

# Recycling Attitudes and Behaviours among Chinese International Students in Australia: A Social-Psychological Perspective

Ziyue Zhang<sup>1</sup>, Guohua Zhang<sup>2\*</sup>

<sup>1</sup>School of Communication and Arts, University of Queensland, Brisbane, Australia

<sup>2</sup>School of Foreign Studies, Zhongnan University of Economics and Law, Wuhan, China

Email: \*huntergh@zuel.edu.cn

**How to cite this paper:** Zhang, Z. Y., & Zhang, G. H. (2025). Recycling Attitudes and Behaviours among Chinese International Students in Australia: A Social-Psychological Perspective. *Open Journal of Social Sciences*, 13, 605-623.

<https://doi.org/10.4236/jss.2025.136040>

**Received:** May 21, 2025

**Accepted:** June 27, 2025

**Published:** June 30, 2025

Copyright © 2025 by author(s) and Scientific Research Publishing Inc. This work is licensed under the Creative Commons Attribution International License (CC BY 4.0).

<http://creativecommons.org/licenses/by/4.0/>



Open Access

## Abstract

This study aims to investigate the changes in recycling attitudes and behaviours of mainland Chinese international students in Australia, as well as the social-psychological and experiential factors that may have been functional in resulting in these changes. Based on a questionnaire survey involving 136 respondents, the study reveals that approximately half of the respondents report more positive recycling attitudes and increased recycling behaviours since their arrival in Australia, with social norms playing a significant role in these changes. Importantly, they are more likely to exhibit more positive recycling attitudes and behaviours when they believe that those around them are actively involved in recycling. Furthermore, it is discovered that their recycling attitudes and behaviours are markedly influenced by environmental education they have received and their frequent exposure to nature, while acculturation is found not to have played an equally significant role. The research findings offer empirical support for the creation of more focused recycling initiatives, particularly when it comes to using social norms as an incentive to encourage recycling among international Chinese students.

## Keywords

Ecological Behavioural Change, Social Norms, Environmental Education, Recycling Attitudes

## 1. Introduction

Waste recycling stands out as a significant practice for advancing sustainability, which is defined as meeting the needs of the present without compromising the

ability of future generations to meet their own needs and has become a central concern globally (Leal Filho et al., 2018). It encompasses economic development, social inclusion, and environmental protection (Halisçelik & Soytaş, 2019). Recycling as a key waste management strategy involves the collection and processing of materials to be reused, contributing to both environmental protection and the circular economy (Cerqueira et al., 2020; Park & Ha, 2014). However, recycling practices vary widely across countries, influenced by socio-economic factors and local infrastructure (Oliveira et al., 2012; Picuno et al., 2021). Recycling in Australia, for example, is an essential waste management strategy managed by local councils through systems like curbside collection (Agarwal et al., 2020; Cáceres Ruiz & Zaman, 2022). Despite such systems, challenges remain in the efficiency of recycling processes, especially in countries with lower socio-economic status (Aparcana & Salhofer, 2013).

Moreover, effective recycling requires active participation of local people, which involves increasing their awareness of sustainable development approaches. A crucial factor influencing their recycling behaviours is the cultural context in which individuals engage with sustainability practices, as it exposes them to new attitudes and practices. For some of them as international students, studying abroad could be a significant period of time and special life experience because they are well-educated and will likely become a part of the mainstream of a society. Additionally, such experiences can increase their sensitivity and awareness of facing up to or even handling complicated global environmental challenges. They may take actions to improve both themselves and others (Wynveen et al., 2011: p. 335). Such experiences in countries like Australia may as well influence their environmental attitudes and behaviours, offering an opportunity to explore how exposure to different social norms affects recycling practices.

In fact, cultural adaptation among international students has been examined in substantial examination (Schultz et al., 2000; Schwartz et al., 2010; Zhang & Goodson, 2011), while insufficient investigation has been conducted of how studying in a drastically different cultural context shapes one's sustainability attitudes and behaviours. This gap in the literature is especially pertinent for understanding recycling behaviours, as the targeted students may adopt new environmental attitudes and practices that could influence not only their behaviours but also those of their social networks. Therefore, cross-cultural environmental behaviour research is required so that one can explore how study-abroad experiences influence international students' recycling behaviours and lead to changes in their attitudes towards maintaining sustainable development. For that reason, this study seeks to explore how Chinese international students' study abroad in Australia affects their recycling attitudes and behaviours. Specifically, it investigates whether their recycling behaviours have changed markedly during their stay in Australia and identifies the key social-psychological and experiential factors that influence these behaviours or lead to such changes. The following two questions are raised to address the issue:

RQ 1: Have the recycling attitudes and behaviours of Chinese international students changed since their study in Australia?

RQ 2: What social-psychological and experiential factors are closely related to their recycling attitudes and behaviours?

### **1.1. Factors That Influence Recycling Attitudes and Behaviours: A Literature Review**

Meta-analyses of environmental psychology literature identify key psychological, social, and contextual factors that can predict environmental attitudes and behaviours. Psycho-social variables such as attitudes, social norms, and problem awareness, which correspond to environmental education/information, have been widely recognised as predictors of recycling behaviours (Bamberg & Möser, 2007; Klöckner, 2013). In addition, experiential factors such as nature contact (Martin et al., 2020) and acculturation in a new cultural setting also play important roles in shaping environmental behaviours, particularly among international students.

#### **1.1.1. Psychological and Social Factors**

Attitudes can produce an immediate effect on pro-environmental behaviours, as found by Jackson et al. (2016), Nigbur et al. (2010), Shan et al. (2020), and Tamar et al. (2020). Specifically, environmental attitudes refer to people's positive or negative feelings regarding some characteristics of the physical environment (Debrah et al., 2021), which significantly impact recycling behaviours, as individuals with stronger pro-environmental attitudes are generally more likely to engage in recycling (Izagirre-Olaizola et al., 2014; Tonglet et al., 2004). Another important predictor of pro-environmental behaviours is problem awareness, which is often enhanced by education (Bamberg & Möser, 2007; Debrah et al., 2021). Environmental knowledge, imparted as a component of education, influences both attitudes and sustainable practices (Ewert et al., 2005; Ramayah et al., 2012). Moreover, social norms function as a significant predictor, which are defined as standards and guidelines understood by group members to direct and/or restrain behaviours (cf. Farrow et al., 2017). Two types of social norms (Cialdini et al., 1990) are particularly relevant, i.e., descriptive norms, which indicate what the majority of people do, and injunctive norms, which describe what others believe one should do. They positively influence recycling behaviours across different cultural contexts (eg., Fornara et al., 2011; Gifford & Nilsson, 2014; Nigbur et al., 2010; Thomas & Sharp, 2013).

#### **1.1.2. Experiential and Contextual Factors**

In a similar vein, nature exposure also plays a critical role in enhancing environmental attitudes and behaviours (Ardoin et al., 2015). Positive nature experiences, such as bird watching and camping, allow individuals to develop a stronger connection with nature and a greater willingness to protect it (Oh et al., 2021; Rosa et al., 2018). Additionally, cultural adaptation, or acculturation, can influence the impact of social norms on behaviours. It is defined as the process by which an

individual undergoes transformations in their interaction with a different culture (Zhang & Goodson, 2011: p. 614). Research indicates that group membership and identification with the source of normative information are crucial factors in determining behavioural compliance (Nigbur et al., 2010; Fornara et al., 2011). These findings suggest that acculturation, which involves the host culture practices, values and identifications (Berry, 1980; Schwartz et al., 2010), plays a role in shaping individuals' pro-environmental behaviours.

It is clear that the issue of recycling behaviours and attitudes among international students has gained significant scientific research value, particularly in cross-cultural contexts. However, while previous research has extensively explored recycling behaviours (e.g., Agarwal et al., 2020; Best & Mayerl, 2013; Cáceres Ruiz & Zaman, 2022; Nigbur et al., 2010; Shan et al., 2020), inadequate studies have been done on examining the recycling practices of international students in a foreign cultural setting. Existent studies seem to have focused on the general population or comparing recycling behaviours across different countries, without sufficient consideration of how international students' personal experiences in host countries reshape their environmental attitudes and behaviours. Likewise, while many studies address the role of social-psychological factors, the effects of cultural adaptation and its interaction with social norms in influencing and reshaping recycling behaviours remain under-explored (Izagirre-Olaizola et al., 2014). Hence, this study hopefully fills the research gap by focusing on the recycling attitudes and behaviours of Chinese international students in Australia and contributes to future research literature seeking to elucidate the relationship between various related factors. Its findings have practical implications for improving recycling practices of the specific population and offer insights into similar efforts in other cross-cultural contexts.

## 2. Research Methodology

### 2.1. Participants

The dataset consisted of 136 verified respondents. Among them, 65.4% identified themselves as female, 32.4% as male, 7% as non-binary, and 1.5% preferred not to disclose their gender. Most participants (66.2%) were aged 25 - 34, 32.4% were 18 - 24, and 1.5% were 35 - 44. Regarding their study duration in Australia, 38.2% had been there for over three years, 29.4% for one to two years, 16.9% for six to twelve months, 8.8% for two to three years, and 6.6% for less than six months. Those informants came from various regions in mainland China and studied diverse majors at Australian universities. They were recruited through convenience and snowball sampling. Specifically, a recruitment message with a survey link was shared among Chinese international students' WeChat groups, private social networks, and a course website. Beforehand, they had received an information sheet detailing the study's objectives, voluntary participation, and their right to withdraw at any time.

## 2.2. Measures

This study adopts a survey questionnaire as a data collection instrument, drawing from previous research on social-psychological factors influencing environmental attitudes and behaviours (e.g., Agarwal et al., 2020; Jackson et al., 2016; Rosa et al., 2018; Stoeva & Alriksson, 2017; Tonglet et al., 2004). The questionnaire includes eight separate scales assessing recycling attitudes, recycling behaviours, social norms, environmental education/information, nature exposure, and acculturation, along with two separate questions on changes in attitudes and behaviours of the informants since their overseas study in Australia. It was administered via Qualtrics in their respective language and pilot-tested for clarity before data collection. In this study, the term and notion of “recycling” refers to the separation and proper disposal of recyclable materials such as papers, plastics, glass, and metal according to the local recycling guidelines in Australia.

### 2.2.1. Recycling Attitudes and Behaviours

Recycling attitudes were measured using six items adapted from Tonglet et al. (2004), rated on a seven-point Likert scale (1 = “strongly disagree” to 7 = “strongly agree”). Of them, five items assessed general attitudes (e.g., “Recycling is good,” “Recycling is useful”, “Recycling is a waste of time” (reverse-worded item)), while one other measured any perceived change in their attitudes: “I feel more positively towards recycling since I came to Australia.” On top of that, recycling behaviours were assessed using three items adapted from Ramayah et al. (2012) and Stoeva & Alriksson (2017), evaluating engagement in recycling practices (e.g., “I regularly recycle household waste that can be recycled by putting them in the recycling bin”). These items were rated on a seven-point Likert scale ranging from 1 = “strongly disagree” to 7 = “strongly agree”. Finally, another fourth item measured any behavioural change on a five-point Likert scale (1 = “recycled much less than in China” to 5 = “recycled much more than in China”).

### 2.2.2. Social Norms and Environmental Education/Knowledge

Social norms were assessed using five items adapted from Culiberg & Elgaaied-Gambier (2015) and Stoeva & Alriksson (2017), measuring both injunctive norms (e.g., “Most of my friends in Australia think I should recycle household garbage”) and descriptive norms (e.g., “Most of my friends in Australia recycle their household garbage”). Responses were rated on a five-point Likert scale (1 = “strongly disagree” to 5 = “strongly agree”). Furthermore, environmental education/ knowledge was measured using three items evaluating the participants’ exposure to information on environmental issues and recycling during their stay (e.g., “How much information about recycling have you get since you’ve arrived in Australia?”), rated on a five-point Likert scale (1 = “no information at all” to 5 = “a great deal of information”).

### 2.2.3. Nature Exposure and Acculturation

Nature exposure was measured using four items adapted from Rosa et al. (2018),

assessing the participants' frequency of engaging with nature (e.g., "While you've been in Australia, how often have you visited zoos or aquariums or places where you can see animals?"), rated on a five-point Likert scale (1 = "never/rarely [i.e. once or twice a year]" to 5 = "often [i.e. more than once a week]"), with the frequency descriptors designed to capture a broad range of engagement. Moreover, acculturation was assessed with three items from [Ward & Kennedy \(1999\)](#), measuring the informants' understanding of Australian culture (e.g., "Understanding the Australian value system"), rated on a five-point Likert scale (1 = "no difficulty" to 5 = "extreme difficulty").

### 3. Results

#### 3.1. The Descriptive Statistics

**Table 1** summarises the valid responses, score ranges, means, and standard deviations for the focal variables (see **Table 1**). Notably, recycling attitudes had the highest mean score (6.16), indicating generally positive attitudes towards recycling. Recycling behaviours (5.36) and social norms (5.56) were also relatively high, suggesting active recycling participation and peer influence. Environmental education exposure was moderate (3.05), indicating that the respondents received a moderate amount of recycling information since their stay in Australia. Nature exposure was lower (2.48), indicating limited interaction with nature while in Australia. Lastly, acculturation (2.81) suggested slight to moderate difficulty they have had in understanding Australian culture.

**Table 1.** The general descriptive statistics.

	N	Min	Max	M	SD
Recycling Attitudes	136	1.00	7.00	6.16	.81
Social Norms	136	1.00	7.00	5.56	1.32
Environmental Education/Knowledge	136	1.00	5.00	3.05	.88
Nature Exposure	136	1.00	5.00	2.48	.86
Acculturation	136	1.00	5.00	2.81	1.03

*Note:* M = Mean; SD = Standard deviation.

All variables were measured using Likert-type scales across six domains (23 items), i.e. recycling behaviours, recycling attitudes, social norms, nature exposure, environmental education/knowledge, and acculturation (see **Table 2**). Scale reliability (Cronbach's  $\alpha$ : .8 - .9) was acceptable ( $>.70$ ; cf. [Peterson, 1994](#)). Notably, the two items assessing changes in recycling attitudes and behaviours were treated separately for Research Question 1, with one reverse-coded item. While social norms were measured as injunctive (i.e., perceived expectations) and descriptive (i.e., observed behaviours), they might have shared conceptual similarities (cf. [Thomas & Sharp, 2013](#)) and formed a valid scale in this study.

**Table 2.** Variable scales, questionnaire questions and Cronbach's alpha scores.

Scales	Items	Cronbach's alpha
Recycling Attitudes	RA1. Recycling is good. RA2. Recycling is useful. RA3. Recycling is a waste of time (reverse scored). RA4. I believe that my recycling will help reduce waste going to landfills. RA5. I believe that my recycling will help conserve natural resources.	$\alpha = .79$
Recycling Behaviours	RB1. Since I came to Australia, I usually separate and dispose of all recyclable materials (e.g., cans, bottles, paper/cardboard, plastics, batteries etc.). RB2. I have high involvement in recycling activities. RB3. I regularly recycle household waste that can be recycled by putting them in the recycling bin.	$\alpha = .84$
Social Norms	SN1. Most of my friends in Australia think I should recycle household garbage. SN2. Most of my friends in Australia think I should recycle when I'm in public places. SN3. Most of my friends in Australia think that waste separation is a good thing to do. SN4. Most of my friends in Australia recycle their household garbage. SN5. Most of my friends in Australia recycle when they are in public places.	$\alpha = .94$
Environmental Education/ Knowledge	EE1. How much information about environmental issues (eg. climate change, pollution, biodiversity loss, sustainability, and conservation efforts, etc.) have you come across in your degree program since arriving in Australia? EE2. How much information about recycling (eg. waste management, recycling processes, and the importance of recycling, etc.) have you come across in your degree program since arriving in Australia? EE3. How much information about recycling have you seen since you've arrived in Australia?	$\alpha = .81$
Nature Exposure	NE1. While in Australia, how frequently do you participate in leisure activities in contact with nature (eg. visiting natural places, playing sports at the beach, swimming, surfing, camping, hiking, boating, fishing etc.)? NE2. While you've been in Australia, how often have you visited zoos or aquariums or places where you can see Australian animals? NE3. While you've been in Australia, how often have you visited coastal or inland wilderness areas? NE4. While you've been in Australia, how often have you seen a native animal (e.g., koalas, kangaroos, alpacas, quokkas, etc.) in the wild?	$\alpha = .83$
Acculturation	ACC1. Understanding the Australian value system. ACC2. Understanding Australians' world view. ACC3. Seeing things from Australians' point of view.	$\alpha = .92$

### 3.2. The Reported Changes in Recycling Attitudes and Behaviours

Research Question 1 was intended to examine changes in the respondents' recycling attitudes and behaviours since their stay in Australia. As shown in **Table 3**, 47.7% of them reported improved recycling attitudes, while 34.6% disagreed and 17.6% were neutral. In terms of behaviour, 53% recycled more, 42.6% maintained the same amount, and 4.4% recycled less.

**Table 3.** Frequency analysis of changes in recycling attitudes and behaviours.

Question	Options	Frequency	Percentage (%)
I feel more positively towards recycling since I came to Australia.	Strongly disagree	5	3.7
	Disagree	9	6.6
	Somewhat disagree	33	24.3
	Neither agree nor disagree	24	17.6
	Somewhat agree	9	6.6
	Agree	32	23.5
Have you changed your recycling behaviour since coming to Australia?	Strongly agree	24	17.6
	Recycled much less than in China	2	1.5
	Recycled somewhat less than in China	4	2.9
	No change in my recycling	58	42.6
	Recycled somewhat more than in China	50	36.8
	Recycled much more than in China	22	16.2

*Note:* Total valid cases (N) = 136.

### 3.3. Measuring the Relationship between Social-Psychological and Experiential Factors and Recycling Attitudes and Behaviours

To investigate what social-psychological and experiential factors closely relate to the respondents' recycling attitudes and behaviours, Pearson correlation analyses were conducted (see **Table 4**) for Research Question 2, and several significant relationships were ascertained.

Specifically, their recycling behaviours correlated positively with their attitudinal change ( $r = .40, p < .01$ ), social norms ( $r = .60, p < .01$ ), and their environmental education/knowledge ( $r = .35, p < .01$ ), indicating their greater engagement in recycling behaviours was associated with their more positive attitudinal changes and their increased exposure to recycling-related information. Furthermore, the respondents were found to have recycled more when their "Australian friends" (i.e. non-Australian friends, referring to their friends who were staying in Australia) were more involved in recycling activities and believed that they should recycle. A weak but positive correlation was found between nature exposure and recycling behaviours ( $r = .21, p < .05$ ), which indicates that the respondents re-

ported more recycling behaviours when they had more natural contact since arriving in Australia. However, acculturation was found not to show a significant correlation with any of these factors. Additionally, it is found out that their behavioural changes were significantly correlated with their attitudinal change ( $r = .65, p < .01$ ), social norms ( $r = .53, p < .01$ ), nature exposure ( $r = .22, p < .01$ ), and their environmental education/knowledge ( $r = .29, p < .01$ ), but not with acculturation ( $r = -.02$ ). These results indicate that the respondents who reported more positive recycling attitudes also exhibited more recycling behaviours. Their behavioural changes were notably influenced by social norms, with greater changes observed among those whose Australian friends participated in recycling. Moreover, their increased time span spent in Australia's natural environments and exposure to environmental education were found to be associated with more behavioural changes, whereas their level of acculturation showed no significant correlation.

**Table 4.** Correlation analysis (N = 136).

Variables	M	SD	1	2	3	4	5	6	7	8
Recycling Attitudes	6.16	.81	-							
Recycling Behaviours	5.36	1.39	.23**	-						
Attitudinal Change	4.58	1.77	.12	.40**	-					
Behavioural Change	3.63	.84	.06	.61**	.65**	-				
Social Norms	5.56	1.32	.23**	.60**	.43**	.53**	-			
Nature Exposure	2.48	.86	-.03	.21*	.11	.22**	.30**	-		
Environmental Education/Knowledge	3.06	.88	.12	.35**	.31**	.29**	.38**	.30**	-	
Acculturation	2.81	1.03	.06	-.03	.08	-.02	.08	.05	.09	-

Note: M = Mean; SD = Standard deviation. \*\* $p < .01$  \* $p < .05$ .

### 3.4. The Influence of Social-Psychological and Experiential Factors on Recycling Attitudes, Recycling Behaviours, and Their Reported Changes

To further address Research Questions 1 and 2, multiple regression analysis was conducted to explore the independent effects of social-psychological and experiential factors on recycling attitudes, behaviours, and their changes. **Table 5** below shows the results of all the model analyses, which reveal that social norms were the only significant predictor of recycling attitudes ( $B = .14, \beta = .23, p < .05$ ), explaining about 4% of the variance (adjusted  $R^2 = .04$ ). It is discovered that changes in recycling attitudes were also significantly influenced by social norms ( $B = .50, \beta = .37, p < .001$ ), explaining 19% of the variance (adjusted  $R^2 = .19$ ). In contrast, environmental education/knowledge was shown to have produced a marginally significant effect ( $B = .37, \beta = .19, p = .05$ ), while nature exposure and acculturation had no significant impact.

**Table 5.** Multiple regression analysis results for recycling attitudes, attitudinal changes, recycling behaviours, and behavioural changes.

	Recycling Attitudes	Attitude Change	Recycling Behaviours	Behavioural Change
<b><i>Social Norms</i></b>				
B	.14*	.50***	.58***	.31***
SE	.06	.12	.08	.05
95% Confidence Interval (Lower Bound, Upper Bound)	(.03, .26)	(.27, .73)	(.42, .74)	(.21, .41)
$\beta$	.23	.37	.55	.48
<b><i>Nature Exposure</i></b>				
B	-.11	-.12	.01	.06
SE	.09	.17	.12	.08
95% Confidence Interval (Lower Bound, Upper Bound)	(-.28, .06)	(-.45, .22)	(-.22, .25)	(-.09, .21)
$\beta$	-.12	-.06	.01	.06
<b><i>Environmental Education/Knowledge</i></b>				
B	.06	.37*	.24*	.09
SE	.09	.17	.12	.08
95% Confidence Interval (Lower Bound, Upper Bound)	(-.11, .23)	(.03, .71)	(.00, .48)	(-.07, .24)
$\beta$	.06	.19	.15	.09
<b><i>Acculturation</i></b>				
B	.03	.06	-.12	-.06
SE	.07	.13	.09	.06
95% Confidence Interval (Lower Bound, Upper Bound)	(-.10, .16)	(-.21, .32)	(-.31, .06)	(-.17, .06)
$\beta$	.04	.03	-.09	-.07
<b><i>Constant</i></b>				
B	5.38	.79***	1.73***	1.67***
SE	.37	.75	.52	.34
95% Confidence Interval (Lower Bound, Upper Bound)	(4.64, 6.11)	(-.68, 2.27)	(.70, 2.77)	(1.00, 2.33)
Adjusted R <sup>2</sup>	.04	.19	.37	.27
P	.06	<.001	<.001	<.001
SEE	.79	1.59	1.11	.72
N	136	136	136	136

Note: B = Unstandardized coefficient; SE = Standard Error;  $\beta$  = Standardized coefficient; CI = Confidence Interval; SEE = Standard Error of Estimate. \* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$ .

Regarding recycling behaviours, the present analysis shows that both social

norms ( $B = .58, \beta = .55, p < .001$ ) and environmental education/knowledge ( $B = .24, \beta = .15, p < .05$ ) were significant predictors, explaining 37% of the variance (adjusted  $R^2 = .37$ ). It is shown that changes in recycling behaviours were again mainly influenced by social norms ( $B = .31, \beta = .48, p < .001, \text{adjusted } R^2 = .27$ ), while environmental education/knowledge and nature exposure were not significant predictors. However, no evidence has been found to show that acculturation significantly predicted recycling behaviours. Therefore, in a general sense, these findings combine to show that social norms consistently played a significant role in reshaping both recycling attitudes and behaviours, as well as their changes. In a similar vein, receiving or having environmental education/knowledge also had a positive but limited influence on one's recycling behaviours and attitudinal changes. By comparison, nature exposure and acculturation produced relatively weak or no significant effect on recycling behaviours and attitudes.

#### 4. Discussion

This study investigates the recycling attitudes and behaviours of Chinese international students studying in Australia, focusing on whether their attitudes and behaviours have changed and how these changes, if any, relate to social-psychological and experiential factors. The answers to the first research question, intended to address those changes, reveal that over 50% of the participants reported increased recycling rates, and slightly less than 50% stated that they had developed more positive attitudes towards recycling. The regression analysis further confirms social norms as the strongest predictors of their attitudinal changes, while it shows that nature exposure and environmental education/knowledge have weaker, non-significant effects. Neither does acculturation significantly influence their recycling attitudes or behaviours. Additionally, it is seen that increased social support and one's more active participation in recycling practices are strongly linked to his or her more positive recycling attitudes. The correlation analysis highlights that more positive social norms, one's greater exposure to nature and having more environmental education/knowledge are all strongly associated with improvements in one's recycling attitudes since his or her stay in Australia. The regression analysis also indicates that social norms is the key driver of behavioural changes, with other factors showing no significant impact. Overall, these findings highlight the dynamic process through which the Chinese international students adapted their recycling attitudes and behaviours to a new cultural environment, emphasizing the key role of social norms in driving both attitudinal and behavioural changes, while highlighting the limited influence of other factors. A more detailed discussion of these findings is provided in the following subsections.

##### 4.1. The Relationship between Social-Psychological and Experiential Factors and Recycling Attitudes and Behaviours

The present study demonstrates a positive (albeit weakly) correlation between recycling attitudes and behaviours, but not with changes in recycling behaviours.

Specifically, it reveals that positive attitudes towards recycling are more significantly associated with both recycling practices and reported changes in recycling behaviours. These findings are in line with prior research (Kollmuss & Agyeman, 2002; Ramayah et al., 2012; Tonglet et al., 2004), which suggests that positive recycling attitudes increase participation in recycling. Although the correlation between recycling attitudes and behaviours is relatively weak, there is a stronger relationship between attitudinal changes and the two behaviour measures. This result is consistent with those previously reported by Ramayah et al. (2012) and Tonglet et al. (2004). Thus, the associations are weak or slightly moderate. In particular, obstacles like behavioural costs and ingrained habits (cf. Kollmuss & Agyeman, 2002) contribute to the attitude-behaviour gap, indicating that additional factors call for considerations. Social norms, however, are found to be significantly positively-related to all recycling measures, supporting previous findings (eg., Fornara et al., 2011; Nigbur et al., 2010; Ramayah et al., 2012; Stoeva & Alriksson, 2017) that stress their essential role in shaping people's behaviours. Indeed, one is more likely to recycle when one realises that most people around them recycle and believe they should, too.

Additionally, the present research findings demonstrate that environmental education/knowledge is significantly associated with attitudinal and behavioural changes. Since the respondents are more likely to recycle when they have more environmental knowledge, to enhance recycling education and impart related knowledge to people could be an effective strategy to promote their recycling habits. This aligns with previous research findings reported by Ramayah et al. (2012) and Tonglet et al. (2004), among others, who found that education is an essential element in increasing people's knowledge that leads to more positive recycling behaviours. Furthermore, the close relationship found between environmental education/knowledge and attitudinal changes again lends support to Tonglet et al.'s (2004) findings, which suggested that there was an association between recycling attitudes and appropriate environmental knowledge.

Nature exposure is also found out to be a significant element related to recycling behaviours and their reported changes, consistent with the findings of numerous previous studies (cf. Ardoin et al., 2015; Oh et al., 2021; Rosa et al., 2018) that examined the connection between nature exposure and environmental attitudes and behaviours. Those research findings indicate that people tend to get more closely linked to different aspects of nature if they spend more time in nature and have pleasant contacts with it more often (Martin et al., 2020). This connection may encourage people to adopt appropriate environmental behaviours and attitudes, which in turn could help to protect the environment. Furthermore, the present study discovers that nature exposure has a relatively weak link with recycling behaviours and is practically unrelated to attitudes regarding recycling. This is likely related to the principle of correspondence, which states that variables that are more aligned (e.g. social norms of recycling) will be more closely related than variables that are less aligned (e.g. nature exposure) (cf. Martin et al., 2020). In-

terestingly, the present study suggests that acculturation did not significantly correlate with recycling attitudes or behaviours. This finding, contrary to the claim made by [Schultz et al. \(2000\)](#), which stated that acculturation had a significant role in influencing environmental attitudes, may be accounted for by the fact that recycling is viewed favorably in various cultures or nations, including China, where diverse recycling initiatives encourage recycling ([Picuno et al., 2021](#)). These initiatives generally aim to highlight the advantages of recycling. As a result, cultural differences in Australia may have very limited impact on Chinese international students' recycling attitudes and behaviours.

## **4.2. The Influence of Social-Psychological and Experiential Factors on Recycling Attitudes, Recycling Behaviours, and Their Changes**

### **4.2.1. Recycling Attitudes and Attitudinal Changes**

This study shows that social-psychological factors produce significant influence on the recycling attitudes and their changes of the Chinese international students. In particular, social norms play a crucial role in both reshaping the recycling attitudes and predicting changes in these attitudes, with regression analysis confirming their strong impact. This finding suggests that in a multicultural environment, when individuals perceive strong support for recycling from the society, they are more likely to develop positive recycling attitudes. This result aligns with [Fornara et al. \(2011\)](#), who emphasised the positive relationship between recycling attitudes and injunctive norms, though the relationship with descriptive local norms was weaker. Additionally, [Duerden & Witt \(2010\)](#) ascertained the influence of social norms and perceived constraints on environmental intentions. Furthermore, this study finds a positive correlation between environmental education/knowledge and attitudinal changes, though its effect is not as strong as that of social norms. This finding is in principle consistent with [Debrah et al. \(2021\)](#), who ascertained a positive correlation between environmental knowledge and environmental attitudes. Specifically, individuals with higher levels of education tend to be more concerned about the environment. However, such an effect on attitudinal changes brought about by environmental education/knowledge is found to be relatively more limited in this study, which is possibly due to the limited size of the sampling, the varying levels of command of environmental knowledge of the participants and their different exposure to such knowledge in Australia.

Surprisingly, acculturation as a widely discussed factor in cross-cultural research is found not to be significantly affecting the changes in recycling attitudes in this study. This may result from the complexity of acculturation and personal adaptation ([Schwartz et al., 2010](#)). [Schultz et al. \(2000\)](#) even found out that cultural adaptation negatively correlated with environmental attitudes among Latinx immigrants, suggesting that acculturation may not always be a determining factor in reshaping environmental attitudes of individuals. Nature exposure is also found to have a marginally significant effect on changes in recycling attitudes, indicating that one's contact with natural environment may indirectly influence their atti-

tudes and result in related changes because of their increasing environmental awareness. This is a finding that aligns with [Oh et al. \(2021\)](#), who pointed out that the connection between humans and nature can promote environmental attitudes. While the influence of nature exposure is less greater than that of social norms, it still provides valuable insights into the dynamic changes in the recycling attitudes of Chinese international students in Australia.

#### **4.2.2. Recycling Behaviours and Behavioural Changes**

Not surprisingly, this study confirms that social norms have a significant positive effect on both recycling behaviours and their changes. Specifically, the frequency of recycling behaviours of the respondents is closely related to the social support they receive and the expectations of others, which is consistent with the views of [Thomas & Sharp \(2013\)](#) and [Gifford & Nilsson \(2014\)](#), who hold that social norms positively influence environmental behaviours. Likewise, [Perry et al. \(2021\)](#) emphasize that social norms help sustain and change people's recycling behaviours. Specifically, previous studies (eg., [Cialdini et al., 1990](#); [Farrow et al., 2017](#); [Fornara et al., 2011](#)) also argue that both injunctive and descriptive norms have direct effects on recycling behaviours and related behavioural changes. In this study, social norms are found out to be the strongest predictor of recycling behaviours, suggesting that when recycling is frequently practiced in the community and the students feel supported by their Australian peers, they are more likely to engage in recycling activities.

Additionally, this study discovers that nature exposure has some effect on recycling behaviour changes, though it is not as significant as that of social norms. Nevertheless, more frequent interaction with nature correlates with greater environmental awareness and participation in recycling, consistent with [Oh et al. \(2021\)](#), [Rosa et al. \(2018\)](#), [Duerden & Witt \(2010\)](#), and [Whitburn et al. \(2019\)](#), who coincidentally pointed out that one's having more contact with nature may increase his pro-environmental behaviours. However, the effect of nature exposure in the regression model is found out to be not significant, possibly due to the longer time required for such influence to take effect or the need for more direct engagement with nature.

Environmental education/knowledge is also discovered as having a positive effect on recycling behaviours, though the effect is not as strong as that of social norms. This discovery is in line with the findings made by [Duerden & Witt \(2010\)](#), [Debrah et al. \(2021\)](#), and [Wu et al. \(2022\)](#), who identify environmental knowledge as a predictor of pro-environmental behaviours. However, this study shows that the influence of environmental education/knowledge, though positive, is not significant at all. This may result from such factors as the educational content available in Australia, the methods of relevant information dissemination, and the respondents' environmental knowledge.

Finally, it is shown in this study that acculturation does not significantly influence recycling behaviours or result in related behavioural changes markedly, though it is often regarded or treated as an important variable in cross-cultural

settings (Schwartz et al., 2010). This finding suggests that Chinese international students' adaptation to recycling behaviours may depend more on external social and educational influences rather than on the cultural adaptation process itself.

### 4.3. Limitations and Future Research

This study explores the recycling attitudes and behaviours of Chinese international students in Australia, identifying key social-psychological and experiential factors such as social norms, nature exposure, environmental education/knowledge, and acculturation. The related findings offer valuable insights into designing and implementing effective recycling interventions, particularly by leveraging the influence of social norms. Promoting visible recycling behaviours and fostering peer influence may enhance the effectiveness of sustainability initiatives.

However, the study has some limitations. Firstly, the relatively small sample size and voluntary participation limit the generalizability of the findings. Future studies, therefore, should include larger, more diverse samples to enhance the external validity. Secondly, this study relies on self-reported data, which may introduce biases, such as over-reporting socially desirable behaviours. To obtain a more accurate assessment of recycling practices, researchers should consider using more objective measures, such as observational data or behavioural tracking, to complement self-reports in their future studies. Thirdly, while demographic data such as age and length of stay in Australia were collected, these variables were not included in the statistical and regression analysis due to the study's focus on specific social-psychological and experiential factors, as well as limitations in sample size. However, these demographic characteristics may play an important role in shaping recycling attitudes and behaviours. Future studies should, therefore, consider incorporating such variables to examine their potential moderating or mediating effects. Additionally, while the study has identified key social-psychological and experiential factors influencing recycling attitudes and behaviours, it does not well establish causal relationships involved. And, the absence of control variables may limit the ability to isolate the effects of specific factors. Future studies, therefore, should incorporate control variables and employ more rigorous analyses to explore underlying causal mechanisms. Moreover, this study did not differentiate between types of social relationships when assessing friends as a source of social norms influencing recycling attitudes and behaviours, such as distinguishing close friends, classmates, or general peers. Hopefully, therefore, future studies may benefit from examining how different types of peer relationships distinctly affect recycling attitudes and behaviours.

Overall, future studies should strengthen empirical foundations by using larger samples and more refined methodologies. These efforts can shed insights into how psycho-social and experiential factors influence the recycling practices and offer guidance for more targeted recycling interventions.

## Acknowledgements

The authors would like to extend sincere gratitude to Prof. Kelly Fielding for her insightful feedback and support. Special thanks go to all the informants.

## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

## References

- Agarwal, P., Werner, T. T., Lane, R., & Lamborn, J. (2020). Municipal Recycling Performance in Victoria, Australia: Results from a Survey of Local Government Authorities. *Australasian Journal of Environmental Management*, *27*, 294-308. <https://doi.org/10.1080/14486563.2020.1765423>
- Aparcana, S., & Salhofer, S. (2013). Application of a Methodology for the Social Life Cycle Assessment of Recycling Systems in Low Income Countries: Three Peruvian Case Studies. *The International Journal of Life Cycle Assessment*, *18*, 1116-1128. <https://doi.org/10.1007/s11367-013-0559-3>
- Ardoin, N. M., Wheaton, M., Bowers, A. W., Hunt, C. A., & Durham, W. H. (2015). Nature-based Tourism's Impact on Environmental Knowledge, Attitudes, and Behavior: A Review and Analysis of the Literature and Potential Future Research. *Journal of Sustainable Tourism*, *23*, 838-858. <https://doi.org/10.1080/09669582.2015.1024258>
- Bamberg, S., & Möser, G. (2007). Twenty Years after Hines, Hungerford, and Tomera: A New Meta-Analysis of Psycho-Social Determinants of Pro-Environmental Behaviour. *Journal of Environmental Psychology*, *27*, 14-25. <https://doi.org/10.1016/j.jenvp.2006.12.002>
- Berry, J. W. (1980). Acculturation as Varieties of Adaptation. In A. M. Padilla (Ed.), *Acculturation: Theory, Models and Some New Findings* (pp. 9-25). Westview Press.
- Best, H., & Mayerl, J. (2013). Values, Beliefs, Attitudes: An Empirical Study on the Structure of Environmental Concern and Recycling Participation. *Social Science Quarterly*, *94*, 691-714. <https://doi.org/10.1111/ssqu.12010>
- Cáceres Ruiz, A. M., & Zaman, A. (2022). The Current State, Challenges, and Opportunities of Recycling Plastics in Western Australia. *Recycling*, *7*, Article No. 64. <https://doi.org/10.3390/recycling7050064>
- Cerqueira, P. A., Soukiazis, E., & Proença, S. (2020). Assessing the Linkages between Recycling, Renewable Energy and Sustainable Development: Evidence from the OECD Countries. *Environment, Development and Sustainability*, *23*, 9766-9791. <https://doi.org/10.1007/s10668-020-00780-4>
- Cialdini, R. B., Reno, R. R., & Kallgren, C. A. (1990). A Focus Theory of Normative Conduct: Recycling the Concept of Norms to Reduce Littering in Public Places. *Journal of Personality and Social Psychology*, *58*, 1015-1026. <https://doi.org/10.1037/0022-3514.58.6.1015>
- Culiberg, B., & Elgaaid-Gambier, L. (2015). Going Green to Fit in—Understanding the Impact of Social Norms on Pro-Environmental Behaviour, a Cross-Cultural Approach. *International Journal of Consumer Studies*, *40*, 179-185. <https://doi.org/10.1111/ijcs.12241>
- Debrah, J. K., Vidal, D. G., & Dinis, M. A. P. (2021). Raising Awareness on Solid Waste Management through Formal Education for Sustainability: A Developing Countries Evidence Review. *Recycling*, *6*, Article No. 6. <https://doi.org/10.3390/recycling6010006>

- Duerden, M. D., & Witt, P. A. (2010). The Impact of Direct and Indirect Experiences on the Development of Environmental Knowledge, Attitudes, and Behavior. *Journal of Environmental Psychology, 30*, 379-392. <https://doi.org/10.1016/j.jenvp.2010.03.007>
- Ewert, A., Place, G., & Sibthorp, J. (2005). Early-Life Outdoor Experiences and an Individual's Environmental Attitudes. *Leisure Sciences, 27*, 225-239. <https://doi.org/10.1080/01490400590930853>
- Farrow, K., Grolleau, G., & Ibanez, L. (2017). Social Norms and Pro-Environmental Behavior: A Review of the Evidence. *Ecological Economics, 140*, 1-13. <https://doi.org/10.1016/j.ecolecon.2017.04.017>
- Fornara, F., Carrus, G., Passafaro, P., & Bonnes, M. (2011). Distinguishing the Sources of Normative Influence on Proenvironmental Behaviors. *Group Processes & Intergroup Relations, 14*, 623-635. <https://doi.org/10.1177/1368430211408149>
- Gifford, R., & Nilsson, A. (2014). Personal and Social Factors That Influence Pro-Environmental Concern and Behaviour: A Review. *International Journal of Psychology, 49*, 141-157. <https://doi.org/10.1002/ijop.12034>
- Halisçelik, E., & Soytas, M. A. (2019). Sustainable Development from Millennium 2015 to Sustainable Development Goals 2030. *Sustainable Development, 27*, 545-572. <https://doi.org/10.1002/sd.1921>
- Izagirre-Olaizola, J., Fernández-Sainz, A., & Vicente-Molina, M. A. (2014). Internal Determinants of Recycling Behaviour by University Students: A Cross-Country Comparative Analysis. *International Journal of Consumer Studies, 39*, 25-34. <https://doi.org/10.1111/ijcs.12147>
- Jackson, L., Pang, M. F., Brown, E., Cain, S., Dingle, C., & Bonebrake, T. (2016). Environmental Attitudes and Behaviors among Secondary Students in Hong Kong. *International Journal of Comparative Education and Development, 18*, 70-80. <https://doi.org/10.1108/ijced-10-2015-0004>
- Klöckner, C. A. (2013). A Comprehensive Model of the Psychology of Environmental Behaviour—A Meta-Analysis. *Global Environmental Change, 23*, 1028-1038. <https://doi.org/10.1016/j.gloenvcha.2013.05.014>
- Kollmuss, A., & Agyeman, J. (2002). Mind the Gap: Why Do People Act Environmentally and What Are the Barriers to Pro-Environmental Behavior? *Environmental Education Research, 8*, 239-260. <https://doi.org/10.1080/13504620220145401>
- Leal Filho, W., Tripathi, S. K., Andrade Guerra, J. B. S. O. D., Giné-Garriga, R., Orlovic Lovren, V., & Willats, J. (2018). Using the Sustainable Development Goals towards a Better Understanding of Sustainability Challenges. *International Journal of Sustainable Development & World Ecology, 26*, 179-190. <https://doi.org/10.1080/13504509.2018.1505674>
- Martin, L., White, M. P., Hunt, A., Richardson, M., Pahl, S., & Burt, J. (2020). Nature Contact, Nature Connectedness and Associations with Health, Wellbeing and Pro-Environmental Behaviours. *Journal of Environmental Psychology, 68*, Article ID: 101389. <https://doi.org/10.1016/j.jenvp.2020.101389>
- Nigbur, D., Lyons, E., & Uzzell, D. (2010). Attitudes, Norms, Identity and Environmental Behaviour: Using an Expanded Theory of Planned Behaviour to Predict Participation in a Kerbside Recycling Programme. *British Journal of Social Psychology, 49*, 259-284. <https://doi.org/10.1348/014466609x449395>
- Oh, R. R. Y., Fielding, K. S., Nghiem, L. T. P., Chang, C. C., Carrasco, L. R., & Fuller, R. A. (2021). Connection to Nature Is Predicted by Family Values, Social Norms and Personal Experiences of Nature. *Global Ecology and Conservation, 28*, e01632. <https://doi.org/10.1016/j.gecco.2021.e01632>

- Oliveira, C. R. d., Bernardes, A. M., & Gerbase, A. E. (2012). Collection and Recycling of Electronic Scrap: A Worldwide Overview and Comparison with the Brazilian Situation. *Waste Management, 32*, 1592-1610. <https://doi.org/10.1016/j.wasman.2012.04.003>
- Park, J., & Ha, S. (2014). Understanding Consumer Recycling Behavior: Combining the Theory of Planned Behavior and the Norm Activation Model. *Family and Consumer Sciences Research Journal, 42*, 278-291. <https://doi.org/10.1111/fcsr.12061>
- Perry, G. L. W., Richardson, S. J., Harré, N., Hodges, D., Lyver, P. O., Maseyk, F. J. F. et al. (2021). Evaluating the Role of Social Norms in Fostering Pro-Environmental Behaviors. *Frontiers in Environmental Science, 9*, Article ID: 620125. <https://doi.org/10.3389/fenvs.2021.620125>
- Peterson, R. A. (1994). A Meta-Analysis of Cronbach's Coefficient Alpha. *Journal of Consumer Research, 21*, 381-391. <https://doi.org/10.1086/209405>
- Picuno, C., Van Eygen, E., Brouwer, M. T., Kuchta, K., & Thoden van Velzen, E. U. (2021). Factors Shaping the Recycling Systems for Plastic Packaging Waste—A Comparison between Austria, Germany and the Netherlands. *Sustainability, 13*, Article No. 6772. <https://doi.org/10.3390/su13126772>
- Ramayah, T., Lee, J. W. C., & Lim, S. (2012). Sustaining the Environment through Recycling: An Empirical Study. *Journal of Environmental Management, 102*, 141-147. <https://doi.org/10.1016/j.jenvman.2012.02.025>
- Rosa, C. D., Profice, C. C., & Collado, S. (2018). Nature Experiences and Adults' Self-Reported Pro-Environmental Behaviors: The Role of Connectedness to Nature and Childhood Nature Experiences. *Frontiers in Psychology, 9*, Article No. 1055. <https://doi.org/10.3389/fpsyg.2018.01055>
- Schultz, P. W., Unipan, J. B., & Gamba, R. J. (2000). Acculturation and Ecological Worldview among Latino Americans. *The Journal of Environmental Education, 31*, 22-27. <https://doi.org/10.1080/00958960009598635>
- Schwartz, S. J., Unger, J. B., Zamboanga, B. L., & Szapocznik, J. (2010). Rethinking the Concept of Acculturation: Implications for Theory and Research. *American Psychologist, 65*, 237-251. <https://doi.org/10.1037/a0019330>
- Shan, X., Ang, W. L., & Yang, E. H. (2020). Mobile App-Aided Risks, Attitudes, Norms, Abilities and Self-Regulation (RANAS) Approach for Recycling Behavioral Change in Singapore. *Resources, Conservation and Recycling, 162*, 1-8. <https://doi.org/10.1016/j.resconrec.2020.105049>
- Stoeva, K., & Alriksson, S. (2017). Influence of Recycling Programmes on Waste Separation Behaviour. *Waste Management, 68*, 732-741. <https://doi.org/10.1016/j.wasman.2017.06.005>
- Tamar, M., Wirawan, H., Arfah, T., & Putri, R. P. S. (2020). Predicting Pro-Environmental Behaviours: The Role of Environmental Values, Attitudes and Knowledge. *Management of Environmental Quality: An International Journal, 32*, 328-343. <https://doi.org/10.1108/meq-12-2019-0264>
- Thomas, C., & Sharp, V. (2013). Understanding the Normalisation of Recycling Behaviour and Its Implications for Other Pro-Environmental Behaviours: A Review of Social Norms and Recycling. *Resources, Conservation and Recycling, 79*, 11-20. <https://doi.org/10.1016/j.resconrec.2013.04.010>
- Tonglet, M., Phillips, P. S., & Read, A. D. (2004). Using the Theory of Planned Behaviour to Investigate the Determinants of Recycling Behaviour: A Case Study from Brixworth, UK. *Resources, Conservation and Recycling, 41*, 191-214. <https://doi.org/10.1016/j.resconrec.2003.11.001>

- Ward, C., & Kennedy, A. (1999). The Measurement of Sociocultural Adaptation. *International Journal of Intercultural Relations*, *23*, 659-677.  
[https://doi.org/10.1016/s0147-1767\(99\)00014-0](https://doi.org/10.1016/s0147-1767(99)00014-0)
- Whitburn, J., Linklater, W., & Abrahamse, W. (2019). Meta-Analysis of Human Connection to Nature and Proenvironmental Behavior. *Conservation Biology*, *34*, 180-193.  
<https://doi.org/10.1111/cobi.13381>
- Wu, L., Zhu, Y., & Zhai, J. (2022). Understanding Waste Management Behavior among University Students in China: Environmental Knowledge, Personal Norms, and the Theory of Planned Behavior. *Frontiers in Psychology*, *12*, Article ID: 771723.  
<https://doi.org/10.3389/fpsyg.2021.771723>
- Wynveen, C. J., Kyle, G. T., & Tarrant, M. A. (2011). Study Abroad Experiences and Global Citizenship. *Journal of Studies in International Education*, *16*, 334-352.  
<https://doi.org/10.1177/1028315311426782>
- Zhang, J., & Goodson, P. (2011). Acculturation and Psychosocial Adjustment of Chinese International Students: Examining Mediation and Moderation Effects. *International Journal of Intercultural Relations*, *35*, 614-627.  
<https://doi.org/10.1016/j.ijintrel.2010.11.004>