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College Students' Willingness to Separate Municipal Waste and Its Influencing Factors: A Case Study in Chongqing, China

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Abstract: College students are the engine of the sustainability of the future, and their awareness of environmental protection and waste classification is very important for the sustainable implementation of urban solid waste separation projects. Chongqing is one of the first 46 waste separation pilot cities in China. The primary objective of this study was to investigate the municipal waste separation behavior of college students and its influencing factors. Data from a total of 814 questionnaires among college students from sixteen universities in Chongqing were collected. Results showed that most college students think it is necessary to separate waste, and they have executed it in their daily life. Students have a high accuracy in classifying perishable waste, but they are not familiar with the classification of waste lamps, bulbs (14.00%), expired drugs (30.71%), toilet paper (11.3%), peel (18.80%) and brick kilns (27.76%). Special attention should be paid to distinguishing recyclables and other wastes. The principal factors that affect students' willingness to classify waste are attitude, situational factors and publicity and education, which are embodied in students' attitude towards waste separation, the surrounding environmental hygiene, the convenience of waste separation, the ease of understanding of waste separation marks and the degree of publicity and education of the school. Four measures are recommended for improving students' willingness to separate municipal waste based on this investigation.

Keywords: college students; waste separation; influencing factors; Chongqing

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1. Introduction

The separation and treatment of solid waste is important work in urban management and is also a challenge to the high-level development of cities and regions in China. With the gradual advancement of China's urbanization process and the increasing improvement of people's living standards, municipal solid waste is increasing at an annual level of 5–8% [1]. China's total annual waste output ranks among the highest in the world. To date, about two-thirds of the country's large and medium-sized cities appear to be part of the "waste siege" of the grim situation [2]. China's domestic waste storage encroachment on land resource area has reached more than 500 million square meters [2]. According to statistics, the municipal solid waste produced by Chinese residents every year contains 60 million tons of recyclable resources, and the value of usable but unused waste reaches about 3.83 billion dollars [3]. In order to solve the problems of environmental pollution and resource waste caused by solid waste, waste separation is considered as an important method to reduce waste and improve recycling efficiency [4,5]. China has carried out pilot work on waste separation in Beijing, Shanghai and Guangzhou. However, due to lack of experience, insufficient publicity, people's lack of willingness and imperfect infrastructure, the actual results are not satisfactory [6,7]. Therefore, how to promote people's conscious implementation of waste separation behavior has become an urgent problem to be solved.

At present, there are many studies on people's waste separation behavior and its influencing factors. Chen et al. [8] studied the formation and recurrence mechanism of

residents' waste separation behavior from the perspective of information interaction intervention, and pointed out that external rewards and punishments, situational information and personal psychological deviation information would affect residents' waste separation behavior. Yin et al. [9], based on the theory of planned behavior, analyzed the influence of behavioral attitudes, subjective norms and other factors on residents' willingness to classify garbage in Shanghai. Xu et al. [10] analyzed the external influencing factors of Hangzhou residents' waste separation behavior, and pointed out that market incentives, government incentives and government promotion had significant influences on recycling intention. Wang et al. [11] discussed the main factors that affect farmers' domestic waste separation and disposal behavior, including environmental awareness, environmental skills and economic incentives. Kang et al. [12] analyzed the influence of subjective norms, external perceived behavior control, attitude and other factors on farmers' waste separation behavior based on the TPB. The existing research mostly focuses on urban residents and rural residents [13–15], or take families [16,17], communities [18,19] and cities as research units to discuss the influencing factors and influencing mechanisms of people's waste separation behavior.

The university campus is regarded as the epitome of society [20], covering various social and scientific activities [21]. As a group with higher education, college students acquire professional knowledge and skills that help them better understand and implement waste classification. Therefore, college students can be pioneers and leaders of waste separation [22,23]. Universities usually have clear waste management systems. The distribution of solid waste in universities is relatively concentrated, and the types of waste are mostly similar. These factors can make the operation of solid waste separation easier with a higher success rate [24–26]. College students will enter society after graduation, and they are the engines of sustainability of the future [27]. The successful implementation of the municipal solid waste separation project depends on people's participation [28]. Therefore, it is of great significance to study the main participants' willingness to separate waste and its influencing factors. The campus can also provide a good environment for the pilot study of waste separation behavior. Although there are many research works abroad involving universities or college students, most of them concern waste conversion and energy systems [29], waste recycling management systems [20,27] and quantitative and qualitative analyses of solid waste on campus [30]. Research on the driving factors of college students' waste separation behavior only concerns a single factor or a certain kind of waste [31–33]. Research on comprehensive influencing factors of college students' separation behavior and willingness to separate solid waste is insufficient.

In China, research on college students' willingness to separate waste and its influencing factors focuses on the developed areas in central and eastern areas, including Beijing, Shanghai, Guangzhou and Henan [25,34,35], and have rarely been studied in the western region. Chongqing is one of the first forty-six pilot cities for municipal domestic waste classification in China, and also one of the core cities in western China. Therefore, the innovation of this study lies in choosing Chongqing as the study area and Chongqing college students as the study objects. This study conducted a questionnaire survey on typical universities in Chongqing, to collect the first-hand data of students' waste separation behavior and its influencing factors. The purpose of this study is to explore college students' willingness to separate waste and its influencing factors in Chongqing, determine problems in the waste classification of college students and put forward measures to improve their willingness to separate waste.

The structure of this paper is as follows. Following the introduction, the specific content of this survey design is introduced in detail, including behavior research and research on influencing factors. Then, based on the analysis of the data, the research results are obtained and discussed. On this basis, certain measures to improve college students' willingness to separate waste are put forward. Finally, the conclusions of the study are described.

2. Methodology

2.1. Study Area

Chongqing is one of China's four municipalities directly under the central government. According to the Chongqing Statistical Yearbook 2019, Chongqing has a total population of 343.64 million, and there are 65 regular institutions of higher learning in the city, accounting for 19% of the total number of colleges and universities in Southwest China. There are about 827,900 students in schools, accounting for 21.32% of the total number of ordinary higher education students in Southwest China. According to the standard in the China Statistical Yearbook 2019, the per capita daily output of domestic waste in China is about 0.449 kg, and it was concluded that in 2018, colleges in Chongqing produced nearly 135.69 million tons of domestic waste.

Based on a scale of ten thousand people of colleges, through the household waste classification collection, more than 50 tons of wastepaper, 60 tons of waste plastics and 15 tons of empty bottles are recycled every year, reducing waste emissions by 130 tons. In addition, according to the Chongqing college students' household waste classification, every year, around 4139.74 tons of wastepaper, 4967.67 tons of recycled plastic, and 1241.92 tons of empty bottles are recycled, and waste emissions can be reduced by 107.6 million tons.

2.2. Study Design

In this study, a structured questionnaire was used. The questionnaire survey was used to investigate college students' household waste separation behavior and its influential factors.

2.2.1. Investigation Design for Behavior Research

This study adopts the method of a questionnaire survey to understand the current situation of college students' waste separation by designing questions related to college students' waste separation behavior. Thus, this survey investigated students' waste source separation behavior by asking for responses to two statements, namely "I classify my waste frequently" and "I classify my waste regularly". The respondents chose from five responses of "strongly agree", "agree", "generally", "disagree" and "strongly disagree". We assigned 5, 4, 3, 2 and 1 to each of these levels in descending order, and respondents were given a 5-scale Likert option. According to their answers, two multiple-choice questions were set to ask the respondents why they did or did not classify waste, which were "why do you separate waste" and "why do you not separate waste".

2.2.2. Investigation Design for Influential Factors

This study is based on the Theory of Planned Behavior (TPB) to construct the research framework of influential factors. TPB is widely used to study people's behaviors and wishes [36]. The Theory of Planned Behavior explains the general decision-making process of individual behavior from the perspective of information processing [37]. According to the TPB, three factors that determine the behavioral intention of MSW separation are individual attitude, subjective norm and perceived behavioral control [10]. A review of the literature related to the Theory of Planned Behavior reveals that in addition to the three factors mentioned above, other behavior-specific factors can be added to enhance the reliability of the model [38]. Therefore, based on previous studies, the authors designed the influencing factors from six aspects: Attitude, knowledge, situational factors, subjective norms, perceived behavior control and publicity and education. Then, the authors designed the questions of these six dimensions and set six hypotheses for testing. The Likert 5-point scoring method was used to design the answer options of the influencing factors questions, so as to evaluate the degree to which the contents of the questions influence college students' willingness to separate waste. The assignment method is the same as the behavior survey research.

(1) Attitude

Attitude refers to the degree to which an individual agrees or disagrees with waste separation, which represents the individual's position on waste separation [39]. Some studies have determined that attitude is closely related to waste separation behavior [40]. Through the attitude of the individual towards waste separation, one can predict whether people have the intention or behavior of waste separation [41]. Multiple studies have shown that the more positive the attitude is, the more positive the will to separate waste [41,42].

In this survey, the authors designed three questions to evaluate students' attitude and willingness for waste separation, including "waste separation is very necessary", "college students should carry out waste separation" and "if I do not carry out waste separation, I feel guilty". Respondents were able to describe their thoughts on a five-point scale. They were asked to choose how much they agreed on a five-point scale ranging from "strongly agree" to "strongly disagree" and wrote these questions in turn as AT1–AT3. Based on these questions, the first hypothesis was formulated to be "H1: Attitude has a significant positive impact on the willingness to separate municipal waste".

(2) Knowledge

Knowledge refers to personal information about environmental conditions, climate change, environmental views and ecological impacts of consumption and production [43]. People do not know enough about environmental knowledge, so they cannot judge the risks in the environment [44]. Therefore, knowledge will affect people's concern and attitude towards the environment [45,46]. Some studies have proved that the key basis of environmental management research is environmental concerns [47,48]. Gkargkavouzi et al. [49] proved that knowledge can be used to predict individuals' environmental behaviors and willingness. The more knowledge people have about waste classification, the more successful they will be in the process of waste classification, which may increase their willingness to carry out waste classification. Zhang et al. [10] and Michalos et al. [50] proved that knowledge is positively correlated with waste separation behavior.

In this survey, three questions were designed to understand students' knowledge of household waste classification. The first question was "Do you know about the waste management standard of Chongqing", and the second was "Do you know about the current situation of 'garbage sieg', with five choices from "know very well" to "not at all". The third question was "I know how to conduct waste classification", in which answers were rated on a five-point scale, from "very much" to "not at all", and the method of assignment was the same as above. We denoted these questions in turn as KN1–KN3. Based on these questions, a hypothesis was formulated to be "H2: Knowledge has a significant positive impact on the willingness to separate municipal waste".

In order to examine the students' understanding of waste separation knowledge, this survey also listed 12 types of waste at the end of the questionnaire, and asked responders what kind of waste they should belong to. According to the current management measures of municipal waste classification in Chongqing, broken glass, broken mirrors, cans and discarded electronics should be classified as recyclable waste; leftovers, rotten fruit and so on should be classified as perishable waste; toilet paper, paper towels, fruit peels, nut shells, bricks and tiles, porcelain kilns and so on should be classified as other waste; waste batteries, expired drugs, waste lamps, bulbs, desk lamps and so on should be classified as hazardous waste. Therefore, if respondents chose the correct waste category, we recorded it as "correct" and calculated the accuracy of each waste category.

(3) Situational factors

Even if individuals have a positive attitude towards waste separation and have enough environmental knowledge, there may be a lack of waste separation behavior

due to a lack of conditions and resources [51]. Certain scholars put forward the concept of the situational factor in the study on recycling behavior of household waste of British residents [52], and pointed out that the environmental conditions such as the convenience of waste classification, waste classification marks, facilities and surrounding sanitation will have an impact on people's willingness to participate in waste classification. Ma et al. [53] and Tonglet et al. [51] also believe that recycling behavior will be influenced by situational factors, which should be included in the expansion of the TPB model.

To study the influence of situational factors on college students' willingness to classify MSW, this survey designed four questions. The first question was "whether it is convenient to reach the waste classification point set by the school". The respondents choose from five grades: "very convenient" to "very inconvenient". The second and third questions were "the waste classification bins of the school are disposed of in a timely manner" and "the waste classification points of the school look neat and clean". The fourth question was "Do you think garbage classification marks are easy to understand?". Respondents were also asked to make a five-scale Likert choice to rate their agreement from "strongly agree" to "strongly disagree". We denoted these four questions as SF1–SF4 in turn. Based on these questions, a hypothesis was formulated to be "H3: situational factors have a significant positive impact on the willingness to separate municipal waste".

(4) Subjective norms

Subjective norms refer to the influence of the pressure exerted by society or other members of society on the behavioral intentions of the individual [54]. Many studies have confirmed that subjective norms will affect people's waste recycling behavior [34,55].

In this survey, the authors asked respondents to state the waste separation behavior of their parents, their classmates and their surrounding friends, using the questions "Do your parents do waste classification at home", "Do your friends do waste classification" and "Do your surrounding classmates do waste classification". By asking about the waste classification behavior of the parents, classmates and friends of the respondents, we studied the influence of the members around the respondents on their willingness to waste classification. Respondents could choose from "Good waste classification", "Simple waste classification", "Occasionally waste classification" and "No waste classification", and we assigned the values 4 to 1 from the highest to the lowest. These three questions were called SN1-SN3 in turn. Based on these questions, a hypothesis was formulated to be "H4: subjective norms have a significant positive impact on the willingness to separate municipal waste".

(5) Perceived behavior control

Perceived behavior control (PBC) indicates people's perceptions on their ability to perform a given behavior; that is, they perceive it to be difficult or easy to perform a given behavior [54]. PBC can be divided into internal and external perceptual behavioral control; internal includes willpower, ability, skills and so on, while external includes time, space, convenience and so on [56]. Many past studies have proven the importance and significance of the PBC determinant in influencing waste separation behavior [17,55,57].

Therefore, this survey evaluated the respondents' perceived behavior control ability from five aspects: Time, space, willpower, waste classification knowledge cognition and waste classification complexity cognition. These questions were "I don't have enough time to correct my food waste classification", "I don't have enough space in the dormitory to do household waste classification", "if not school requirements, I will not do waste classification", "I don't have enough knowledge of waste classification, so the waste classification is difficult for me to do" and "according to the school of waste classification standard, do you find it complicated to classify waste". Under these questions, respondents chose from a five-point scale of "strongly agree" to

"strongly disagree". These five questions were called PBC1–PBC5 in turn. Based on these questions, a hypothesis was formulated to be "H5: perceived behavior control have a significant positive impact on the willingness to separate municipal waste".

(6) Publicity and education
Generally speaking, policy publicity includes laws and regulations, economic policies, public policy and so on. Many studies have shown that publicity efforts have a very positive relationship with people's waste separation behavior [39,58,59]. We have already discussed the influence of knowledge on people's waste separation activities. Through public education, people can understand the knowledge, policies and information regarding waste recycling, thus improving their ability to separate waste [41]. This survey primarily studied full-time college students enrolled in higher education institutions in Chongqing. Therefore, the influence of school publicity and education on the willingness to classify waste was mainly considered, and the following three questions were designed: "Can you get the knowledge of household waste classification in class?", "Does your school do a good job in the publicity and education of waste classification?" and "Does your university attach importance to waste classification?". We denoted these three questions as PE1-PE3 in turn. Based on these questions, a hypothesis was formulated to be "H6: publicity and education have a significant positive impact on the willingness to separate municipal waste".

(7) Separation willingness
In this study, respondents' willingness to classify municipal waste was taken as the dependent variable. The following two questions were used to show the college students' willingness to classify waste: "I am willing to classify waste" and "I will try my best to classify household waste during my college years". Respondents were asked to choose their degree of agreement on a five-point scale ranging from "strongly agree" to "strongly disagree", and we denoted the two questions as INT1–INT2 in turn.

2.3. Questionnaire Collection and Sample Data

This survey mainly adopted the method of a questionnaire survey, in the form of electronic questionnaire distribution, and selected 1–3 universities from the first, second and junior colleges in Chongqing to issue questionnaires to. The respondents of this survey are mainly undergraduates from universities in Chongqing. The distribution of the number of respondents is shown in Table 1. Respondents filled in the questionnaires online, which were then collected by the investigators and finally analyzed. The survey was conducted from September 2020 to October 2020. In this survey, a total of 814 questionnaires were sent out and 814 questionnaires were returned. A total of 814 people participated in the survey. The questionnaire recovery rate was 100%.

Table 1. Number distribution of respondents in different universities.

College	Frequency	Percentage (%)
Southwest University	248	30.47
Chongqing College of Mobile Communication	176	21.62
Chongqing University	130	15.97
Yangtze Normal University	102	12.53
Chongqing Jiaotong University	72	8.85
Sichuan International Studies University	33	4.05
Southwest University of Political Science & Law	24	2.95
Chongqing Medical University	20	2.46
Other universities	9	1.11
Total	814	100.00

2.4. Model Hypothesis and Examination Method

Based on the literature review above, six hypotheses were designed to be examined to study the relationship between students' municipal waste separation behavior and possible influential factors. These six hypotheses are summarized as follows:

Hypothesis 1 (H1). *Attitude has a significant positive impact on the willingness to separate municipal waste.*

Hypothesis 2 (H2). *Knowledge has a significant positive impact on the willingness to separate municipal waste.*

Hypothesis 3 (H3). *Situational factors have a significant positive impact on the willingness to separate municipal waste.*

Hypothesis 4 (H4). *Subjective norms have a significant positive impact on the willingness to separate c waste.*

Hypothesis 5 (H5). *Perceived behavior control has a significant positive impact on the willingness to separate municipal waste.*

Hypothesis 6 (H6). *Publicity and education have a significant positive impact on the willingness to separate municipal waste.*

The six hypotheses were taken as independent variables, and college students' willingness to classify and dispose of household waste was taken as the dependent variable. In SPSS26.0, the reliability and validity of the variables were analyzed first, and then the linear regression method was adopted to explore whether the influence of independent variables on college students' willingness to classify and dispose municipal waste reached statistical significance, as well as determining the magnitude of the influence.

3. Results and Discussion

3.1. Students' Municipal Waste Separation Behavior

According to the assignment rules mentioned above, the data obtained from the questionnaire survey were analyzed. Table 2 shows the average value of students who often conduct waste separation is 4.00, and the average value of students who regularly conduct waste separation is 3.96. This indicates that most of the students perform well in waste classification and can carry out waste separation in their daily life.

Table 2. College students' municipal waste separation behavior.

Waste Separation Behavior	Total Sample	Average Value	Standard Deviation
I often conduct waste separation.	814	4.00	0.883
I regularly conduct waste separation.	814	3.96	0.931

Along with their behavior of waste separation, we also conducted an investigation on the reasons respondents do or do not participate in waste separation. The respondents who participate in waste separation chose the reasons for their separation in the multiple-choice questions of the questionnaire, and the respondents who do not participate in waste separation also chose the reasons for their non-waste separation in the multiple-choice questions.

The results showed that (Figure 1) half of the students (50.86%) separated municipal waste because they responded to the national call, 47.79% of the respondents believed that waste separation could avoid environmental pollution and recycling and 47.72% of the respondents believed that separation of municipal waste was a reflection of a good quality in college students. This indicates that the sense of responsibility as a citizen, especially a

student, and the protection of the environment are the main driving forces that influenced college students' waste separation behavior.

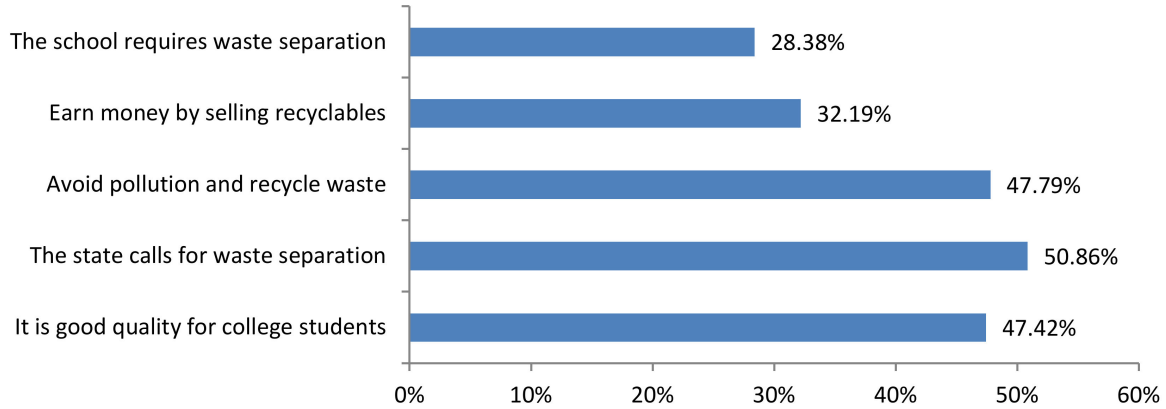

Figure 1. Reasons college students participate in waste separation.

The investigation into why respondents do not engage in waste separation showed that (Figure 2) 39.43% of respondents do not participate in waste separation because they do not know how to, while other reasons included garbage bins without garbage separation (37.59%), the classified waste is mixed up when the school collects it (30.96%), no one else is separating their waste (27.03%), the separation of municipal waste is too cumbersome (22.73%) and a lack of care for waste separation (21.50%). It can be seen from this result that the reason for the largest proportion is that college students are not clear about how to classify waste, which indicates that college students lack knowledge of waste classification. Thus, we can infer that the lack of knowledge of waste classification will influence the classification behavior of college students. In addition, the waste separation infrastructure and management system, the attitude of students and the behavior of others around them all have a certain influence on college students' waste separation behavior and intention.

3.2. Factors That Influence Students' Behavior

In this part, six hypotheses were tested. Firstly, the reliability and validity of seven variables including behavior intention, attitude, knowledge, situational factors, subject norms, perceived behavioral control and publicity and education were tested, and then descriptive statistical analysis and regression analysis were carried out.

3.2.1. Reliability and Validity Tests

In the study, confirmatory factor analysis was used to test the reliability and validity. The reliability test was measured by Cronbach's Alpha and combined reliability [60]. Previous studies showed that 0.7 is an acceptable critical value of the reliability coefficient [51,61]. SPSS26.0 software was used to analyze the data, and the results are shown in Table 3. Cronbach's Alpha coefficients of all variables except behavior intention are above 0.7. Although the reliability coefficient of behavioral intention (0.529) is lower than 0.7, the lower threshold is sometimes used in the literature [53,62,63]. The combined reliability of all variables is above 0.8, which indicates that all variables in the questionnaire have good reliability [61].

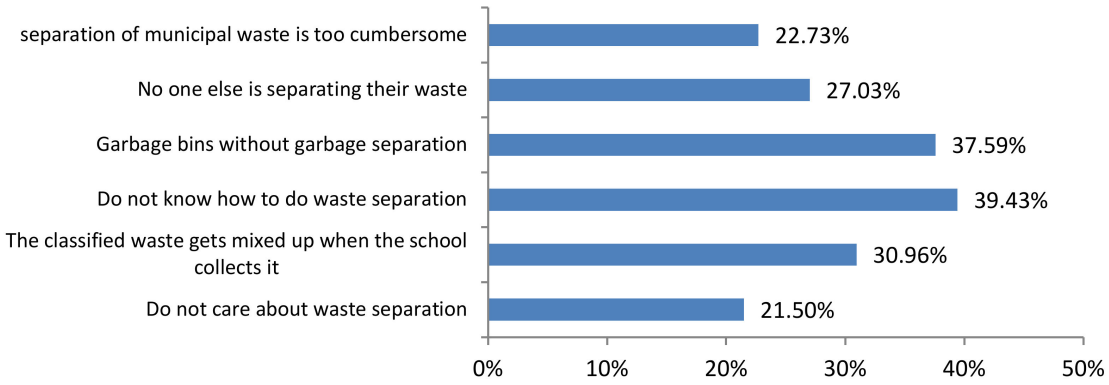

Figure 2. Reasons college students do not participate in waste separation.

Table 3. Confirmatory factor analysis results.

Variable	Measurement Items	Factor Load Value	Cronbach's Alpha	Combined Reliability	AVE
Behavior intention	INT1	0.824	0.529	0.809	0.680
	INT2	0.824			
Attitude	AT1	0.860	0.713	0.840	0.639
	AT2	0.835			
	AT3	0.692			
Knowledge	KN1	0.914	0.858	0.914	0.780
	KN2	0.900			
	KN3	0.834			
Situational factors	SF1	0.871	0.854	0.902	0.697
	SF2	0.857			
	SF3	0.816			
	SE4	0.792			
Subject norms	SN1	0.916	0.902	0.938	0.835
	SN2	0.916			
	SN3	0.910			
Perceived behavior control	PBC1	0.877	0.890	0.920	0.697
	PBC2	0.867			
	PBC3	0.865			
	PBC4	0.830			
	PBC5	0.727			
Publicity and education	PE1	0.909	0.875	0.923	0.799
	PE2	0.897			
	PE3	0.876			

The validity of the questionnaire was measured according to the factor load value and AVE value of the relevant variables [63]. Firstly, KMO values were tested for all variables, and the test value is 0.892, which is significant at the level of 0.000. Table 3 shows that, except for the factor load value of one measure in attitude, which is 0.692, the factor load values of other measures are all above 0.7. The AVE values of all variables are all above 0.6, which is above the recommended 0.5 level, indicating that each variable has good convergence validity [63,64].

The discriminant validity can be determined by the correlation coefficient between variables and the size of the relationship between the arithmetic square root of AVE [65]. The results from Table 4 show that the correlation coefficients among variables are all less than the arithmetical square root of their AVE. Therefore, it can be judged that there is good discriminant validity between college students' willingness to separate municipal waste and influential factors.

Table 4. Correlation analysis results.

	AT	SN	KN	PBC	SF	PE	INT
AT	0.799						
SN	0.431 **	0.914					
KN	0.522 **	0.758 **	0.883				
PBC	0.334 **	0.552 **	0.648 **	0.835			
SF	0.541 **	0.679 **	0.775 **	0.592 **	0.835		
PE	0.491 **	0.709 **	0.826 **	0.610 **	0.820 **	0.893	
INT	0.700 **	0.463 **	0.565 **	0.396 **	0.638 **	0.596 **	0.825

Note: The square root of AVE is shown on the diagonal of the table and is bold. The correlation coefficient is shown below the diagonal line; ** $p < 0.05$.

3.2.2. Descriptive Statistical Analysis

The descriptive statistical analysis results of respondents' attitudes for municipal waste separation and its influential factors are illustrated in Table 5. Table 5 shows that the average score of each test question ranges from 2.98 to 4.44, and the average score of behavior intention is above 4.00. From this perspective, we can see that college students have a strong willingness to participate in waste separation and have a strong awareness of waste separation. Among the test variables of influential factors, the average score for attitude is the highest, but the standard deviation is unstable, which shows that most college students have a positive attitude towards waste separation and think that college students should participate in waste separation and it is very necessary to do it. However, some students show a negative attitude towards waste separation.

Table 5. Descriptive statistical analysis results.

Variable	Measurement Items	Test Number	Average Score	Standard Deviation
Behavior intention	INT1	Q1	4.41	0.681
	INT2	Q2	4.14	0.764
Attitude	AT1	Q3	4.44	0.670
	AT2	Q4	4.41	0.677
	AT3	Q5	4.06	0.880
Knowledge	KN1	Q6	3.86	1.017
	KN2	Q7	3.86	1.012
	KN3	Q8	4.03	0.865
Situational factors	SF1	Q9	4.06	0.846
	SF2	Q10	4.07	0.818
	SF3	Q11	4.06	0.865
	SF4	Q12	4.11	0.814
Subject norms	SN1	Q13	3.00	0.923
	SN2	Q14	2.98	0.896
	SN3	Q15	3.00	0.894
Perceived behavior control	PBC1	Q16	3.89	0.948
	PBC2	Q17	3.91	0.953
	PBC3	Q18	4.00	0.918
	PBC4	Q19	3.88	0.981
	PBC5	Q20	3.76	1.123
publicity and education	PE1	Q21	3.95	0.983
	PE2	Q22	4.00	0.897
	PE3	Q23	4.03	0.855

The second factor is the situational factor. The scores of the four test questions of this variable are all above 4.00, and the standard deviation is relatively stable, indicating that college students are satisfied with the degree of waste classification and labeling in the school. The lowest average score of subjective norms is only 2.98, and the standard deviation is relatively stable, indicating that most college students' parents, friends and classmates are not good at waste separation, and there is a lack of a good atmosphere for waste separation. The average score of the three measures of knowledge is between 3.86

and 4.03, which indicates that college students do not have a deep understanding of the waste separation standard and the current situation of the "waste siege" in Chongqing. They have good knowledge of how to separate waste, but the standard deviation is not stable, which indicates that there is some difference in the mastery of waste separation knowledge among individual college students. The average score of the five test questions for perceived behavioral control is between 3.76 and 4.00, and the maximum value is 4.00, which indicates most students feel it is difficult to classify waste, and they do not have enough time and space for waste separation. Even if they want to classify waste, they need to do it under the supervision of the school. Based on this, we can see that college students' perceived behavior control ability need to be improved. The average score of publicity and education is about 4.00, and the standard deviation is relatively stable, indicating that most college students hold a positive attitude towards the publicity and education of waste separation in school.

3.2.3. Regression Analysis

In the study, the linear regression method was used for regression analysis of independent variables. The analysis results are composed of the standardized coefficient β, the T value and the significance level ($p < 0.05$) of the influence of independent variables on college students' willingness to participate in waste separation. The model-fitting degree is judged by the adjusted R^2. The adjusted R^2 is 0.590, and its value is above 0.5, indicating that the model fitting degree is good, indicating the independent variables explain the dependent variable by 59% [17].

As can be seen from Table 6, the significance coefficients of attitude, situational factors and publicity and education are all less than 0.05, which indicates that attitude, situational factors and publicity and education have a significant positive impact on college students' willingness to separate waste. The standardization coefficient of the three in descending order is attitudes, the situational factor and publicity and education. The standardization coefficient of attitude is 0.495, indicating that attitude has the greatest influence on college students' willingness to participate in waste separation. This means that the more positive attitude college students have towards waste separation, the stronger their willingness to engage in waste separation. Therefore, hypothesis H1 is true. The standardization coefficient of situational factors is 0.263, indicating that the better the management facilities for waste separation, the better the environmental hygiene, the higher the degree of convenience and the easier the labels of waste separation are to understand, the stronger the willingness of college students to classify household waste. Therefore, hypothesis H3 is true. Publicity and education also passed the hypothesis test, indicating that the greater the influence of publicity and education on college students, the higher their willingness to participate in waste separation. Therefore, hypothesis H6 is true. In addition, this study also conducted an investigation to understand the channels through which college students receive waste separation publicity and education. The results showed that most college students learned about waste separation through Internet publicity and TV advertisements, accounting for 47.91% and 47.79%, respectively. It can be seen that college students mainly receive waste separation information through modern means and channels. Therefore, in terms of popularizing waste separation knowledge, we can make full use of modern network media and other tools to expand the scope of waste separation publicity and create a good atmosphere in which all members of the society know, learn and are willing to separate waste.

Table 5 also shows that the significance levels of knowledge, perceived behavior control and subject norms do not meet the standard. Therefore, hypotheses H2, H4 and H5 are not true; that is, knowledge, perceived behavior control and subjective norms have no significant influence on college students' willingness to separate MSW, which does not conform to the idea that the subjective norm and perceived behavioral control proposed by Ajzen in the Theory of Planned Behavior (TPB) will have an impact on individual behavior intention. However, subjective attitude is a type of social pressure, and some

studies have pointed out that social pressure is difficult to obtain through compliance with the will of others, which leads to the unclear relationship between subjective norms and individual will [9]. Perceived behavior control refers to individuals' subjective feelings about whether they have enough time and space, whether they have strong willpower for garbage classification and whether they are familiar with waste separation, etc., which were prone to deviation due to the size of sample data, unreasonable questionnaire topic setting, individual psychological differences and other issues. The result of the study on the influence of knowledge on the willingness to participate in waste separation showed that knowledge does not have a significant positive impact on the willingness to participate in waste separation. However, as a national top talent training target, college students' mastery of waste separation knowledge plays a certain role in promoting the participation of the whole population in waste separation and promoting the household waste separation system.

Table 6. Variable regression analysis results.

Variable	Normalized Coefficient β	t	Significant
AT	0.495	18.152	0.000
SN	−0.049	−1.384	0.167
KN	−0.006	−0.116	0.907
SF	0.263	6.141	0.000
PE	0.180	3.848	0.000
PBC	−0.004	−0.128	0.898

Note: The dependent variable is behavior intention (INT).

In order to determine more about college students' understanding of different types of waste, and to clearly determine which types of waste government managers and the public should pay special attention to, this study also set up specific waste separation questions. We asked participants to make a choice for deciding which category (e.g., recyclable waste, perishable waste, hazardous waste or other waste) 12 kinds of waste belong to. Results of respondents' choice and the accuracy rates are illustrated in Table 7.

Table 7. Respondents' selection of waste separation and accuracy rate.

According to Government, Correct Waste Separation	Respondents' Choice of Waste (Number of People)				Accuracy Rate (%)
	Recyclable Waste	Perishable Waste	Other Waste	Hazardous Waste	
Broken glass, broken mirrors (recyclable waste)	351	246	167	50	43.12%
Toilet paper (other waste)	399	307	92	16	11.30%
Leftovers (perishable waste)	237	526	46	5	64.62%
Fruit skin, nut shell (other waste)	233	422	153	6	18.80%
Rotten fruit (perishable waste)	221	541	35	17	66.46%
Waste batteries (hazardous waste)	251	246	30	287	35.26%
Brick and tile ceramic (other waste)	316	260	226	12	27.76%
Cans (recyclable waste)	508	259	37	10	62.41%
Waste lamp tube, bulb, desk lamp (hazardous waste)	332	278	90	114	14.00%
Waste electronic products (recyclable waste)	342	256	53	163	42.01%
Expired medicines (hazardous waste)	219	277	68	250	30.71%

Table 7 showed that most of the respondents can correctly classify leftovers, rotten fruit as perishable, and cans as recyclable. Therefore, it can be inferred that for most perishable waste, college students can classify them well. However, for other categories

of recyclables (broken glass, broken mirrors, discarded electronics), respondents were less likely to classify them correctly. Table 7 also showed that students tend to confuse recyclable waste with hazardous waste. For example, only 14% of the students correctly classified waste lamps and bulbs as hazardous waste, while 40.79% of the students wrongly classified such waste as recyclable waste. The classification accuracy of the other two types of hazardous wastes (expired drugs and used batteries) was 30.71% and 35.26%, respectively. Of all types of waste, the lowest rate of separating is other waste. Only 11.30%, 18.80% and 27.76% of the respondents choose toilet paper, fruit ski nut shells and brick and tile ceramic as other waste. It can be seen that college students are not clear about the classification of other waste such as toilet paper, brick and tile ceramic and so on. Therefore, the public should pay special attention to the classification of waste light tubes, light bulbs, expired medicine, toilet paper, fruit peels and brick kilns, especially in distinguishing recyclables and other wastes.

4. Measures to Improve College Students' Willingness of Waste Separation

Upon testing the above six hypotheses regarding influencing factors, H1, H3 and H6 are true, and H2, H4 and H5 are not true. According to the above survey results, we found that college students have a strong awareness of waste separation. The principal factors that affect students' willingness to classify waste are their attitude towards waste separation, the surrounding environmental hygiene, the convenience of waste separation, the comprehensibility of waste separation marks and the degree of publicity and education of the school.

Therefore, based on the study results, the authors put forward the following suggestions:

Firstly, the government should pay more attention to the important role of college students in the implementation of waste classification and treatment. The state needs to improve the laws, regulations, policies and systems related to municipal waste separation treatment. At the same time, a good social atmosphere should be actively created to improve college students' and citizens' understanding and recognition of the social value and significance of waste classification, so as to ensure they have a positive attitude towards waste separation. In addition, specific means can be implemented in society and universities. For example, economic incentives, in terms of the causal factors of waste reduction, have proved to be effective [59]. Relevant honorary titles can be awarded to universities with better implementation effects of waste separation treatment, and these universities will be given policy subsidies and financial support. On campus, individuals or groups that have achieved a good job in separating waste can be rewarded.

Secondly, social cultural and creative enterprises and related green social welfare organizations can increase cooperation with universities. According to the interest and personality of college students, they can design related products such as rubbish bins and rubbish bags that are more suitable for colleges and can improve college students' willingness to take the initiative in household waste classification. Certain innovative, interesting and practical infrastructure can stimulate students' curiosity and concern, so that they are interested in the knowledge and practical operation of waste classification, which will guide college students to realize the transformation from concept to behavior implementation.

Thirdly, schools need to improve their waste recycling management system. At present, some universities have the problem of chaotic waste collection management. Students finished separating waste in the dormitory, but the recyclers mixed the waste together when recycling. Therefore, school administrators can refer to the system planning of waste classification and recycling in urban planning and construction and accelerate the establishment of a complete waste classification management system for "classification-disposal, classification-recycling, classification-transportation, classification-management" on campus [39]. For example, a department can be set up to take charge of school waste collection, classification and disposal, and full-time staff can be set up to take charge of the arrangement, personnel deployment, supervision and management of this work. The results show that the degree of convenience of waste classification would affect students' willingness to

do waste classification. Based on this, school administrators should reasonably allocate the interval and quantity of rubbish bins on campus according to the actual situation of students, and regularly check whether the classification marks on the rubbish bins are clear, undamaged or fuzzy, so as to improve the convenience of students in waste separation.

Fourthly, publicity and education should be strengthened to improve students' understanding of waste separation. Courses related to waste separation can be set up, and these courses can be taken as elective courses for students to choose. Besides, schools can encourage and support student organizations and societies to carry out such activities on campus, so as to educate students about waste classification and disposal. This study has shown that more attention needs to be paid to raising students' waste separation awareness, therefore schools should also strengthen the publicity of relevant waste separation policies, systems and so on.

5. Conclusions

This study used an electronic questionnaire survey among college students at eight universities in Chongqing, to collect data from 814 questionnaires about college students' municipal waste separation behavior and the influencing factors. The main conclusions are as follows:

Firstly, results showed that most college students think it is necessary to separate waste, and they have executed it in their life. The most important reason they participate in waste separation is the state calls for waste separation, and the most important reason they do not is they do not know how to separate waste.

Secondly, there is a significant positive correlation between college students' attitude towards waste separation and their intention to participate in waste separation. Thus, more attention should be paid to improving college students' awareness of waste separation, creating a good social atmosphere and enhancing college students' recognition of the social value of waste separation.

Thirdly, situational factors have a significant positive impact on the willingness to separate municipal waste. Situational factors, including the convenience of waste separation, waste separation marks, facilities, surrounding health and other environmental conditions, will have an impact on college students' willingness to separate waste. Based on this, some interesting waste separation facilities (such as trash cans, waste bags, etc.) can be designed to improve college students' willingness to classify waste. In addition, the management of the waste separation system, as well as ensuring the convenience of waste separation and the cleanliness of the school environment are the key ways for schools to improve waste separation in the future.

Fourthly, results also showed that publicity and education have a significant positive correlation with students' willingness to participate in municipal waste separation. The survey found that the students' accuracy in classifying 12 categories of waste was generally less than 50%. Therefore, it is necessary for schools to strengthen students' mastery of waste separation knowledge. Schools can publicize the policies and knowledge of waste separation by setting up courses and organizing community activities.

The waste produced by colleges has the characteristics of large output and simple type structure, which can be used as a pilot unit to effectively promote the progress of urban waste separation. Moreover, the special group characteristics of college students are propitious to the development of waste separation. The main contribution of this study is to explore the willingness of college students in Chongqing to separate municipal waste and its influencing factors, which makes up for the lack of research in this field in western China. Based on the conclusions, several suggestions are put forward, including implementing economic incentives on campus, designing creative infrastructure, establishing a complete waste separation management system and strengthening the publicity and education of students' environmental knowledge. Findings from this investigation may also be useful to provide a reference for decision making for the efficient implementation of waste classification on campus in western and other parts of the country.

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