

Towards zero waste: Chinese school students' perspective on campus waste

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ABSTRACT

In the past decade, the number of students at high schools in China has risen to over 80 million. School campuses are high-density and administratively independent communities where a vast amount of food waste is produced daily. Although there are studies on the reduction and management of food waste on university campuses, little attention has been paid to high school campuses in this respect. Given the large number of high school students, it is important to study how the recycling attitude and behavior of this group of students towards food waste could help achieve zero waste on school campuses. This paper subjectively examines high school students' environmental awareness and pro-environmental behavior through a questionnaire survey administered in several local high schools in Suzhou and Nanjing, China. The data from the survey was analyzed to identify the factors influencing students' attitudes towards food use and food waste, thus establishing a possible correlation between the factors and providing evidence for a future food waste reduction plan. The study divided students' attitudes to food waste on high school campuses into the following categories: socio-psychological factors, individual characteristics, and dining factors. The research findings will help to improve waste management and recycling on school campuses and ultimately achieve the goal of a green and sustainable environment for high school students.

Keywords: Food waste, Chinese high school, Waste management, Student attitude, Sustainability

1. INTRODUCTION

Food losses and waste are global issues with profound environmental, social and economic impacts (Garrone et al., 2014). While food losses often refer to

reducing food matter and quality in the earlier stages of a food supply chain, food waste reflects losses in the later stages, as in retail and consumption. Food waste (FW) in the consumption stage accounts for nearly 35% of total food losses and waste and contributes to 8–10% of global greenhouse gas emissions (Kusumowardani et al., 2022). It was estimated in 2021 that 17% of total global food production may be wasted, 61% of which comes from households, 26% from food service, and 13% from retail. Since FW may not be consistent under different circumstances, many studies have been conducted in specific contexts, such as in the contexts of households (Elimelech et al., 2018), universities (Zhang et al., 2021) and restaurants (Yang et al., 2019). FW in high schools has also attracted increasing academic attention in recent years (Abdelaal et al., 2019). In the past decade, the student population in high schools across China has surged to exceed 80 million. These school campuses function as densely populated and administratively independent communities, producing significant daily food waste. While studies have been conducted on food waste reduction and management in university settings, comparatively little attention has been paid to high school campuses in this regard (Alattar et al., 2020). Considering the substantial number of high school students, it is crucial to investigate their recycling attitude and behavior in relation to food waste. Such research is an important step in working towards the goal of achieving zero waste on school campuses.

Factors that influence food waste behavior are diverse and context specific. Research shows that food waste is shaped by individual psychological, dietary, and habitual factors, external influences from service providers and society, as well as the interaction of these complex factors. This paper subjectively examines the environmental awareness and pro-environmental behavior of high school students through a questionnaire

survey conducted in several local high schools in Suzhou and Nanjing, China. The research findings will contribute to the enhancement of waste management and recycling practices on school campuses, ultimately facilitating the achievement of a green and sustainable environment for high school students..

2. METHODS

2.1 Conceptual framework and theoretical hypotheses

The theory of planned behavior (TPB) is an extension of the theory of reasoned action proposed by Ajzen (1991). The TPB is one of the most parsimonious theoretical models accounting for food waste behavior (FWB). The central point of TPB is the individual's intention to engage in FWB. An individual's reducing waste intention and behavior is governed by three constructs: attitudes, subjective norm, and perceived behavior control, as shown in Figure 1. The student waste attitude (WA) mainly refers to buying less food to save money and reducing resource waste (Filimonau et al., 2020). Therefore, when students waste food, they will experience negative emotions and then generate the intention and behavior to reduce food waste. Social norm (SN) is the psychological tendency of consumers under the influence of other factors such as social pressure, and is the result of the comprehensive effect of various social normative beliefs (Soorani & Ahmadvand, 2019). The social pressure that students perceive on wasting or not wasting food will subtly affect students' attitudes towards food waste. Perceived behavior control (PBC) refers to the difficulty of completing a specific behavior, which mainly depends on time, money, experience, information and other factors (Graham-Rowe et al., 2015). Students make value judgments based on obtaining relevant information, and the stronger their ability to reduce food waste or control the amount of food waste is, the stronger their perceived behavior control is. At the same time, SN will affect students' intuitive behavior control to a certain extent. In addition, related research on food waste shows that individuals' reducing waste intention (RWI) is a key determinant of predicting waste behavior.

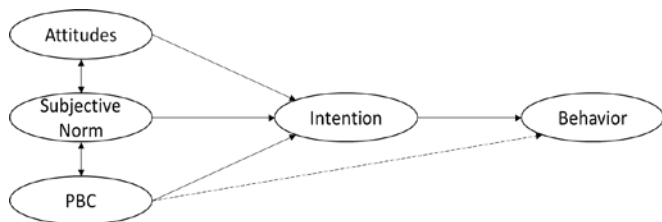


Figure 1. Theory of planned behaviour (after Ajzen, 1991)

According to the attitude-behavior-condition (A-B-C) theory, environmental behavior is determined by environmental attitude and external conditions (Zhang et al., 2021). This paper integrates TPB with the ABC theory to identify attitude as a crucial factor in promoting the intention to reduce food waste. Accordingly, the dining condition (DC) is included in the model to examine the influence of the dining environment on attitude and behavior related to food waste. Considering the related literature, this study hypothesizes the following:

H1: Perceived behavior control (PBC) is positively associated with reducing food waste (WA)

H2: Social norm (SN) is positively associated with waste attitude (WA)

H3: Dining condition (DC) is positively associated with waste attitude (WA)

H4: Social norm (SN) is positively associated with perceived behavior control (PBC)

H5: Waste attitude (WA) is positively associated with reducing waste intention (RWI)

H6: Reducing waste intention (RWI) is positively associated with food waste behavior (FWB)

H7: Dining condition (DC) is positively associated with food waste behavior (FWB)

2.2 Data collection

Convenience sampling was employed to select the 280 survey participants. The questionnaire was administered in several local high schools in Suzhou and Nanjing, including Nanjing Foreign Language School, and was completed by 254 students. The details of the respondents are shown in Table 1.

Table 1. Social demographic and background characteristics of respondents (N=254)

Demographic	Category	Percentage (Frequency)
Gender	Male	51.97% (132)
	Female	48.03% (122)
Age	15	10 (3.94%)
	16	22 (8.66%)
	17	149 (58.66%)
	18	61 (24.02%)
	19	12 (4.73%)
Grade	10	17.71% (45)
	11	41.73% (106)
	12	40.55% (103)
School	School A	36.61% (93)
	School B	18.50% (47)
	School C	21.65% (55)
	School D	23.23% (59)

3. METHODS AND DISCUSSION

3.1 Reliability and validity tests of the questionnaire

AMOS-SEM (Structural Equation Modeling) was used to test the conformity of the expressions used in the study with the constructs and hypotheses. Amos-SEM analysis consists of two stages. The first stage evaluates the measurement model that explains how each construct is measured with the relevant expressions. The first stage analysis shows that the Cronbach's α

coefficient for all latent variables is 0.936, and the α coefficient for each individual latent variable is also above 0.600 (Table 2), indicating that the scale has good reliability. Furthermore, the results of the factor analysis show that the minimum standardized factor loading for all latent observed variables is 0.675 (> 0.500), indicating good convergent validity of the measured variables. Additionally, the KMO values for all variables are at least 0.500 and are significant at the 0.1% level, indicating good structural validity of the questionnaire and suitability for factor analysis. Confirmatory factor analysis (CFA) also showed that the measurement CFA

Table 2. Results of reliability and validity tests

Latent variables	Items	Observed variables	Cronbach's α	KMO	Factor loadings	AVE	CR
Food waste behavior (FWB)	The frequency of food wastage during on-campus dining.	FW1	0.755	0.61	0.798	0.631	0.78
	The average proportion of food wastage during on-campus dining.	FW2			0.790		
Reducing waste intention (RWI)	I try my best not to waste food during on-campus dining.	RWI1	0.893	0.828	0.802	0.638	0.89
	I frequently encourage my fellow classmates to waste less food.	RWI2			0.855		
	I deeply recognize that wasting food is a bad behavior.	RWI3			0.809		
	I pay attention to ordering food moderately.	RWI4			0.775		
	I often think about how to reduce food wastage.	RWI5			0.752		
Waste attitude (WA)	I feel very sad when I see food being wasted.	WA1	0.83	0.719	0.834	0.613	0.83
	I believe wasting food is equivalent to wasting money.	WA2			0.727		
	I believe wasting food is wasting national resources.	WA3			0.790		
Dining condition (DC)	I believe wasting food is wasting national resources.	DC1	0.86	0.833	0.836	0.611	0.88
	I find the on-campus dining environment very comfortable.	DC2			0.839		
	I find the food served during on-campus dining very appetizing.	DC3			0.675		
	The dining environment has little impact on my dining experience.	DC4			0.676		
	I believe there is a good atmosphere during on-campus dining.	DC5			0.858		
Social norm (SN)	My classmates and friends around me all respond to the "clean plate".	SN1	0.86	0.725	0.872	0.688	0.86
	My teachers and parents often teach me not to waste food.	SN2			0.776		
	The school or class often organizes themed activities promoting food conservation.	SN3			0.840		
Perceived behavior control (PBC)	I believe that food waste can be completely avoided.	PBC1	0.919	0.754	0.845	0.794	0.92
	I believe that the environmental burden caused by food wastage can be avoided.	PBC2			0.767		
	I can reduce the amount of food wastage.	PBC3			0.798		

model has good fit index values (χ^2/df : 2.148, RMSEA:0.074, TLI:0.91, CFI:0.915). Under the premise of a well-fitted model on the food waste behavior scale, each dimension's convergence validity (AVE) and composite reliability (CR) are further examined. The procedure involves calculating the standardized factor loadings of each measurement item on its corresponding dimension using the established CFA model. The analysis results in Table 2 indicate that in this validity test, all dimensions have AVE values above 0.5 and CR values above 0.7. This comprehensive analysis demonstrates that all dimensions exhibit good convergence validity and composite reliability.

3.2 Structural model validation and hypothesis tests

In the second stage of the analysis, the structural model was tested. In the Amos 24.0-SEM analysis, hypothesis tests were performed via the structural model. The hypothesis tests, path coefficients, and the squared multiple correlations are presented in Table 3. Except for hypotheses "H3: DC is positively associated with WA", all the other hypotheses H1 ($p < 0.01$), H2 ($p < 0.01$), H4 ($p < 0.01$), H5 ($p < 0.01$), H6 ($p < 0.05$), and H7 ($p < 0.01$) were accepted. The overall fitting diagram of the model is shown in Figure 2.

3.3 Discussion

The estimation results of the measurement model show that social norm (SN) and perceived behavior control (PBC) have a significant positive impact on students' food waste attitudes, indicating that the higher the students' perceived behavior control ability, the more positive their attitude towards reducing food waste (WA). The standardized path coefficients of the two are 0.352 and 0.544 respectively, indicating that compared with social norm (SN), perceived behavior control (PBC) has the most significant impact on students' attitudes. Moreover, social norm (SN) also positively affects perceived behavior control (PBC), which shows that the more students care about the opinions of those around them, the stronger their perceived behavior control will be. Dining condition (DC) does not have a significant effect on attitude but has a significant negative effect on food waste behavior. The standardized estimated value of the impact of food waste attitude on the intention to reduce food waste is 0.234, indicating that the more negative students' attitude is towards food waste (they think food waste is bad), the stronger their willingness to reduce food waste will be. In addition, the reducing food waste intention

Table 3. Regression results among variables of the structural equation model

Hypothesis	Structural Path	Estimates of standardized regression weights		Estimates of standardized regression weights		Result
		Coefficient	S.E.	Coefficient	C.R.	
H1	SN→WA	0.309***	0.097	0.352***	3.178	Supported
H2	PBC→WA	0.538***	0.111	0.544***	4.824	Supported
H3	DC→WA	0.072	0.041	0.078	1.742	Not Supported
H4	SN→PBC	0.747***	0.056	0.842***	13.233	Supported
H5	WA→RWI	0.729***	0.064	0.876***	11.429	Supported
H6	RWI→FWB	-0.245**	0.087	-0.207**	-2.825	Supported
H7	DC→FWB	-0.358***	0.074	-0.396***	-4.846	Supported

Note: *** and ** respectively indicate significance at the 1%, 5% level.

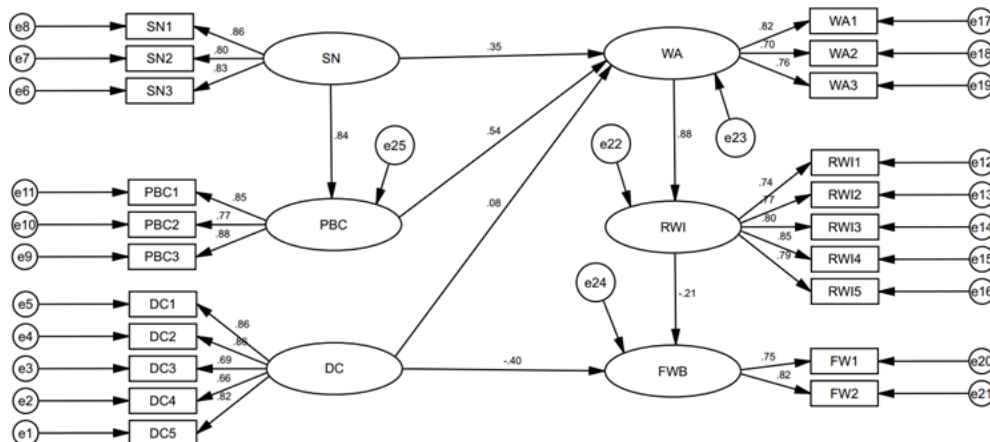


Figure 2. Model fit diagram

has a significant negative impact on the amount of food wasted by consumers, with a path coefficient of -0.207.

4. CONCLUSIONS

In this paper, the influence of social psychology, personal characteristics, and dining factors on the food waste attitudes of high school students was analyzed by using a questionnaire survey combined with structural equation modeling. The social psychology and personal characteristics were taken from social norms and perceived behavior control in TPB theory, respectively. The results show that the social norm and perceived behavior control have a significant impact on high school students' attitudes towards food waste, and that the social norm affects their perceived behavior control ability to a certain extent. This shows that the social atmosphere in which students live is very important. The awareness of reducing food waste among students and friends around them, the relevant teachings of teachers and parents, relevant school regulations, and the effect of food theme activities will all impact students' attitudes. Therefore, schools can reduce food waste by enhancing students' understanding and knowledge of food waste behavior through information campaigns designed to enhance the perceived behavior control of food waste and the willingness to reduce food waste. From the results of the study, dining conditions directly affect food waste behavior. The more comfortable the dining conditions, the less frequent food wasting is and the less food wasted per meal. Therefore, the school can regularly consult students over their willingness to renovate the canteen, such as changing dishes, adjusting the number of dishes, and optimizing the dining environment, which should effectively reduce students' food waste behavior

DECLARATION OF INTEREST STATEMENT

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper. All authors read and approved the final manuscript.

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