B.M. *Structural Equation Modeling with AMOS: Basic Concepts, Applications, and Programming*; Lawrence Erlbaum Associates, Inc.: Mahwah, NJ, USA, 2001.
120. Fornell, C.; Larcker, D.F. Evaluating structural equation models with unobservable variables and measurement error. *J. Mark. Res.* **1981**, *18*, 39–50. [CrossRef]
121. Hair, J.F.; Black, B.; Babin, B.; Anderson, R.E.; Tatham, R.L. *Multivariate Data Analysis: A Global Perspective*; Pearson Education Inc.: London, UK, 2010.
122. Nunnally, J.C.; Bernstein, I.H. *Psychometric Theory*, 3rd ed.; McGraw-Hill: New York, NY, USA, 1994.
123. Hayward, B. *Children, Citizenship and Environment*; Routledge: Abingdon, UK, 2012.
124. Quinn, F.; Castéra, J.; Clément, P. Teachers' conceptions of the environment: Anthropocentrism, non-anthropocentrism, anthropomorphism and the place of nature. *Environ. Educ. Res.* **2015**, *22*, 893–917. [CrossRef]
125. Cocks, S.; Simpson, S. Anthropocentric and Ecocentric. *J. Exp. Educ.* **2015**, *38*, 216–227. [CrossRef]
126. Kopnina, H.; Cocis, A. Environmental Education: Reflecting on Application of Environmental Attitudes Measuring Scale in Higher Education Students. *Educ. Sci.* **2017**, *7*, 69. [CrossRef]
127. Best, S.; Nocella, A.; Kahn, R.; Gigliotti, C.; Kemmerer, L. Introducing critical animal studies. *J. Crit. Anim. Stud.* **2007**, *5*, 3–4.
128. ENEC (European Network for Environmental Citizenship) 2018. Available online: <http://enec-cost.eu/our-approach/enec-environmental-citizenship/> (accessed on 20 February 2019).
129. Bonnett, M. Education for Sustainable Development: A coherent philosophy for environmental education? *Camb. J. Educ.* **1999**, *29*, 313–324. [CrossRef]
130. Kopnina, H. Education for sustainable development (ESD): The turn away from 'environment' in environmental education? *Environ. Educ. Res.* **2012**, *18*, 699–717. [CrossRef]
131. Kahn, R. *Critical Pedagogy, Ecoliteracy and Planetary Crisis: The Ecopedagogy Movement*; Peter Lang: New York, NY, USA, 2010.
132. Fassbinder, S.D.; Nocella, A.J., II; Kahn, R. *Greening the Academy—Ecopedagogy through Liberal Arts*; Sense Publishers: Rotterdam, The Netherlands, 2012.
133. Poškus, M.S. Normative Influence of pro-Environmental Intentions in Adolescents with Different Personality Types. *Curr. Psychol.* **2017**, *1*–14. [CrossRef]



© 2019 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<http://creativecommons.org/licenses/by/4.0/>).