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Impacts of Building Energy Consumption Information on Energy-Saving Intention of College Students

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Abstract: As college students bear little energy cost of public buildings on campus, information intervention is more feasible than economic intervention to augment the energy-saving intention of college students. College students are sensitive to environmental information; thus, building energy consumption information, which reflects the energy consumption levels of the environment where students live, may be effective to promote the energy-saving intention of college students. However, the changeable cognitive structure of college students makes it difficult to predict the cognitive results of building energy consumption information. Based on social cognitive theory and theory of planned behavior, this paper reveals the impacts of building energy consumption information on energy-saving intentions of college students from the perspective of perceived value and personal norms. The conclusions are: (1) The impacts are positive and indirect; (2) the impacts are realized through the path "perceived benefit—perceived value—intention" and "perceived benefit & risk—personal norm—intention"; (3) the perceived value and personal norm independently affect energy-saving intention; and (4) the effect of perceived benefits is the most obvious. Based on the above results, we put forward a series of policy suggestions, with the aim to enhance the positive effect of building energy consumption information on college students.

Keywords: energy-saving intention; building energy consumption; college students; perceived value

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1. Introduction

Building energy saving is one of the important ways to promote carbon emission reduction [1]. Among various kinds of buildings, college buildings deserve special attention due to their high energy consumption. The energy consumption of American college's accounts for 13% of the total building energy consumption [2], and the energy consumption of French colleges accounts for 38% of public facilities [3]. In addition, the energy consumption intensity of college buildings is also higher than that of other buildings. Research shows that the energy consumption per unit area of college buildings is 5–10 times that of ordinary houses [4]. One of the important reasons for the high energy consumption in colleges is that few college students are required to pay for the energy they have used [5]. At the same time, electricity price may limit users' enthusiasm for energy-saving [6]. Therefore, economic policies, namely the economic intervention, are not effective for altering energy-saving intentions of college students. Aside from economic intervention, information intervention is also effective to promote energy saving [7]. At the practical level, the Chinese government has clearly point out that it is necessary to improve energy-saving intention of college students by disclosing and proving relevant information [8,9]. However, what kind of information to provide and how to improve its effect remain to be answered.

Economic intervention affects behavior patterns, while information intervention affects cognition. Energy-saving, as a part of pro-environmental behavior, is affected by environmental cognition. Environmental cognition of daily life links the basic attitude and behavior cognition, and has a regulatory effect in the formation of intention [10]. Campus buildings constitute the environment for the daily study and life of college students. Due to their higher-intensity environmental scanning [11], college students are more sensitive to the building environment including building energy consumption. The research of Fu et.al. also shows that intention is related to the surrounding environment [12]. That is, building energy consumption may have a significant impact on the energy-saving behavior of college students. However, it is difficult to judge the result of the impact, because college students usually experience great changes in cognitive structure while in the stage of socialization [11]. Since the cognitive structure affects the understanding and thoughts of college students regarding problems or events [13], college students' cognition of building energy consumption information may be uncertain, meaning that the impact of building energy consumption information (BECI) is difficult to judge. Therefore, in order to better understand the impact of BECI, the following two aspects should be clarified. First, is the impact positive or negative? Second, through what path does BECI affect the energy-saving intention of college students? By exploring these questions, some guidance on the information intervention for college students could be provided in the future, including whether to disclose building energy consumption information and how to design information content to realize the intervention.

Although the content of information intervention and disclosure have become research hot spots, most of the research focuses either on the ecological worldview, which is macroscopic [14], or on the energy-saving technologies or skills, which is microscopic. The attention to intermediate perspective, that is, the energy and environment information, is not enough. The ecological worldview is the result of relevant research summarized by scholars, it includes environmental concern [14], understanding of climate change, and environmental issues [7]. Ecological worldview is regarded as the basis for the formation of generalized pro-environmental behavior [15], and has been proven to have a positive impact on energy-saving intention. However, the ecological worldview is not the only factor affecting energy-saving intention. At the micro level, the information of energy-saving technologies or skills can affect the energy-saving intention through skill and behavior choices. For example, information on personal energy-saving skills usually has a positive impact on energy-saving intention, including information on household energy-saving skills [16] and information on specific measures to reduce carbon dioxide emissions [17]. However, information related to the progress of energy-saving technology, including energy-saving products [18] and the stand-by energy consumption of electrical appliances [19], may have negative impacts on energy-saving intention due to the rebound effect (that is, although energy efficiency is improved, energy consumption may not be reduced) [20]. Existing studies show that the ecological worldview affects the basic attitude of all pro-environmental behaviors at the macro level, and energy-saving technology mainly affects the means to achieve energy saving at the micro level, thus affecting the energy-saving intention. In contrast, building energy consumption information acts on environmental perception. The relationship of the three types of information is shown in Figure 1. The impact and significance of environmental perception on energy-saving can be supported by social cognitive theory (SCT).

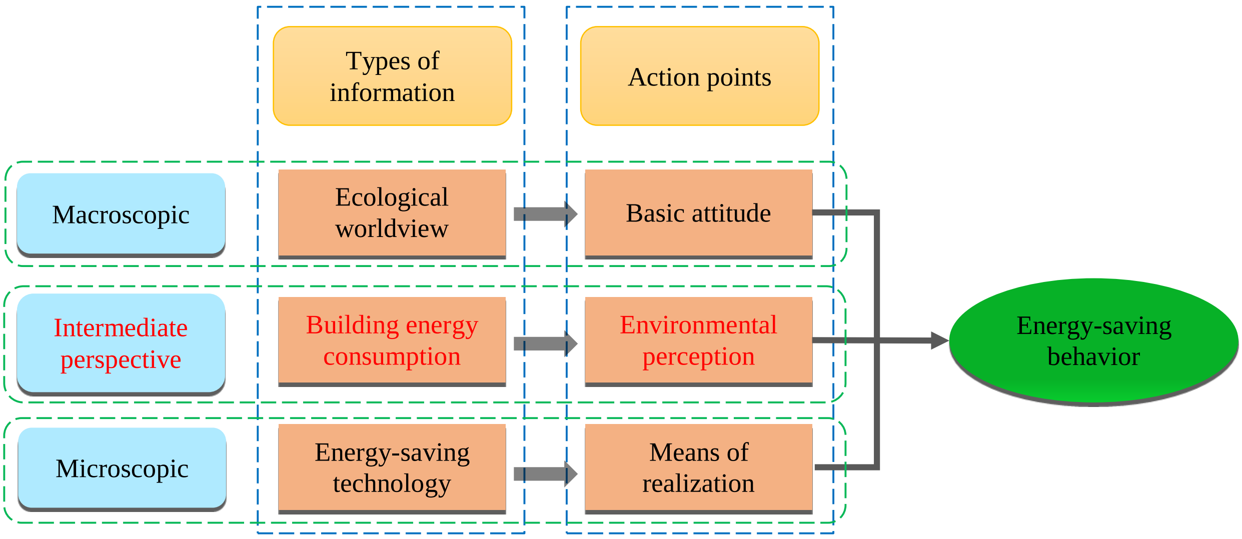

Figure 1. The connection and difference of the three types of information.

SCT agrees that perceptions serve as mediators and coordinators among environments, perceptions, and behaviors. Perceptions have direct impacts on personal behaviors, and personal cognition is subject to the surrounding environment [10]. In addition, perceptions of the surrounding environment are sometimes rational, and information disclosure can impact personal or group environmental perceptions obviously [21]. That is, the information of surrounding environment will play a vital role in cognition, thus affecting intention and behavior [22]. The above research supports the theoretical impact of BECI on energy-saving intention of college students. However, the specific mechanism of the impact still cannot be explained. Namely, the action target and action path are not clear. College students are in the transition period from campus to society. Thus, their experience consists of both campus experience and social experience. Because experience impacts perception significantly [23], the environmental perception of college students and the cognition caused by perception may be specific. It is necessary to study the mechanism of BECI on energy-saving intention of college students. However, the impact of information disclosure on China's environmental problems is still not clear [24], and the current research on the impacts of information disclosure on group behavior and intention focuses more on economics rather than environment [25,26]. Therefore, it is necessary to study the impact of BECI on energy-saving intention of college students, especially to explore its mechanism and action path.

However, there are few studies on the mechanism of information intervention in the existing research. Although some studies considered various kinds of information when studying the energy-saving intention, the information was only taken as the research background rather than an important variable. For example, Song et al. [27] used the Norm Activation Model to take haze pollution as the background, then setting norms, responsibilities, and other variables that related to the haze pollution. However, the information on haze pollution was not been considered as a specific factor. Trotta [17] regarded the impact of information as a pro-environmental variable to study the influencing factors on energy-saving intention. Although some scholars took the information of specific content as an independent variable, they only tested whether the information had a significant effect on energy-saving intention, the mechanism and path of action were not deeply explored. For example, Pothitou et al. [28] and Ding et al. [16] tested whether information on carbon emission reduction or energy-saving household appliances, respectively, would affect the energy-saving intention. In summary, there is a relative lack of research on the action mechanism of energy-saving intention based on information content.

To sum up, although there has been a lot of research on energy-saving related information and information disclosure, deficiencies still exist in the following aspects. First, whether the impact of environmental information (especially BECI) on energy-saving intention is positive remains unknown. Second, the action path of BECI on energy-saving intention of college students remains unclear. Whether the impact is direct, and whether there is interaction remains to be explored. Aiming to solve the above problems, this paper will establish an action mechanism model of BECI on energy-saving intention of college students based on SCT and theory of planned behavior (TPB), which includes action path. Then, the survey data will be used to verify the model, clarify whether the impact of BECI is positive, and clarify the effective action path. The research results will help to provide theoretical support and policy implications to improve energy-saving intention of college students in a wider range.

2. Literature Reviewed and Hypothesis Postulate

TPB has been widely used to study environmental behaviors and intentions [15]. The core premise is that intention is directly affected by attitude, subjective norms, and perceived behavior control [29]. However, TPB does not deeply explore how a specific factor acts on intention through attitude, norms, and perceived behavior control. Although the two parts "building energy environment—personal cognition" are important in SCT, they not reflected in TPB. The purpose of this study is to explore whether and how BECI affects energy-saving intentions. Therefore, based on SCT and TPB, a mechanism model of BECI on energy-saving intention (INT) of college students will be constructed. In this model, BECI reflects energy environment, and perceived value (PV) and personal norms (PN) reflect two aspects of cognition. In Section 2, we will deduce the mechanism of BECI on INT and list the basis of relevant assumptions.

2.1. Influencing Factors on Energy-Saving Intention

Attitude in TPB refers to the cognition of behavior and its consequences [15], and the related knowledge and information are factors influencing this cognition [30]. Since one of the key goals of this paper is to explore how the BECI affects energy-saving intentions, the mechanism of BECI on attitude is analyzed (see Section 2.2 for details). Based on this, we specifically study one of the elements of attitude, that is, the PV of energy saving. PV represents college students' judgments on the value of a certain behavior. Note that the judgements are related to the social practice experience of college students. The relationship between PV and INT is similar to the relationship between attitude and intention in TPB [31]. As such, Hypothesis 1 is put forward as the following:

Hypothesis 1. *PV has a positive impact on INT.*

The second factor is norm. In recent years, many relevant research divided norms into subjective norms [32], descriptive norms (Ding et al., 2019), and PN [27]. Subjective norms refer to the social pressures on individuals when they carry out their behaviors—the norms formed by the behavior of people around us. However, it is unknown to what extent the formation of people's behavior around us is affected by BECI, so it is not suitable to accurately express the influence of BECI. Descriptive norms refer to how to carry norms out in a specific situation. Although BECI can provide background knowledge, it cannot create a specific situation. PN, defined as the moral obligation to fulfill or not perform a particular act [33], is mainly about personal cognition and principles of conduct rather than external pressure, which can directly show the impact of BECI on individuals. In addition, PN can reflect the judgment of college students on energy-saving. Therefore, this paper replaces the subjective norms in TPB with PN and assumes that they exert a positive impact on energy-saving intentions. Hypothesis 2 thus reads as follows:

Hypothesis 2. *PN has a positive impact on INT.*

The third factor is perceived behavior control. Perceived behavior control refers to the expectation of resources and obstacles related to the implementation of behavior. This factor is not directly related to background information such as BECI, so we do not consider the influence of this factor on this study's target problems.

In view of the above, we have taken personal cognition as the core, discriminated and adjusted the TPB model, and will study the impact mechanism of BECI on INT of college students from two aspects: PV and PN. In addition, we also assume that BECI may directly affect energy-saving intention and have a positive impact on it, that is, the more students learn BECI, the more energy they will tend to save:

Hypothesis 3. *BECI has a positive impact on INT.*

2.2. Influencing Factors of Perceived Value

The concept of PV originally refers to consumers' perceived preference and evaluation of products; it affects the whole process of consumers' perception, evaluation, and purchase of products [34]. On the basis of this concept, scholars have put forward the concept of green PV, which refers to consumers' overall assessment of the net income of a product or service based on environmental aspirations and expectations of sustainability [35]. In recent years, the concept of PV has been used to study issues surrounding the environment and energy saving [31,36]. According to the definition of PV in the above literature, we use PV to describe college students' overall evaluation of the net income of energy saving.

In recent years, research on PV and energy saving or environmental intention suggests that PV can be further subdivided [37] into categories such as perceived quality, perceived price, and perceived environmental values. These factors will significantly affect consumers' purchase intention for energy-saving devices in a positive way [38]. Some studies divide the factors that affect PV into perceived benefit (PB) and perceived sacrifices—the cost of implementing green consumption. Moreover, PB is positively correlated with green consumption intention, while perceived sacrifice is negatively correlated [39]. Based on the references cited above, three influencing factors of PV are set according to the analysis of value composition in technical economics [40]. The three influencing factors are PB, perceived costs (PC), and perceived risk of non-implementation of energy saving (PR). In addition, it is necessary to assume that BECI has an impact on these three factors. The reason is that although the growth rate of China's energy consumption has decreased to some extent in recent years, it still shows an upward trend in general. Considering the connotation of PB, PR and PC, we assume that BECI has a positive impact on them, and make the following hypotheses:

Hypothesis 4a. *BECI has a positive impact on PB;*

Hypothesis 4b. *BECI has a positive impact on PR;*

Hypothesis 4c. *BECI has a positive impact on PC;*

Hypothesis 5a. *PB has a positive impact on PV;*

Hypothesis 5b. *PC has a negative impact on PV;*

Hypothesis 5c. *PR has a positive impact on PV.*

2.3. Influencing Factors of Personal Norm

At present, relevant studies suggest that PN are influenced by attitude, consequence, responsibility [41,42], environmental concern, and perceived consumer effect [27]. As mentioned earlier, we assume that BECI will affect INT and that the attitude can be divided into three aspects: PB, PC, and PR. Among the three aspects, PB and PR can reflect the consequences, while PC reflects the ascription of responsibility. Therefore, we assume that PB, PC, and PR will have an impact on PN, as follows:

Hypothesis 6a. *PB has a positive impact on PN;*

Hypothesis 6b. *PC has a negative impact on PN;*

Hypothesis 6c. *PR has a positive impact on PN.*

According to the above assumptions, we established a structural model as shown in Figure 2.

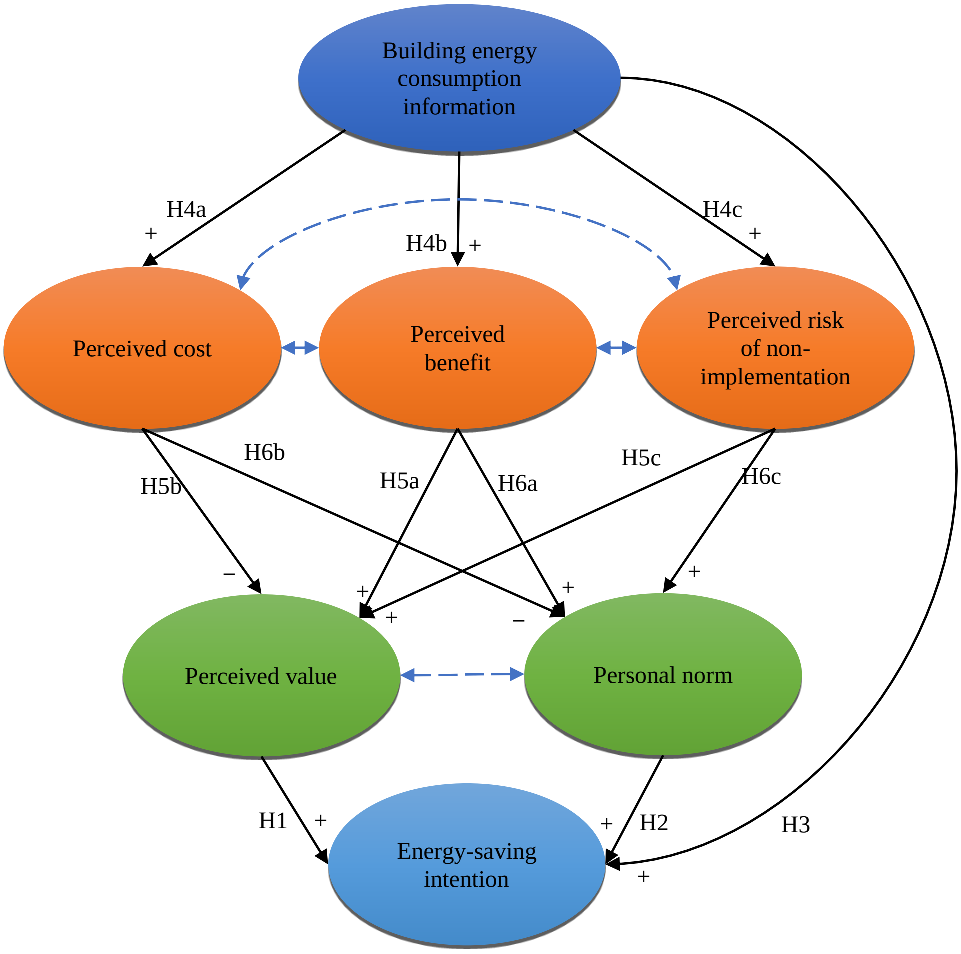

Figure 2. Structural model of the research.

2.4. Interaction Effects

There may be interaction between PV and PN, PB and PC, PB and PR, and PC and PR. For example, when studying recycling intention, some scholars found that norms and attitudes affect the intention interactively, and there are also interactions between different types of norms [32]. Ru et al. [43] found that there was also interaction between perceived behavioral control and different types of norms. Since we use the idea of technological economics to extract PV, PB, PC, and PR from attitudes, it is necessary to examine whether there is interaction in between. The interacting effects which need to be examined include the effect of PN and PV, PB and PC, PB and PR, and PC and PR (as shown by the blue dashed arrow in Figure 2).

3. Methodology

3.1. Questionnaire and Data Source

The measurement items employed in this paper include INT, PN, PV, PB, PC, PR, and BECI. On the basis of relevant research [27,43–45], questionnaire items were designed, as shown in Appendix A. For all measurement items, a five-point scale was used to indicate the extent to which respondents approve of these items, where 5 represents the most agreement and 1 represents the most disagreement. Three procedures were implemented to improve the questionnaire and, in turn, to improve the accuracy of measurement. First, a descriptive sentence was designed for each item based on previous research. Second, in pre-investigation, 150 college students in Xi'an were selected to fill out the questionnaire (127 valid questionnaires were collected) to identify and, consequently, modify any problems in the questionnaire. Third, a team of four teachers and five graduate students were invited to examine the questionnaire to ensure that it was easy to read and understand so that high-quality data could be collected.

To ensure the quality of the survey, the questionnaire was distributed to students of a university in Xi'an between April and May 2021. Xi'an is a city with relatively concentrated colleges. The development level of higher education in Xi'an is relatively high. According to China's urban statistical yearbook, there were 63 colleges in Xi'an in 2020, and the number of colleges in Xi'an ranks sixth among Chinese cities. The data indicates that Xi'an has a high level of higher education development and college agglomeration. Additionally, the urban development level of Xi'an is close to the national average level. Xi'an's per capita disposable income and per capita consumption expenditure are close to the national average. In 2020, Xi'an's annual per capita disposable income and annual per capita consumption expenditure were CNY 35,783 and CNY 22,168, while China's average levels were CNY 32,189 and CNY 21,210, respectively. Therefore, the survey results of Xi'an will reflect the general situation of Chinese colleges.

During the investigation, we chose some classrooms randomly and invited the students in the classroom to complete the questionnaire during the break between classes. Each respondent was informed of the purpose of the investigation and the anonymity of the questionnaire. From the survey, we received a total of 473 responses. Before the data analysis, some invalid questionnaires that have logic error or short answer time should be deleted [43,46]. Finally, 72 invalid questionnaires with the same answer for most items, answer time is less than 90 s, and with logical errors were removed. A total of 401 valid responses were finally obtained. Among the valid responses, male students accounted for 44.39% and female students for 55.61%. Students at first, second, third, and fourth grade account for 14.21%, 24.64%, 46.38%, and 14.46%, respectively. Data sources show that the survey covers different types of college students.

3.2. Methods to Examine the Hypotheses

The data analysis of this study was conducted using the Structural Equation Modeling (SEM) technique and followed the two-step approach for assessing the measurement and structural models, respectively [47]. SEM is a powerful statistical research technique which is effective in analyzing relationships between multiple-item constructs [48,49]. SEM consists of two parts: measurement model (Equations (1) and (2)) and structural model (Equation (3)). In the equations, X and Y are the exogenous measured variables and the endogenous measured variables, Λ_X and Λ_Y are the loadings, δ and ε are the measurement error, ξ and η are the exogenous latent variables, and the endogenous latent variables, B represents the relationship between endogenous latent variables while Γ represents the effect of exogenous latent variables on endogenous latent variables; ζ is the uniqueness. The maximum likelihood estimation method is used to estimate the parameters in the model.

$$X = \Lambda_X \xi + \delta \quad (1)$$

$$Y = \Lambda_Y + \varepsilon \quad (2)$$

$$\eta = B\eta + \Gamma\xi + \zeta \quad (3)$$

The sample size of a model should more than 200 [50]. There are 401 valid sample of this study, which meets the requirements.

In this study, we first used SEM to verify the hypotheses and structural model, and then used the bootstrap method [51] to test the mediating effect of some variables. Then, process v3.5, which was developed by Andrew F. Hayes [52], was used to test whether the interaction effect exists.

4. Results Analysis

4.1. Structural Equation Model Examination

First, confirmatory factor analysis (CFA) was employed to evaluate the reliability and validity of the model. Convergent validity and composite reliability evaluate the correlation between the items within the latent variables. According to the related research, Cronbach's alpha and composite reliability reflect the validity of the answered surveys, and they should be greater than 0.7, and the lowest average variance extracted (AVE) should be greater than 0.5 [53,54]. The relevant indicators of this study are shown in Table 1, and the results show that all measurement items have robust convergent validity.

Table 1. Results of measurement model analysis.

Unobserved Variables	Observed Variables	Factor Loads	Cronbach's Alpha	AVE	Composite Reliability
INT	INT1	0.919	0.965	0.874	0.965
	INT2	0.958			
	INT3	0.943			
	INT4	0.905			
PV	PV1	0.897	0.936	0.826	0.935
	PV2	0.902			
	PV3	0.825			
PN	PN1	0.907	0.940	0.801	0.941
	PN2	0.905			
	PN3	0.917			
	PN4	0.809			
PB	PB1	0.792	0.929	0.774	0.932
	PB2	0.913			
	PB3	0.923			
	PB4	0.883			
PR	PR1	0.896	0.794	0.583	0.804
	PR2	0.616			
	PR3	0.754			
PC	PC1	0.845	0.883	0.658	0.885
	PC2	0.838			
	PC3	0.740			
	PC4	0.817			
BECI	BECI1	0.884	0.864	0.618	0.866
	BECI2	0.777			
	BECI3	0.721			
	BECI4	0.753			

In addition, discriminant validity should be checked. The square root values of AVE for each latent variable should be larger than the correlation between constructs, thus supporting discriminant validity [55]. The results in Table 2 indicate a high level of discriminant validity.

Table 2. Correlation matrix and square roots of the AVEs.

	BECI	PB	PC	PR	PV	PN	INT
BECI	0.786						
PB	0.124	0.880					
PC	0.000	0.000	0.811				
PR	0.191	0.028	0.000	0.764			
PV	0.109	0.425	−0.055	0.025	0.909		
PN	0.115	0.259	−0.059	0.232	0.233	0.895	
INT	0.105	0.362	−0.053	0.076	0.427	0.279	0.935

In total, 401 samples were used to test the structural model,. The value of the fitting indicators and the judgment standard [50,56,57] of the modified model are shown in Table 3. Note that the p value of some path coefficients is not significant (see Table 4 for details). Therefore, we modified the model and deleted these paths The results show that the overall fit of the structural model is good and that the modified structural model is acceptable.

Table 3. Fit indices of the models.

Types of Indicators	Statistics of Goodness-of-Fit	Standard Values	Test Values	Adaptability of the Model
Absolute goodness-of-fit	CMIN/DF	<3.00	2.343	Qualified
	CMIN	$p < 0.05$	$p = 0.000$	Qualified
	GFI	>0.80	0.884	Qualified
	AGFI	>0.80	0.859	Qualified
	RMSEA	<0.08	0.058	Qualified
Added-value goodness-of-fit	CFI	>0.90	0.958	Qualified
	NFI	>0.90	0.929	Qualified
	IFI	>0.90	0.958	Qualified
	RFI	>0.90	0.920	Qualified
Concise goodness-of-fit	PNFI	>0.50	0.829	Qualified
	PCFI	>0.50	0.855	Qualified
	CN	>200	206	Qualified

Table 4. Path coefficient estimation of the model.

Paths	Standardized Regression Weights	S.E.	C.R.	Hypotheses	Results
PV→INT	0.622	0.056	12.309 ***	H1	Supported
PN→INT	0.212	0.055	4.613 ***	H2	Supported
BECI→INT	−0.044	0.035	−1.116	H3	Not supported
BECI→PB	0.194	0.041	3.576 ***	H4a	Supported
BECI→PC	−0.039	0.054	−0.697	H4b	Not supported
BECI→PR	0.229	0.056	4.052 ***	H4c	Supported
PB→PV	0.843	0.045	19.445 ***	H5a	Supported
PC→PV	−0.087	0.028	−2.537 *	H5b	Supported
PR→PV	0.057	0.029	1.569	H5c	Not supported
PB→PN	0.535	0.047	11.130 ***	H6a	Supported
PC→PN	−0.099	0.034	−2.220 *	H6b	Supported
PR→PN	0.354	0.037	7.200 ***	H6c	Supported

Note: * $p < 0.05$, *** $p < 0.001$.

The modified model is shown in Figure 3. The path coefficient of each path in the model and the related test indicators are shown in Table 4. The factor loads of all latent variables are not less than 0.5, which indicates that the model is more accurate in measuring factors. The standardized regression coefficients and their test results for each path in

Table 4 show that the C.R. value of path coefficients of H4 and H4b falls in the interval (−1.8, 1.8), and the *p* value is greater than 0.05. Therefore, the two hypotheses above were negated, and the corresponding three paths in the structural model were deleted. The paths corresponding to the other hypotheses are highly significant, and these hypotheses have been verified.

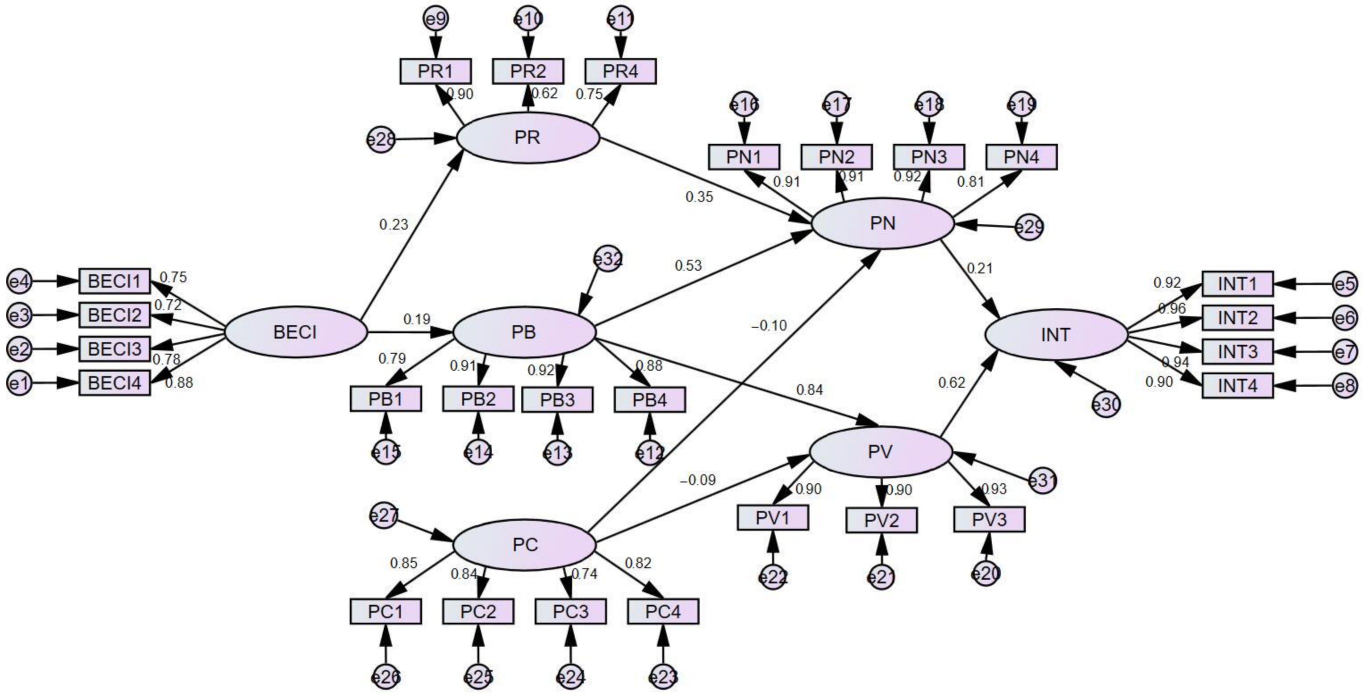

Figure 3. Theoretical model and its parameters.

4.2. General Effect

The results show that BECI has no significant direct effect on INT, indicating that the effect of BECI is complex to a certain extent. However, the result does not suggest that BECI has no effect on INT. Therefore, the mediating effects of related factors have been tested and the results are shown in Table 5. The number of bootstrap samples was set at 5000 times. The existence of mediating effects was then decided according to whether the indirect effect includes zero in the 95% confidence interval deciding. The results show that all of the value of mediating effects fall into the 95% confidence interval, that is, the mediating effects in Table 5 are significant.

Table 5. Results of mediation effect analysis.

Path	Effect	95% Confidence Intervals	
		Lower Limit	Upper Limit
BECI→PB→PV	0.130	0.057	0.223
BECI→PB→PN	0.118	0.052	0.214
BECI→PR→PN	0.060	0.024	0.114
PC→PV→INT	−0.050	−0.099	−0.007
PC→PN→INT	−0.019	−0.052	0.001
BECI→PB→PV→INT	0.090	0.042	0.162
BECI→PB→PN→INT	0.033	0.013	0.069
BECI→PR→PN→INT	0.015	0.006	0.033
BECI→INT (total)	0.139	0.066	0.237

The results can be explained in four aspects. First, the indirect effect of BECI on INT is realized through PB and PR. BECI has no significant direct effect on INT, but has a significant positive effect on PB and PR, and PB and PR affect INT through PV and PN. The results show that PB and PR are two key perspectives to explore the effect of BECI on INT. Second, the most important impact path of BECI to INT is BECI→PB→PV→INT. By comparing the paths, it can be found that PB and PV are the key mediating variables of BECI acting on INT. Third, compared with PB and PR, PC is an external factor affecting INT. BECI has no significant effect on PC, while PC has significant negative effects on PV and PN. The results show that although PC is not on the action paths of BECI on INT, it is one of the factors affecting these paths. In addition, it also shows that BECI does not significantly and directly affect the PC of college students. Fourth, compared with PN, PV has a greater impact on INT. This result shows that, college students' judgement of the value of energy saving is more important than self-discipline of energy behavior.

4.3. Interaction Effects

Results show that, when acting on PN, there is significant interaction effect between PB and PC and between PB and PR (as shown in Figure 4), while there is no significant interaction effect between PR and PC. In addition, there is no significant interaction effect between PN and PV; when acting on PV, there is no significant interaction between PB and PC.

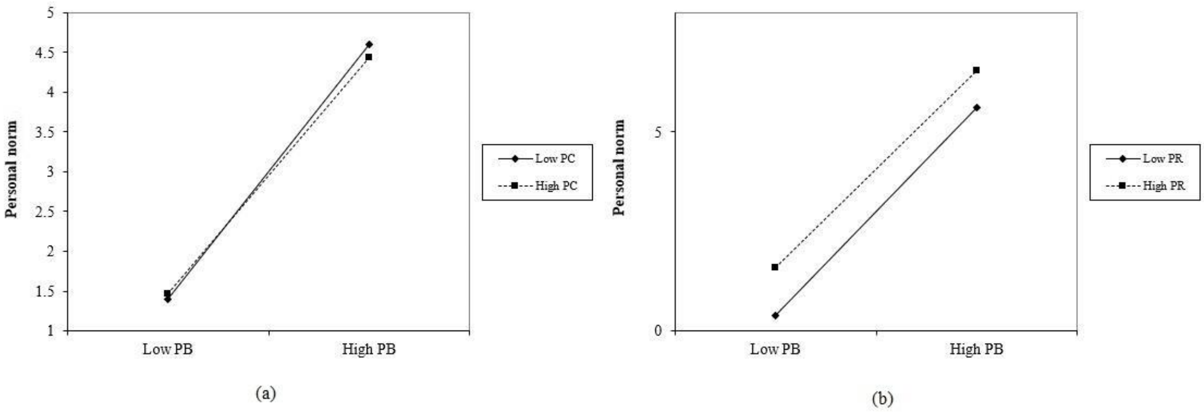

Figure 4. Interacting effects between PB and PC (**a**) and PB and PR (**b**).

First, there is no significant interaction between PV and PN. The result indicates that the connotation of PV and that of attitude are not consistent, and PV and PN do not affect each other. Therefore, when formulating relevant policies, how to improve PV and PN need to be separately considered. Second, as shown in Figure 4a, when acting on PN, the slope of the function image corresponding to high PC is smaller than that of low PC, indicating that PC will weaken the positive impact of PB. Third, although the slope of high PR is slightly smaller than that of low PR, the two lines still do not intersect at the high PB level. These results show that, although the influence of PB decreases slightly at the high PR level, the total effect of PB on PN is still stronger than that of the low PR level.

5. Discussion

5.1. Impact of Building Energy Consumption Information

The results show that BECI indirectly affects INT by affecting their perception of energy saving, thus affecting their PV and PN. This is different from the result obtained by [58] that the information disclosure will directly affect the public's environmental intention. The reason may be that people's pro-environmental behavior will be affected by their experience of relevant scenes. When this experience is reproduced or prompted, the intention of pro-environmental behavior will be mobilized [59]. In the study conducted by Hou et al. [58], people living in arid areas are more likely to experience the scene of water shortage; therefore, their intention is directly affected by regional water shortage information disclosure. In contrast, since the power supply reliability of China State Grid reached 99.91% [60] in 2005, college students have less experience with energy shortages, power outages, and other related problems. Therefore, the memories and experiences of energy shortage scenes of college students are rarely aroused by BECI; thus, BECI cannot affect INT directly. In addition, it also shows that the mechanism of information disclosure on different issues may be complex. Thus, in order to explain the impact of information disclosure, it is necessary to explore the mechanism of information disclosure. This paper explains the impact of BECI from the perspective of the perception of energy saving.

The positive effect of BECI on PB and PR can be explained from two aspects. First, college students' basic value orientation for energy saving is positive. Values–Beliefs–Norms (VBN) theory holds that people's basic attitude towards the ecological environment is the key factor influencing the perception of the consequences of environmental behavior, and the basic attitude is affected by people's value orientation towards environmental problems [61]. Building energy consumption information provide students with the general energy consumption situation in where they live. According to the theory of Henry and Dietz, the energy consumption situation is closely related to the basic attitude of energy saving. Therefore, the positive effect of BECI on PB and PR proves that college students' basic value orientation for energy saving is positive. Second, BECI guides college students to visualize energy problems in the future, and this process reflects the key mechanism of the formation of PB and PR. Research shows that projecting the self into the future to pre-experience future events is associated with a higher level of risk perception and a greater tendency toward pro-environmental behavior [62]. Due to the increasing building energy consumption in China in recent years, the energy consumption information will stimulate college students to pre-experience the increased energy consumption scene in the future. Based on their positive value orientation for energy saving, college students may believe that if they do not promote their energy-saving behavior, they may face greater risks of energy supply in the future. Therefore, college students may believe that energy-saving is valuable. If we can predict or clarify the basic value orientation of specific groups for specific energy-saving behavior through investigation, disclosing information that can stimulate pre-experience of future scenes will contribute to their PB and PR of energy-saving, and improve their energy-saving intention.

H4c is denied; BECI has no significant impact on PC. BECI does not make college students feel that implementing energy-saving behavior is troublesome or laborious. Because the building energy consumption has shown an upward trend in recent years, we speculate that after receiving BECI, college students will believe that not only greater efforts are needed to achieve energy saving, but the people around them may also not spare any effort to saving energy. Under the influence of subjective norms, college students tend to believe that the cost of energy saving is high due to the extra efforts. However, the results showed that BECI does not affect PC significantly. We believe that there are two reasons. First, BECI does not involve the daily energy-saving behavior of college students. Second, whether there is an upward or downward trend of energy consumption, college students' evaluation of the cost of implementing energy saving is relatively independent. Therefore, while BECI makes college students aware of the importance of energy saving, it will not make them believe that it is difficult to be realized. In general, providing BECI to college students is a practice worthy of implementation.

5.2. Impact of Perceived Value and Personal Norm

The results show that both PV and PN have a positive impact on INT, which verifies the previous assumptions and theories. However, the interaction results show that there is no significant interaction between PV and PN when they act on INT, which is inconsistent with the conclusions of existing studies. Norms and attitudes usually have significant interaction when acting on energy and environmental behavior [32,41]. According to the existing studies, as a part of attitude, PV should have significant interaction with PN. However, they act independently on INT. The reason may be that attitude is a complex concept, which involves many aspects, and PV is only one of them. Some specific factors of concepts of attitude may interact with norms, but PV will not. This phenomenon shows that it is necessary for future research to further divide the aspects of attitude as the research object.

PC has little effect on PV (the standardized path coefficient is only −0.087), while PR has no significant effect on PV. PC and PR represent the perceived loss, and they are negative factors. The central element of Prospect Theory is loss aversion, which describes the observation that losses have a relatively larger impact on observed decisions than gains, relative to a subjective reference point [63,64]. According to this theory, PC and PR should have a greater impact on the judgment of the value of energy saving than PB. In recent years, studies on the application intention of energy-saving technology and equipment also show that loss- and risk-averse groups are less willing to engage with energy-efficient appliances or technologies [65–67].

How to explain the contradiction between the results of this paper and the existing theories? Firstly, from the whole theoretical model, college students judge PV through PC and PB, and PV is the comprehensive factor that ultimately affects the INT. In other words, when judging energy saving, college students will first comprehensively evaluate the overall value of energy saving through the evaluation of the cost and benefit of energy saving (and their evaluation of cost and benefit is independent rather than interactive), and then make decisions according to this overall value. In this evaluation process, because the cost of energy saving is in an acceptable range, college students pay more attention to the benefits of energy saving. Therefore, improving the PB of college students is the key to enhancing their energy-saving intention, and BECI plays a significant role in this process. Combined with the discussion in Section 5.1, we believe that through pre-experience, BECI enables college students to realize the possible improvement of energy consumption trends after their energy-saving behaviors, thus forming a value judgment dominated by benefits. This is similar to the results of some studies. For example, understanding the possible benefits of energy-saving products will enhance the intention to use such energy-saving products [68].

When studying the energy-saving intention, scholars often take various norms as influencing factors, but there are few studies on what factors affect norms. The results of this study show that in the context of BECI, PN will be affected by PB, PC, and PR. Zhao et al. (2019) found that consequences and responsibilities will affect PN. PR and PC are part of consequences and responsibilities, respectively; therefore, the corresponding results of this paper can be explained. In addition, future research may further divide the consequences and responsibilities, so as to contribute to the design of intervention that may enhance INT. The results also show that, compared with PC and PR, PB has a more obvious effect on PN. Considering the obvious impact of PB on PV, attention should be paid to the interpretation and publicity of energy-saving benefits when intervening in energy-saving behavior in the future, so as to gain more obvious results. In addition, the interaction effect between PB and PC shows that when PB increases, the smaller the PC, the more obvious the positive effect of PB on PN. That is, PC will weaken the positive impact of PB, so it is necessary to reduce PC. However, PC is not affected by BECI. Future research can deeply explore the influencing factors of PC and formulate corresponding improvement measures.

5.3. The Functioning Mechanism of Building Energy Consumption Information on Energy-Saving Intention

According to the hypothesis and results, the mechanism of BECI on INT can be divided into three stages. In the first stage, BECI has a positive effect on the perception of college students, including PB and PR. College students become more deeply aware of the benefits and consequences of energy saving in the first stage. Then, in the second stage, college students will judge the value of energy saving according to PB and PC, and form PN for energy saving under the action of PB, PC, and PR. In the third stage, PN and PV are independently evaluated and positively affect the INT.

As a kind of background knowledge related to energy, building energy consumption information has a positive impact on INT. However, some studies have shown that knowledge may have a negative impact on INT, such as the stand-by energy consumption of electrical appliances [69]. The reason may be that people realize that energy-saving problems can be solved by technology, and the benefits of personal energy-saving behavior are limited—that is, the knowledge of energy-saving technology has a negative impact on PB. The reduction of PB caused by energy-saving technology may also be one of the key reasons for the rebound effect, that is, the proportion of energy consumption reduction is lower than that of energy efficiency improvement, and even the phenomenon of energy consumption increase occurs [20,70]. BECI can promote the INT by positively effecting PB and, therefore, it is an effective means to make up for the rebound effect and to save energy.

From the process of BECI acting on INT, the mechanism revealed in this study defines the relationship between building energy consumption information, value, and responsibility. Some studies conclude that attitudes and views towards ecological environment affect the judgment of consequences, that the judgment of consequences affects the attribution of responsibility and, finally, acts on norms [15]. The connotation of PC defined in this paper is similar to responsibility attribution, but not affected by information that closely related to energy users. Therefore, PC is an independent variable. Although both connotations of PB and PR are similar to the consequences, when acting on PV and PN, the effect of PB is stronger than PR. In addition, the action mechanism found in this study also reveals that the consequences may not be the influencing factors of responsibility attribution, but parallel to it. This point of view is similar to the views of some scholars [18].

6. Conclusions and Policy Implications

Improving the energy-saving intention of college students is the key to reducing college energy consumption, improving national energy-saving quality in the future, and realizing carbon neutralization and sustainable development. As a means of intervention, regional information disclosure is easy to implement, and its effectiveness for energy-saving improvement and action mechanism deserve attention. By constructing related hypotheses, the path of BECI acting on INT was verified by applying structural equation model, and the following conclusions were obtained: (1) The impact of BECI on INT is positive and indirect; (2) the impact realizes through the path "PB—PV—INT" and "PB & PR—PN—INT"; (3) PV and PN affect INT independently, and the effect of the former is stronger; and (4) the effect of PB is more obvious than that of PR and PC.

Based on the results and conclusions, we propose five suggestions to help colleges and governments augment the energy-saving intention of college students and, possibly, the public. The five suggestions involve the channel of BECI, the guidance of the disclosure content, the supplement of the disclosure content, the strengthening of external factors of BECI, and the problems that should be further explored.

The first three suggestions focus on BECI and its auxiliary strategies in the process. First, reinforce the publicity and education of BECI through various channels. Results show that BECI has a positive impact on INT and the impact is realized by strengthening college students' perception of the energy environment. Therefore, aiming at strengthening college students' perception of relevant information is important in the process of the publicity and education of BECI. Relevant departments and institutions should strengthen information disclosure in traditional ways and various social media in the future. In addition, colleges can advocate for or require teachers to add the display of building energy consumption information in appropriate links in some energy-related courses. Second, set up guiding information. The aim of guiding information is to guide college students to predict and pre-experience the future scenes of energy consumption. Projecting the self into the future to pre-experience future events is associated with pro-environmental behavior. Therefore, while disclosing building energy consumption information, relevant departments can display the prediction of the energy consumption, the progress and limitations of energy technology, and the speculation and display of energy problems in the future. In similar ways, guiding college students to ponder over energy consumption and its impact in the future enhance the effect of BECI. Third, strengthen the interpretation and publicity of the benefits that can be obtained from energy saving. Results show that PB plays a key role in the formation of INT. Therefore, advantages of energy saving should be propagated in company with disclosing BECI—for example, disclosure of energy payment, campus energy-saving construction, the impact of energy-saving behavior on light and thermal comfort, and environmental improvement. The "pre-experience of future" may also be formed in the process of propagation, which will lead a synergistic effect with the measures mentioned in the second suggestion.

The latter two suggestions are for external factors of BECI. Fourth, schools should pay attention to guiding students to form energy-saving habits and norms. The publicity and guidance of energy-saving benefits will affect the PV of college students. However, there is no significant interaction effect between PV and PN. Therefore, while the publicity and education of BECI, it is necessary for relevant departments to draw up some training measures of norms. For example, hold regular meetings to guide college students to compare their energy-saving behaviors with others, or compare their own energy-saving behaviors between the present and past. In this process, some specific means such as an energy-saving diary and themed publicity month can be used. In the process of the activities, we also need to guide college students to think about the relationship between their own behavior and building energy consumption. In this way, a strong PN of energy-saving can be established to enhance the effect of BECI. Fifth, explore the influencing factors of PC, and set corresponding improvement strategies accordingly, so as to give better play to the positive role of PB. PC is not affected by BECI, but it impacts INT negatively and weaken the role of PB. Therefore, it is necessary to explore the influencing factors of PC on possible methods to intervene in the future.

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Nomenclature

BECI	building energy consumption information
INT	energy-saving intention of college students
PV	perceived value
PN	personal norms
PB	perceived benefit
PC	perceived costs
PR	perceived risk of non-implementation of energy saving
TPB	theory of planned behavior
SCT	social cognitive theory

Appendix A

Table A1. Questionnaire Items Employed in the Main Survey.

Factors	Items	Explanation
Energy saving intention (INT)	INT1	I'm willing to participate in energy saving.
	INT2	I'm willing to try my best to save energy.
	INT3	I'm willing to make specific energy-saving behaviors.
	INT4	I'm willing to frequently implement energy-saving behaviors.
Perceived value (PV)	PV1	My energy-saving behavior is worth it.
	PV2	It makes sense for me to save energy.
	PV3	Energy saving is a valuable behavior.
Perceived benefits (PB)	PB1	I think saving energy is good for the development of the school.
	PB2	I think saving energy is good for society.
	PB3	I think saving energy is conducive to the sustainable development of our country.
	PB4	I think saving energy is good for the future ecological environment.
Perceived cost (PC)	PC1	Energy saving interrupts what I'm doing.
	PC2	Energy saving is a waste of time.
	PC3	I need to constantly remind myself to implement energy-saving behavior.
	PC4	Energy saving will sacrifice my study and life experience.
Perceived risk of non-implementation (PR)	PR1	If I don't save energy, I may face environmental pollution.
	PR2	If I don't save energy, people around me may think my habits are not good.
	PR3	If I don't save energy, I may face energy shortage.
Personal norm (PN)	PN1	It is necessary for me to form the habit of saving energy.
	PN2	It is necessary for me to maintain the habit of saving energy.
	PN3	It is necessary to be an energy-saving person.
	PN4	I have a responsibility to save energy for the sustainable development of our country.
Building energy consumption information (BECI)	BECI1	I often learn about building energy consumption from school education (including total energy consumption, energy consumption per unit area, change trend of energy consumption, etc.)
	BECI2	I often learn about building energy consumption from social media.
	BECI3	I often learn about building energy consumption from people around me.
	BECI4	I often learn about building energy consumption from school advocacy activities.

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