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Effect of Cognitive Variables and Emotional Variables on Urban Residents' Recycled Water Reuse Behavior

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Abstract: Urban residents' perception of recycled water reuse is the foundation for the realization of recycled water reuse behavior. However, even though the perception factor is equipped, it does not mean that urban residents will use recycled water continuously for sure. Therefore, in this research, the authors try to put cognitive factors and emotional factors into a unified behavioral process. Based on this theory framework, the paper will interpret the initiation, formation and continuing process of recycled water reuse behavior of urban residents. On the basis of previous studies, this study established a theoretical model to study the influence of cognitive factors and emotional factors on recycled water reuse behavior of the residents. Based on the data of 325 samples, the direct and indirect relationship between the variables in the model is verified through path analysis and mediation analysis. The empirical results show that: firstly, the urban residents' perception of recycled water reuse can activate their emotion for recycled water, and the emotion includes both positive emotion and negative emotion; secondly, although the recognition of recycled water can stimulate both positive and negative emotional factors, there are great differences between positive and negative emotions on the initiation, formation and sustainability of recycled water behavior. Negative emotion has a certain effect on the initiation of recycled water reuse behavior, but it has no significant effect on the formation and sustainability of recycled water reuse behavior. By contrast, positive emotion has no significant effect on the initiation of recycled water reuse behavior, but it has a significant effect on the formation and sustainability of recycled water reuse behavior. That is to say, at different stages, the recycled water reuse behaviors are affected differently by positive emotions and negative emotions. Thirdly, compared with negative emotional variables, positive emotions have a greater impact on individual recycled water reuse behavior. Positive emotional variables can significantly mediate the impact of cognitive variables on recycled water reuse behavior habits. In other words, positive emotions play a vital role in the sustainability of recycled water reuse.

Keywords: perception of recycled water reuse; recycled water reuse behavior; structural equation model; positive emotion; negative emotion

1. Introduction

With the development of the social economy, the demand of human activities for water resources is increasing day by day, and the contradiction between supply and demand of natural water resources is becoming more and more severe [1]. At the same time, human behavior has a very serious impact on the natural ecological water circulation system [2]. Recycled water was developed as early as 19th

century, but recycled water can only be used for agricultural irrigation before 1990 because of backward wastewater treatment technology [3]. With the development of analytical methods, microbiology, the discovery of water-borne diseases, recycled water technology is getting better and better. With the continuous improvement and development of sewage treatment technology, the quality standard of recycled water has been continuously improved, and the recycled water in some countries and regions has even reached the standard of drinking water [4]. Although sewage treatment technology is more and more advanced and the quality standard of recycled water is higher, there are still many urban residents who refuse to use recycled water [5]. Many scholars have studied this issue from different perspectives [6–8]. Some scholars have found that technology is not the biggest obstacle for the promotion and popularization of recycled water, but the resistance and rejection of urban residents towards the use of recycled water [9–11]. Governments and relevant environmental organizations have undertaken much publicity and education among urban citizens, so as to encourage them to use recycled water actively. At present, publicity and education mainly focus on improving urban residents' awareness and perception of recycled water, while ignoring the individual's psychological feelings [12]. That is to say, the current publicity and education has only achieved the goal of "knowing the reason" but neglected the importance "to touch the emotion of the public" [13]. Schmuck P and Schultz W P have studied the effect of psychological factors on sustainability, and sustainable behaviors [14]. The author proves that psychology plays an important role in promoting sustainable values, faith, attitudes and behaviors. Gifford R narrated the progress, potential and challenge of environmental psychology, which has confirmed the important effect of psychology on sustainable development [15].

What is emotion? Emotion refers to the degree of psychological connection of individuals to different things. Emotion includes positive and negative emotions. When the objective things meet the individual's psychological expectations, then there will be positive emotions such as love, happiness and pleasure. By contrast, when objective things violate the individual's psychological expectations, it will generate negative emotions such as sadness, anger and disgust. The emotional variables in this study refer to the positive or negative psychological state of the individuals for recycled water. It should be noted that emotions in this study are different from sentiment. Affection and emotion has different connotation. Emotions are often random, temporary, and more explicit. They are based on individual behavior intentions. However, sentiment is permanent, stable and implicit, which is based on the relationship between individual and external objective things. As a result, the emotions in this study emphasize the long-term and stable psychological state of the actors in the use of recycled water [16].

To a certain extent, cognitive factors and emotional factors can affect the recycled water reuse behavior of urban residents, but their connotations and mechanisms are quite different. Cognitive variables refer to the understanding degree of urban residents about recycled water reuse [17,18]. Cognitive variables have very limited and temporary influences on individual psychological awareness. The emotional variables are the psychological state of an actor's worries and concerns about the current situation of water resources and the urgent behavior intention for the use of recycled water. Compared to the increasing shortage of water resources, urban residents' awareness of recycled water is getting stronger, but only a small proportion of urban residents can really transform this recognition into actual recycled water reuse behavior. The key is that this kind of cognition does not cause emotional resonance or emotional response at the psychological level [19]. In the theory of Nerb and Spada [20], it is believed that when people face environmental problems, their perception of the environment will stimulate an individual's environmental emotions, and the emotion will have influences on the occurrence of pro-environmental behavior. The core of the theoretical model is to assume that the influence of all cognitive activities on pro-environment behavior does not occur directly, but through the mediation of emotional factors [21]. Then, we can find out whether the cognitive variables of urban residents for recycled water can stimulate individual emotional variables, and then lead to the occurrence of their actual recycled water reuse behaviors, and whether the emotional variables play a mediating role between cognitive variables and actual behavior. If yes, then do positive emotions

and negative emotions have same influences on recycled water reuse? This is the main purpose of this paper.

In the research of influential factors of pro-environment behavior, most scholars focus on two aspects, namely, the impact of demographic variables on pro-environment behavior, and the impact of psychological factors on pro-environment behavior. Psychological factors mainly include individual cognitive factors and individual emotional factors. The existing literature often considers that individual cognitive factors are the main variables affecting pro-environment behavior, and basically ignores the influence of emotional factors [22,23]. Almeida et al. found that there was no significant correlation between individual environmental cognitive level and actual pro-environmental behavior [24]. The research of Kanchanapibul also shows that environmental emotion has a greater impact on individual's environmental behavior than environmental cognition [25]. Some studies also show that even though some urban residents have less environmental knowledge, they still do not affect their love and concern for the environment. Therefore, cognition and emotion are two independent variables, and their influence mechanism and process on pro-environment behavior are different. Triandis proposed the Interpersonal Behavior Theory (TIP) [26], which holds that the formation of any behavioral intention includes three main factors, namely, cognitive factors, social factors and emotional factors. Among them, the influence of emotional factors on specific behaviors is greatly affirmed. According to modern psychological research, the main factors determining individual behavior include three aspects: the cognition and concept of objective things; the emotion generated by objective things; and the conscious attitude of the actor.

In the existing literature, more and more scholars have realized it is necessary to add emotional factor to the behavioral theory model as an independent variable. However, up to now, most behavioral theory models, including rational behavior theory, planned behavior theory [27], normative activation model [28,29] and technology acceptance model [30] have neglected the influence of emotional factors on individual behavior. Some scholars have studied the factors that affect an urban resident's recycled water reuse behavior, including risks, objectives, guiding policies, etc. [31,32]. However, it should be noted that this analytical framework is static and discontinuous, and it regards the occurrence of individual behavior as an isolated behavior only subjectively, while ignoring the dynamic development process of its behavior occurrence, that is, recycled water reuse. It only focuses on the formation of recycled water reuse behavior, while neglecting the continuity of recycled water reuse behavior. The stability of any behavior is not formed in a short time, especially the reuse of recycled water. It needs to go through different stages from the initial short-term, accidental, conscious behavior process to the final stable, sustained, unconscious automated behavior mode. At each stage, the influence of cognitive variables and emotional variables on their behavior is different [33]. In this paper, it tries to put cognitive factor and emotional factor into one process, and this process includes three stages, namely, the initial stage, formation stage and continuous stage of recycled water reuse behavior. With this theoretical framework, this paper illustrates the initiation, formation and continuing process of urban residents' recycled water reuse behavior.

The research objectives mainly include three aspects: firstly, whether the perception of recycled water can activate their emotion towards recycled water; secondly, whether positive emotions and negative emotions have the same effect on the initiation, formation and continuity of recycled water reuse behaviors; and thirdly, whether emotional factors can have significant mediate the effect on perception of recycled water on recycled water reuse. Based on these goals, we plan to establish theoretical model and make research assumptions.

2. Research Model and Hypotheses

So far, many scholars have analyzed the influencing factors of urban recycled water reuse behavior from different perspectives, including environmental education, social trust, risk factors, geographic space etc. [34–37]. Many scholars have studied the recycled water reuse behavior with Internet and big data. It should be noted that the above research [38,39] often subjectively regards the recycled water

reuse behavior of urban residents as an isolated behavior, while it ignores the dynamic development process of its behavior. This problem is very common in the study of pro-environmental behavior. For example, Willis et al. [40] found that the behavioral attitude of citizens towards water resources has a significant impact on the actual water-saving behavior, but Chang [41] believes there is no significant relationship between the two factors. We think the main reason is that researchers neglect the different stages of development of water-saving behavior of citizens. Thus, this study draws on the model of goal-directed behavior (MGB) proposed by Perugini and Bagozzi [42], which divides the individual's pro-environment behavior into different stages, and introduces a new variable in the model, namely, individual behavioral intention. Perugini and Bagozzi believe that behavioral behavior intention is not the same as behavioral tendency. Behavioral behavior intention refers to a mental state of an individual's recognition, acceptance, willingness and hope for a particular behavior. To a certain extent, it is weaker than behavioral tendency. If behavioral tendency is defined as "going to do, plan to do and will do", then behavioral intention is defined as "willing, pleased and hope".

In addition, for some specific behaviors, many scholars tend to divide an individual's emotional experience into two distinct dimensions, positive and negative emotional dimension, which is called the dichotomy of emotion [43]. Many works in the literature have studied the influence of environmental emotion on pro-environmental behavior based on this theoretical framework. For example, the researcher Meneses [44] has studied the influence of positive and negative emotions on recycling behavior. The results show that positive emotions have a greater impact on recycling behavior.

According to the above research literature, this study divides the urban resident's recycled water reuse behavior into three stages: behavioral initiation, behavioral formation and behavioral sustainability. The behavior initiation stage is symbolized by the formation of urban residents' behavior intention for recycled water reuse; the behavior formation stage is symbolized by the urban residents' actual recycled water reuse behavior; and the behavior continuity stage is symbolized by urban residents' behavior habits of recycled water reuse. At the start-up stage of recycled water reuse, if urban residents are used to using natural water resources, it would be a big obstacle for encouraging them to use recycled water. According to the relevant psychological research, when the behavior subjects are facing a new environment, most people will generate a habitual behavior pattern, that is, to deal with things based on the original way of thinking habits [45]. Therefore, urban residents are more likely to use natural water resources instead of recycled water.

Under this kind of circumstance, urban residents' recognition of recycled water have direct effect on the initiation of recycled water reuse behavior. At the stage of the formation and stabilization of recycled water reuse behavior, both positive (including joy, happiness, pride, optimism) or negative (disappointment, sadness, regret, anger) emotions toward recycled water reuse behavior can be found. According to Lally's research [46], with the repetition of a particular behavior, the influences of cognitive factors on this behavior will decrease gradually, while the influence of emotional factors on the sustained behavior will become increasingly significant. Therefore, in the formation and continuation of recycled water reuse behavior, emotional variables become the most important factor and driving force. Therefore, this study intergrates cognitive variables and affective variables into one unified framework of the behavior occurrence process on the basis of the time dimension (initiation, formation and continuity of recycled water reuse behavior). On this basis, a theoretical model of the influence mechanism of cognitive variables and affective variables on urban residents' recycled water reuse behavior can be established, which is shown in Figure 1. The research hypothesis is formed according to the logical relationship of all variables in this model.

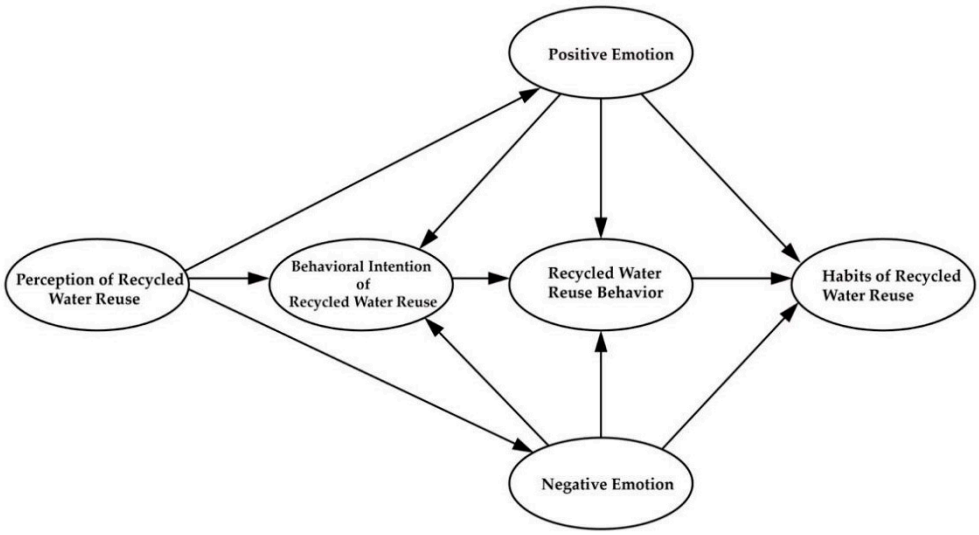

Figure 1. Theoretical model of cognitive variable-affective variable that affect urban residents' recycled water reuse behavior.

The research purpose is to determine whether urban residents' awareness of recycled water can stimulate their emotions toward recycled water, and achieve the formation and sustainability of recycled water reuse behavior, and how this process occurs. Except for cognitive factors, emotional factors also have a greater impact on the formation and sustainability of individual pro-environmental behavior. Both cognitive factors and emotional state can affect the formation of individual behavior. It is necessary to clarify how these two different factors affect the ultimate performance of the target group jointly. Therefore, the author of this study have proposed the below hypotheses:

Assumption 1: Perception of recycled water reuse has a positive and significant effect on behavioral intention of recycled water reuse.

Assumption 2: Perception of recycled water reuse can stimulate positive emotions of urban residents for recycled water.

Assumption 3: Perception of recycled water reuse can stimulate urban residents' negative emotions about recycled water.

Assumption 4: Behavioral intention of recycled water reuse has a positive and significant effect on recycled water reuse behavior.

Assumption 5: Recycled water reuse behavior has a positive and significant impact on the habits of recycled water reuse.

Assumption 6: The positive emotions come from the use of recycled water have a positive and significant impact on behavioral intention of recycled water reuse.

Assumption 7: Positive emotions of recycled water have a positive and significant impact on recycled water reuse behavior.

Assumption 8: Assumption 8: Positive emotions of recycled water have a positive and significant effect on habits of recycled water reuse.

Assumption 9: Negative emotions of recycled water have a positive and significant effect on behavioral intention of recycled water reuse.

Assumption 10: Negative emotions of recycled water have a positive and significant impact on recycled water reuse behavior.

Assumption 11: Negative emotions of recycled water have a positive and significant effect on habits of recycled water reuse.

3. Methodology

3.1. Data Collection

Sample data were collected from May 17 to July 20, 2018 in the following districts and counties in Xi'an administrative region of Shaanxi Province, including Beilin District, Yanta District, Weiyang District and Chang'an District, as shown in Figure 2. The specific investigation sites are Beichen Road, 8th Fengcheng Road, 12th Fengcheng Road, Taiyi Road, Wenyi Road, Xiaozhai Road, Yanta Road, Ziwu Avenue, Shenhe Avenue and Xuefu Avenue in Weiyang District, as shown in Figure 3. After screening samples among 400 questionnaires, we deleted 75 questionnaires that do not meet our requirements, including questionnaires with unclear writing, wrong information and damage et al. According to the suggestion of Hair et al. [47], in the process of structural equation modeling, the ratio between sample number and observed variable number should be 1:10–1:15, and based on the number of observed variables in this paper, the appropriate sample number should be 200–400. All the questions in this questionnaire are stated in statements. The respondents are asked to choose the degree of recognition of the questions in the questionnaire according to their actual situation. In this questionnaire, at least three observation variables (questions) are set for each potential variable (facet). The answer options in the questionnaire were measured by a Likert scale. Scores ranged from small to large, indicating that the degree of recognition ranged from low to high, specifically 1 (total disagree), 2 (disagree), 3 (slight disagree), 4 (uncertain), 5 (slight agree), 6 (agree), 7 (completely agree).

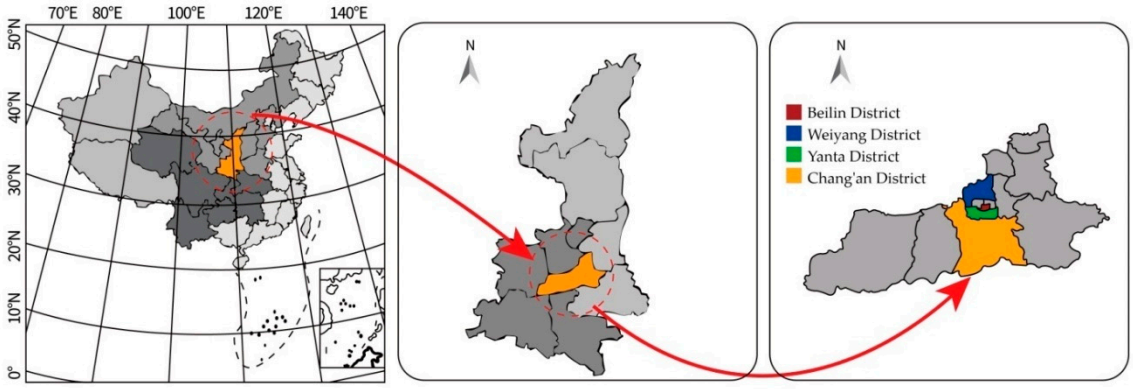

Figure 2. Research area.

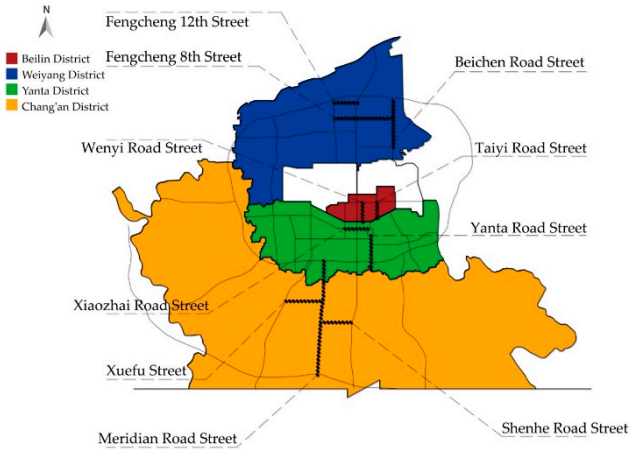

Figure 3. Research sites.

The specific investigation is mainly completed in the streets, residential areas, squares and other public places in various areas of Xi'an with on-site questionnaire, on-site interview and on-site collection. In order to make the sample data more consistent with the actual situation, stratified

sampling technology is used in this survey to ensure that the samples are evenly distributed in different regions, different occupations, different ages, different educational backgrounds and income. The specific sample information is shown in Table 1.

Table 1. Research sample description table.

Item	Gender	Qty	Proportion	Item	Status	Qty	Proportion
Gender	Male	167	51%	Martial status	Married	186	57%
	female	158	49%		Single	139	43%
Age	18–20	17	5%	monthly disposable income of the family (Yuan/month)	<3000	28	9%
	21–30	63	19%		3000–5000	89	27%
	31–40	96	30%		5000–10,000	128	39%
	41–50	72	22%		10,000–30,000	64	20%
	51–60	47	14%		>30,000	16	5%
	>60	30	10%	Family type	Alone	67	21%
Degree	High school and below	26	8%		family of two people	94	29%
	Bachelor	227	70%		family of three people	127	39%
	Master	55	17%		Married and living with parents	37	11%
	doctor	17	5%				

3.2. Questionnaire Design

In this paper, questionaire survey is used, questionnaires have been distributed to ordinary urban residents, and relevant questions were selected, then data was collected based on this. Except for asking some basic information like the age, gender, educational background and income of the subjects, several questions (observation variables) were set for each variable in the model to measure the degree and level of six potential variables, namely, "Perception of recycled water reuse", "Behavioral intention of recycled water reuse", "Recycled water reuse behavior", "Positive emotion", "Negative emotion", and the "Habits of recycled water reuse".

This paper defines the Perception of Recycled Water Reuse as the urban residents' recognition degree and knowledge of recycled water, and it is measured based on the below four aspects, including the importance of recycled water, the source of recycled water, the treatment process of recycled water, the quality level of recycled water. "PRWR" refers to Perception of recycled water reuse in the following sections (Table 2).

Table 2. Measurement table for Perception of recycled water reuse (PRWR).

Latent Variable	Conceptual Interpretation	Question No.	Question Item
PRWR	Perception of Recycled Water Reuse	PRWR 1	I am very clear about the importance of recycled water.
		PRWR 2	I am very familiar with the process of recycled water treatment.
		PRWR 3	I am very clear about the quality of recycled water.
		PRWR4	I know the source of recycled water very well.

According to Perugini and Bagozzi'sresearch [42], "Behavioral intention of recycled water reuse" is defined as the degree of willingness of urban residents to reuse recycled water. "BIRWR" refers to "Behavioral intention of recycled water reuse" (Table 3).

Table 3. Measurement table for Behavioral intention of recycled water reuse (BIRW).

Latent Variable	Conceptual Interpretation	Question No.	Question Item
BIRWR	Behavioral Intention of Recycled Water Reuse	BIRWR1	I would like to use recycled water to water flowers.
		BIRWR2	I would like to use recycled water for cleaning.
		BIRWR3	I am very happy to use recycled water.

"Recycled water reuse behavior" in this paper is defined as the actual recycled water reuse behavior of urban residents. "RWRB" refers to "Recycled water reuse behavior" (Table 4).

Table 4. Measurement table for Recycled water reuse behavior (RWRB).

Latent Variable	Conceptual Interpretation	Question No.	Question Item
RWRB	Recycled water reuse behavior	RWRB1	I have used recycled water to wash toilets
		RWRB2	I have used recycled water to wash vehicles.
		RWRB3	I have used recycled water for cleaning.
		RWRB4	I have used recycled water for fish farming.

The "Habits of recycled water reuse" is defined as the habitual action of urban residents for the continuous use of recycled water. "HRWR" refers to "Habits of recycled water reuse" (Table 5).

Table 5. Measurement table for Habits of recycled water reuse (HRWR).

Latent Variable	Conceptual Interpretation	Question No.	Question Item
HRWR	Habits of Recycled Water Reuse	HRWR1	I am used to flush the toilet with recycled water.
		HRWR2	I am used to wash vehicles with recycled water.
		HRWR3	I am used to use with recycled water for cleaning.
		HRWR4	I already got used to use recycled water.

This study assumes that emotional factors have a significant impact on the formation and sustainability of recycled water reuse behavior. Thus, emotional factors are classified into two basic dimensions, that is, the positive emotions for using recycled water and the negative emotions for not using recycled water. Positive emotions mainly refer to urban residents' approval of the recycled water reuse behavior and the comfort, pride and other emotional states generated by the use of recycled water. "PE" refers to "Positive emotion" (Table 6).

Table 6. Measurement table for Positive emotion (PE).

Latent Variable	Conceptual Interpretation	Question No.	Question Item
PE	Positive Emotion	PE1	I'm very happy and excited about using recycled water.
		PE2	I will sincerely praise and appreciate the behavior when someone uses renewable water resources actively and consciously
		PE3	I would be very proud to abandon the prejudice against recycled water and then accept and use it.

The definition of negative emotions mainly comes from two aspects: firstly, the fear, disgust and anger caused by others' rejection of recycled water and refusal to use recycled water. Secondly, it is the psychological state of guilt, regret and apology for not using recycled water. "NE" refers to "Negative emotion" (Table 7).

Table 7. Measurement table for Negative emotion (NE).

Latent Variable	Conceptual Interpretation	Question No.	Question Item
NE	Negative Emotion	NE1	When a person is prejudiced against recycled water, I will hate and become angry with him.
		NE2	When I can't use recycled water for some reason, I feel very guilty.
		NE3	When people are using recycled water and I am still using natural water, I feel very humiliated.
		NE4	I regret my refusal for the use of recycle water in the past

4. Results

4.1. Measurement Model

A total of 325 valid questionnaires were obtained. The reliability and validity test results can be seen in Table 8. The Cronbach's alpha values of all facets in the model are greater than the acceptable standard of 0.7, which indicates that the questionnaire has good reliability. According to the test values in Table 8, other indicators including standardized factor load, combined reliability (CR), average variance extraction (AVE) [48] and other indicators all meet the requirements. The load of standardized factors is greater than 0.6, and the non-standardized tests are significant. CR values were greater than 0.7, which met the recommended standards of Fornell, Larcker [48] and Hair [47]. At the same time, AVE values are greater than 0.5, which also meet the standards recommended by Fornell and Larcker [48]. Therefore, it can be concluded that the convergence validity of each dimension is good.

Table 8. Results for the measurement model.

Latent Variable	Title	Estimation of Parameter Significance				Factor Loading	Question Reliability	Composite Reliability	Convergent Validity	Cronbach's Alpha
		Unstd	S.E.	t-Value	P	Std.	SMC	CR	AVE	α
PRWR	PRWR1	1.000				0.683	0.466	0.801	0.503	0.799
	PRWR2	1.203	0.111	10.806	***	0.780	0.608			
	PRWR3	1.120	0.110	10.192	***	0.699	0.489			
	PRWR4	1.118	0.113	9.868	***	0.669	0.448			
BIRWR	BIRWR1	1.000				0.958	0.918	0.928	0.814	0.923
	BIRWR2	1.004	0.028	35.913	***	0.974	0.949			
	BIRWR3	0.769	0.040	19.247	***	0.758	0.575			
RWRB	RWRB1	1.000				0.698	0.487	0.802	0.504	0.800
	RWRB2	1.193	0.110	10.798	***	0.756	0.572			
	RWRB3	0.995	0.097	10.211	***	0.690	0.476			
	RWRB4	1.142	0.112	10.233	***	0.692	0.479			
HRWR	HRWR1	1.000				0.939	0.882	0.903	0.705	0.895
	HRWR2	1.027	0.032	31.654	***	0.960	0.922			
	HRWR3	0.751	0.049	15.229	***	0.678	0.460			
	HRWR4	0.833	0.046	17.916	***	0.744	0.554			
NE	NE1	1.000				0.930	0.865	0.875	0.646	0.864
	NE2	0.691	0.049	14.064	***	0.646	0.417			
	NE3	1.077	0.037	28.892	***	0.970	0.941			
	NE4	0.686	0.054	12.595	***	0.600	0.360			
PE	PE1	1.000				0.982	0.964	0.896	0.747	0.923
	PE2	0.950	0.036	26.291	***	0.931	0.867			
	PE3	0.668	0.048	13.789	***	0.640	0.410			

Note: *** Significant at P < 0.001. "BIRWR" refers to "Behavioral intention of recycled water reuse". "RWRB" refers to "Recycled water reuse behavior". "RWRB" refers to "Recycled water reuse behavior". "HRWR" refers to "Habits of recycled water reuse". "PE" refers to "Positive emotion". "NE" refers to "Negative emotion".

In addition to the above indicators, in order to test the degree of difference among different facets (potential variables), in this study, the validity test was made. According to Fornell's research [48], if the square root of AVE value corresponding to each facet (potential variables) in the model is

greater than Pearson correlation coefficient between the facet and other facets, it means there is a good differential validity among potential variables in the model. It is necessary to find out whether the square root of the AVE value for corresponding latent variable is great than other latent variables and other related coefficients based on the findings in the discriminate validity test and Fornell and Larckers' [48] recommendations. Therefore, from Table 9, it can be seen that the latent variables of the questionnaire have better discriminate validity.

Table 9. Discriminant validity for the measurement model.

	AVE	BIRWR	RWRB	HRWR	NE	PE	PRWR
BIRWR	0.814	**0.902**					
RWRB	0.504	0.576	**0.710**				
HRWR	0.705	0.299	0.572	**0.840**			
NE	0.646	0.318	0.324	0.241	**0.804**		
PE	0.747	0.289	0.560	0.586	0.224	**0.864**	
PRWR	0.503	0.407	0.574	0.548	0.295	0.499	**0.709**

Notes: The square root of AVE between the corresponding latent variables and the remaining variables are in bold, and this can be regarded as Pearson correlation values between latent variables.

4.2. Structural Model

The tool used in this study is AMOS software, which is a tool specializing in structural equation path analysis, mediation analysis and so on [49–51]. In recent years, more and more researchers have used AMOS software in the study of structural equation models. For example, Liu et al have established structural equation model based on the first-hand data obtained, and used it to verify the impact of traditional Chinese cultural values on public acceptance behavior of recycled water reuse, and achieved good results [11].

As shown in Figure 4, the more ideal the fitting index is, the closer the model is to the actual situation of the sample. In this study, nine indicators including Chi-square, degrees of freedom (df), Chi-square/df ratio, GFI, AGFI, NFI, TLI, CFI and RMSEA were selected to measure the fitting degree of the model, which can be seen in Table 10. By comparing the actual value with the ideal value of the fitness index, it shows that the fitting degree between the model and the data is higher, which indicates that the theoretical model has reasonable applicability.

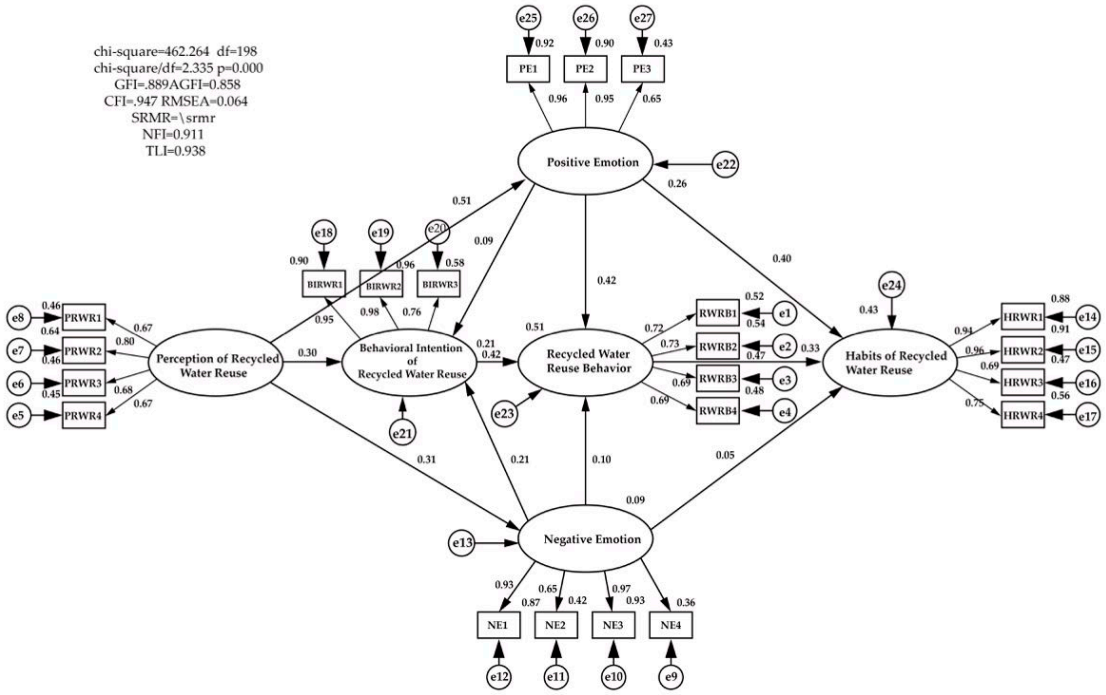

Figure 4. Standardization of theoretical models of cognitive and affective variables that affect urban residents' recycled water reuse behavior.

Table 10. Model fitting table.

Fitting Index	Measurement Value	Ideal Value of Fitting
Chi-square	462.264	
Df	198	
Chi-square/df	2.335	≤3
RMSEA	0.064	<0.08
GFI	0.889	>0.80
AGFI	0.858	>0.80
NFI	0.911	>0.90
TLI	0.938	>0.90
CFI	0.947	>0.90

4.3. Hypothesis Testing

Table 11 is the path coefficient table for the structural model. According to the path coefficient of the model in this table, the corresponding research hypothesis is tested. According to Table 11, it can be found that the positive emotion of recycled water does not have significant effect on the behavioral intention of recycled water reuse, and the negative emotion of recycled water has no significant effect on the behavior and habits of recycled water reuse. In addition, other paths in the structural equation model are significant.

Table 11. Path coefficient for the structural model.

Path name	Standardized Estimated Value	Non-standardized Estimated Value	Standard Error	P	Significance
PRWR→PE	0.515	0.651	0.084	0.000	Significant
PRWR→NE	0.308	0.516	0.107	0.001	Significant
PE→BIRWR	0.087	0.071	0.052	0.171	Non-significant
NE→BIRWR	0.205	0.125	0.034	0.001	Significant
PRWR→BIRWR	0.304	0.311	0.078	0.001	Significant
BIRWR→RWRB	0.424	0.449	0.066	0.000	Significant
PE→RWRB	0.424	0.363	0.049	0.000	Significant
NE→RWRB	0.098	0.063	0.034	0.062	Non-significant
RWRB→HRWR	0.33	0.374	0.078	0.000	Significant
PE→HRWR	0.396	0.384	0.058	0.000	Significant
NE→HRWR	0.049	0.036	0.036	0.319	Non-significant

Based on the results of significance test of path coefficient, we can start the testing of hypothesis 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 and 11.

According to Table 12, it can be found that hypotheses 6, 10 and 11 are not valid, while the rest of the hypotheses are valid. The above results show that, firstly, the cognitive factors of urban residents for recycled water can stimulate the emotional factors of recycled water significantly. The emotional factors include both positive environmental emotions, and negative emotional factors. But the influence of different emotional factors are not the same. According to form 11, we can know the effect of perception of recycled water reuse on citizens' positive emotion is 0.515, and its negative effect is 0.308. From this we can see that cognitive variables are more obvious effect on stimulating positive emotions. Secondly, cognitive variables can affect the behavioral behavior intention of recycled water reuse directly. Based on what we can see in form 11, it can be found that the effect of perception of recycled water reuse on behavioral intention of recycled water reuse is 0.304, which means urban residents' perception of recycled water reuse has a significant effect on behavioral intention of recycled water reuse.

Table 12. Hypothesis test table for theoretical models.

Research Hypothesis	Hypothesis Testing
Assumption 1: Perception of recycled water reuse has a positive and significant effect on behavioral intention of recycled water reuse.	Agree
Assumption 2: Perception of recycled water reuse can stimulate positive emotions of urban residents for recycled water.	Agree
Assumption 3: Perception of recycled water reuse can stimulate urban residents' negative emotions about recycled water.	Agree
Assumption 4: Behavioral intention of recycled water reuse has a positive and significant effect on recycled water reuse behavior.	Agree
Assumption 5: Recycled water reuse behavior has a positive and significant impact on the habits of recycled water reuse.	Agree
Assumption 6: Positive emotions of recycled water have a positive and significant effect on the behavior intention of recycled water reuse.	Disagree
Assumption 7: Positive emotions of recycled water have a positive and significant impact on recycled water reuse behavior.	Agree
Assumption 8: Positive emotions of recycled water have a positive and significant effect on habits of recycled water reuse.	Agree
Assumption 9: Negative emotions of recycled water have a positive and significant effect on behavioral intention of recycled water reuse.	Agree
Assumption 10: Negative emotions of recycled water have a positive and significant impact on recycled water reuse behavior.	Disagree
Assumption 11: Negative emotions of recycled water have a positive and significant effect on habits of recycled water reuse.	Disagree

Thirdly, positive and negative emotions have very different influences on the initiation, formation and sustainability of recycled water behavior. Table 11 shows that positive emotions have no significant effect on behavioral intention of recycled water. On the contrary, negative emotions have a 0.205 effect on behavioral intention of recycled water reuse. Thus, negative emotions play a major role in the initial stage of recycled water reuse. In the formation stage of recycled water reuse behavior, the effect of positive emotions on the behavior of recycled water reuse is 0.424, while the effect of negative emotions on the recycled water reuse behavior is not significant. This indicates that positive emotions play a major role in the formation stage of recycled water reuse behavior. In the stage of continuous recycled water reuse behavior, the effect of positive emotions on the sustainability of recycled water behavior is 0.396, while the effect of negative emotions on this is not significant, which means that positive emotions play a major role in the sustainability stage of recycled water reuse behavior. Therefore, conclusions can be made as follows: positive and negative emotions have different influence stages on recycled water reuse behavior. With the deepening of recycled water behavior, negative emotions have a certain effect on the initiation of recycled water reuse behavior, but its effect on the formation and sustainability of recycled water behavior is not significant. On the contrary, positive emotion has no significant effect on the initiation of recycled water reuse behavior, but it has a significant effect on the formation and sustainability of recycled water reuse behavior. That is to say, with the deepening of recycled water reuse, the role of negative emotions is getting weaker, while the role of positive emotions is getting stronger.

4.4. Mediation Effect Analysis

In recent years, increasing literature in the field of social science and psychological science has tended to analyze the indirect relationship among variables through mediation effect. According to the statistics compiled by Rucker et al. [52], 59% and 65% of the articles published in the *Journal of Personality and Social Psychology* (JPSP) and *Personality and Social Psychology Bulletin* (PSPB) in 2005–2009 used the mediation effect method. "Mediation effect" is an important statistic concept and has been used in many social sciences. Mediation effect test can be used to verify the process and effect of independent variables on dependent variables. Compared with path coefficient test, the mediation effect test focuses more on explaining the process of how and why the influences occur among variables. By analyzing and testing the mediation effect, this can help researchers to have further understanding of the process how independent variable affects the dependent variable. The stepwise regression coefficient method is the most popular mediation effect test method, and it is commonly known as the stepwise method. However, in recent years, the stepwise regression coefficient method has been criticized and questioned by an increasing number of people [53–55]. Therefore, the bootstrap method is suggested, which is generally considered a better test method at present, which can test the significance of coefficient product directly. The bootstrap method does not require data to conform to normal distribution, but it requires the data can reflect the actual situation more. The non-parametric percentile bootstrap method of deviation correction is used in the test of mediating effect in this paper.

According to Figure 1 (the theoretical model of the influence mechanism of cognitive variables—affective variables on urban residents' recycled water reuse behavior), we can see that "cognitive variables of recycled water" can drive "recycled water behavior habits" through seven paths. Table 13 shows that the boostrap method is used to test the mediation effect of the seven paths.

Table 13. Intermediate paths in the theoretical model.

Intermediary Path
Path 1: Perception of Recycled Water Reuse→Positive emotions→Behavior Intention of Recycled Water Reuse→Recycled water reuse behavior→Habits of Recycled Water Reuse
Path 2: Perception of Recycled Water Reuse→Positive emotions→Recycled water reuse behavior→Habits of Recycled Water Reuse
Path 3: Perception of Recycled Water Reuse→Positive emotions→Habits of Recycled Water Reuse
Path 4: Perception of Recycled Water Reuse→Behavior Intention of Recycled Water Reuse→Recycled water reuse behavior→Habits of Recycled Water Reuse
Path 5: Perception of Recycled Water Reuse→Negative emotions→Behavior Intention of Recycled Water Reuse→Recycled water reuse behavior→Habits of Recycled Water Reuse
Path 6: Perception of Recycled Water Reuse→Negative emotions→Recycled water reuse behavior→Habits of Recycled Water Reuse
Path 7: Perception of Recycled Water Reuse→Negative emotions→Habits of Recycled Water Reuse

According to the table of the mediation effect test (Table 14), it can be seen that the z-value of path 1, path 5, path 6 and path 7 is less than 1.96, which means based on the mediation effect test with the product of coefficients, the mediation effect of path 1, path 5, path 6 and path 7 is not significant. Meanwhile, after tests with the bootstrap, it shows both bias-corrected and Percentile max-value and min-value contain zero in the three paths (path 1, path 6 and path 7), which means, path 1, path 6 and path 7 have no mediation effect" [56,57].

Table 14. Test table of the mediation effect between PRWR and HRWR.

SIE Specific Indirect Effects	Point Estimate	Product of Coefficients		Bias-Corrected 95%CI		Percentile 95%CI	
		SE	Z	Lower	Upper	Lower	Upper
Path 3	0.250	0.067	3.731	0.134	0.396	0.134	0.396
Path 1	0.008	0.008	1.000	−0.006	0.025	−0.007	0.023
Path 2	0.088	0.041	2.146	0.034	0.201	0.029	0.182
Path 4	0.052	0.023	2.261	0.02	0.111	0.017	0.103
Path 5	0.011	0.006	1.833	0.003	0.027	0.002	0.025
Path 6	0.012	0.012	1.000	−0.002	0.045	−0.002	0.045
Path 7	0.018	0.027	0.667	−0.025	0.082	−0.032	0.077

Note: BC is Bias-corrected; CI represents confidence interval; Samples are obtained by 1000 times of bootstrap.

There is no significant mediating effect of path 1, which means "urban residents' perception of recycled water" cannot have effect on "behavior intention for recycled water reuse behavior" by affecting "positive emotions of reclaimed water", and then affect the "habits of recycled water reuse behavior". From Table 11 (theoretical model path coefficient table), it can be seen that the reason why this path is not significant is that "positive emotion of recycled water" has no effect on "behavior intention for recycled water reuse behavior". Therefore, in the initial stage of recycled water reuse behavior, positive emotions have no effect on the activation of urban residents behavior intention for recycled water behavior although cognitive variables can stimulate positive emotions.

The mediating effect of path 6 and path 7 is not significant, and the mediating effect of path 5 is very weak, from Table 11 (theoretical model path coefficient), it can be seen that the reason behind this is "positive emotion of recycled water" has no effect on "behavior intention for recycled water reuse behavior". Therefore, in the start-up stage of recycled water reuse behavior, positive emotions have no effect on the start-up of urban residents' behavior intention for recycled water behavior although cognitive variables can stimulate positive emotions and negative emotions have an effect on the behavior intention of recycled water behavior. As regards the deepening of recycled water reuse behavior, negative emotions have a weaker and weaker impact on the formation and sustainability of recycled water reuse behavior. Path 5, path 6 and path 7 include negative emotions, but these

three paths are not significant. Therefore, it can be concluded that negative emotions have very weak influence on the initiation, formation and sustainability of reclaimed water reuse behavior.

According to the table of the mediating effect test (Table 14), there are three paths that have significant mediation effect, namely path 2, path 3 and path 4. These three paths do not contain 0 between the minimum and maximum of bas-corrected and percentile. This result shows that the mediating effect of these three paths exists, and the mediating effect of path 3 is far greater than path 1 and path 2. Therefore, conclusions are drawn as below: the recognition of recycled water can stimulate the positive emotion of urban residents for recycled water significantly, but these positive emotions do not have significant influences in the initial stage. However, with the deepening of recycled water reuse behavior, positive emotions play an increasingly important role in the formation and sustainability of recycled water reuse behavior.

In conclusion, although the cognitive variables of urban residents for recycled water can stimulate two completely different emotional variables (positive and negative emotions), the two emotional variables have completely different mechanisms for the initiation, formation and sustainability of recycled water behavior. In the initial stage, the role of negative emotions is more obvious, but the effect of negative emotions get weaker at later stages. By contrast, in the initial stage, the role of positive emotions is not obvious, the effect of positive emotions get stronger at laster stages. Meanwhile, by comparing the mediating effects of all the paths, it can be found that the mediating effect of path 3 (perception of recycled water reuse→positive emotion→habits of recycled water reuse) is far greater than that of other paths. Therefore, positive emotion variables have greater effect on an individual's recycled water reuse behavior than negative emotion variables, and the positive emotion variables have significant mediating effect on an individual's continuous recycled water reuse behavior compared with negative emotion variables. In other words, positive emotions play a vital role in the sustainability of recycled water reuse.

5. Discussions

This paper studies the interrelationship among six variables of recycled water cognition, behavior intention for recycled water reuse behavior, recycled water reuse behavior, habits of recycled water reuse behavior, positive emotions of recycled water and negative emotions of recycled water. On this basis, a theoretical model of the influence mechanism of cognitive variable-affective variable on urban residents' recycled water reuse behavior is proposed. The interaction between variables in the model is proved based on the research results.

According to form 12, it can be seen that assumption 6, assumption 10 and assumption 11 are not approved, and so it can be concluded that, firstly, positive emotion does not have significant influence on behavioral intention of recycled water reuse, so I deleted the "Positive Emotion→Behavioral Intention of Recycled Water Reuse" in Figure 1. Secondly, negative emotion does not have significant influence on behavioral intention of recycled water reuse, so "Negative Emotion→ Recycled Water Reuse Behavior" was deleted. Thirdly, negative emotion does not have significant influence on habits of recycled water reuse, so "Negative Emotion→Habits of Recycled Water Reuse" was deleted, and that is why we got Figure 5.

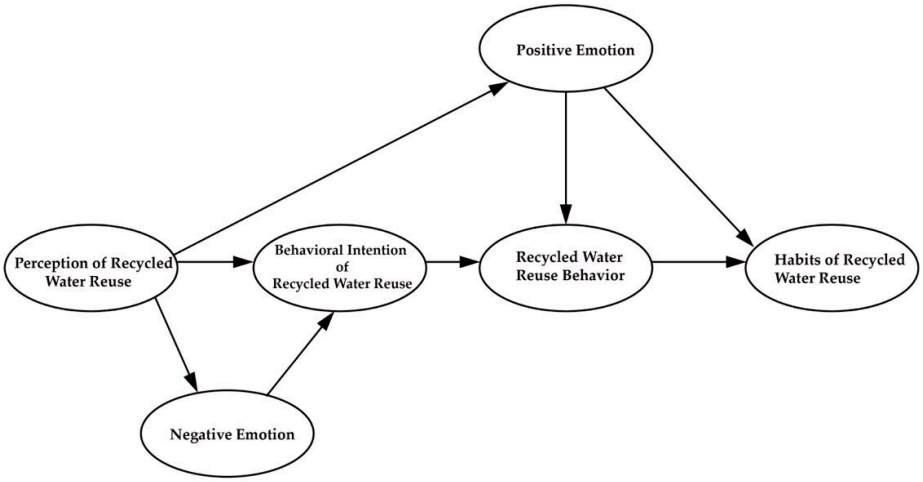

Figure 5. The theoretical model of the mechanism of the cognitive variable-affective variable's influence on urban residents' recycled water reuse behavior.

As shown in Figure 5, the paths listed in the model are all significant and proved influence paths. Meanwhile, after making comparisons regarding to the mediation effect of all paths, this shows the mediation effect of path 3 (perception of recycled water reuse→positive emotion→habits of recycled water reuse). Therefore, it can be concluded that positive emotion can significantly mediate the effect of perception of recycled water on the continuity of recycled water reuse. In other words, although positive emotions do not have a significant effect on the behavior intention of recycled water reuse, positive emotions play critical role in the continuity of recycled water reuse. According to the model, urban residents' perception of recycled water can stimulate two different emotions (positive emotions and negative emotions), but the two emotions have different effects on the initiation, formation and sustainability of recycled water reuse behavior. On the whole, urban residents' perceptions of recycled water has a significant effect on the formation and sustainability of recycled water reuse behavior, but positive emotions must be turned into mediation first; that is, the effect of urban residents' perception of recycled water does not have a direct effect on recycled water reuse behavior, but take effect through positive emotional factors.

The theoretical model of cognitive variable-affective variable's influence on urban residents' recycled water reuse behavior is an improvement and extension of the traditional behavioral theory model. The behavioral theory models we have in the past (including planning behavior theory, normative activation model, etc.) hardly take the influence of emotional factors on individual behavior into consideration, and the research in this paper will contribute to this. Secondly, this study divides urban residents' emotions toward recycled water into two dimensions, namely, positive emotions and negative emotions. The influence process of cognitive variables and affective variables on recycled water reuse behavior has been verified through structural equation path coefficient and mediation effect and conclusions are made as following:

Conclusion 1: Urban residents' perception of recycled water can stimulate the emotional factors of recycled water significantly, including both positive environmental emotions and negative emotional factors. Comparatively speaking, cognitive variables have a more significant effect on stimulating positive emotions.

Conclusion 2: Although perception of recycled water can stimulate both positive and negative emotional factors, positive and negative emotions have significantly different effect on the initiation, formation and sustainability of recycled water behavior. Form 15 was obtained based on the information in Form 11, Form 15 is used to illustrate the effect of positive emotions and negative emotions on the behavior of recycled water reuse. As shown in Table 15, positive and negative emotions have different effects on recycled water reuse. With the deepening of recycled water behavior, negative emotions have a certain effect on the initiation of recycled water reuse behavior, but the effect on the formation

and sustainability of recycled water behavior is not obvious. On the contrary, positive emotion has no significant effect on the initiation of recycled water reuse behavior, but it has a significant effect on the formation and sustainability of recycled water reuse behavior. That is to say, with the deepening of recycled water reuse, the effect of negative emotions is gradually weakened, while the effect of positive emotions is gradually strengthened.

Table 15. Effects of positive and negative emotions on initiation, formation and sustainability of recycled water reuse behavior.

Stage	Negative Emotions	Positive Emotions
(initiation) Behavioral Intention of Recycled Water Reuse	0.125	0.071 (not significant)
(formation) Recycled Water Reuse Behavior	0.063 (not significant)	0.363
(sustainability) Habits of Recycled Water Reuse	0.036 (not significant)	0.384

Conclusion 3: Compared with negative emotional variables, positive emotions have a greater effect on individual's recycled water reuse behavior. Positive emotional variables have a greater mediating effect on strengthening the influence of cognitive variables on recycled water reuse behavior. In other words, positive emotions play a vital role in the sustainability of recycled water reuse.

The conclusions in this paper have positive significance for the government in making policy about recycled water reuse, and many related policies have stressed the importance to improve urban residents' perception of recycled water, and emphasized encouraging urban residents to use recycled water through economical approaches or political approaches. However, they have neglected the emotional factor of urban residents toward recycled water, especially positive emotions. From the conclusion of this paper, it can be seen that positive emotions have a significant effect on the continuity of recycled water reuse, so policy making should tend to improve urban residents' positive emotions toward recycled water.

This paper provides a new way of thinking for urban residents' recycled water reuse behavior. Perceptional and emotional factors are integrated into one unified framework of behavior occurrence process based on the time dimension. This explains the initiation, formation and sustainability of urban residents' recycled water reuse behavior based on this theoretical framework. Although the theoretical model in this paper is based on the specific variable of recycled water reuse behavior of urban residents, it can provide inspiration and reference for general pro-environmental behavior, pro-social behavior, and even altruistic behavior. It clarifies the relationship of perception-emotion-behavior-behavior sustainability; that is, emotion is the link and connection between cognitive factors and specific behavior. Although individual cognitive factors have a certain effect on specific behavior, it is essential to maintain an individual's pro-environment behavior in a sustainable and stable way. As for the issue as to whether the theoretical model has more stable applicability in the general prosocial, pro-environment and altruistic fields, further analysis and verification are required in the future.

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