Investigating the Determinants of University Students' Recycling Behaviour[1]

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Üniversite Öğrencilerinin Geri Dönüşüm Davranışlarının Belirleyicilerinin İncelenmesi[2]

Abstract

Wastes spread to the environment negatively affect the health of humans and all other creatures. It is the responsibility of each person to assess the waste generated correctly. Recycling is an applicable option for environmental protection. This study defines university students' recycling behaviours based on the Theory of Planned Behaviour using Structural Equation Modelling. The results of the study, it is found that subjective norms and perceived behaviour control have a significant impact on students' recycling behaviour. Furthermore, intention partially mediates the positive relationship between subjective norm and recycling behaviour and between perceived behavioural control and recycling behaviour.

Keywords : Municipal Solid Waste, Subjective Norm, Perceived Behavioural Control, Structural Equation Modelling.

JEL Classification Codes : D9, Q53, Q58.

Öz

Çevreye yayılan atıklar insan ve diğer tüm canlıların sağlığını olumsuz etkilemektedir. Her birey, üretilen atıkların doğru değerlendirilmesinin sorumluluğuna sahiptir. Bu çalışmada öğrencilerin geri dönüşüm davranışlarının belirleyicileri Planlı Davranış Teorisi baz alınarak ve Yapısal Eşitlik Modeli kullanılarak tanımlanmaktadır. Çalışmanın sonuçlarına göre, öznel norm ve algılanan davranış kontrolü öğrencilerin geri dönüşüm davranışları üzerinde pozitif ve anlamlı bir etkiye sahiptir. Araştırmanın bir diğer bulgusu ise, niyet öznel norm ve algılanan davranış kontrolü arasında parçalı bir aracılık etkisine sahiptir.

Anahtar Sözcükler : Kentsel Katı Atık, Öznel Norm, Algılanan Davranış Kontrolü, Yapısal Eşitlik Modeli.

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1. Introduction

While a burgeoning world population of billions mainly driven by developments in healthcare, agriculture, infrastructure, and a net rise in fertility rates has spurred the global economy to faster growth, it has also caused an unprecedented increase in waste generation worldwide. Every year, enough waste is produced to circle the earth many times, making its timely and effective disposal vital.

As a result of today's increasing fast consumption habits, municipal solid waste (MSW) has a large place in solid waste. MSW mainly consists of daily items such as glass, product packaging, and newspapers. By 2050, global municipal solid waste generation is expected to have increased by approximately 70% (Worldbank, 2018).

Waste generation creates many adverse effects on the environment. It affects human and environmental health due to the reasons such as littering, dumping, and disposal. The gradual deterioration of environmental quality has been clarified by the emergence of many environmental problems, such as global warming, acid rain, and pollution (Salleh et al., 2016). Carbon and greenhouse gas emissions are often the side effects of unsustainably managed waste, hasten global warming, and result in natural calamities. Since the decomposition of waste in poorly managed landfills emits methane (CH_4), one among several non-CO_2 greenhouse gases, into the atmosphere. CH_4 constitutes about 21% of the total global greenhouse gas emissions (Ho et al., 2017).

OECD Data shows that total municipal waste in Türkiye has increased since 2010 (Figure 1). Even though it tended to decrease slightly in 2010, it has grown since that year. Mainly, a sharp increase was observed in 2016.

Figure: 1
**Total Municipal Waste, Thousand Tonnes, 2009-2019**
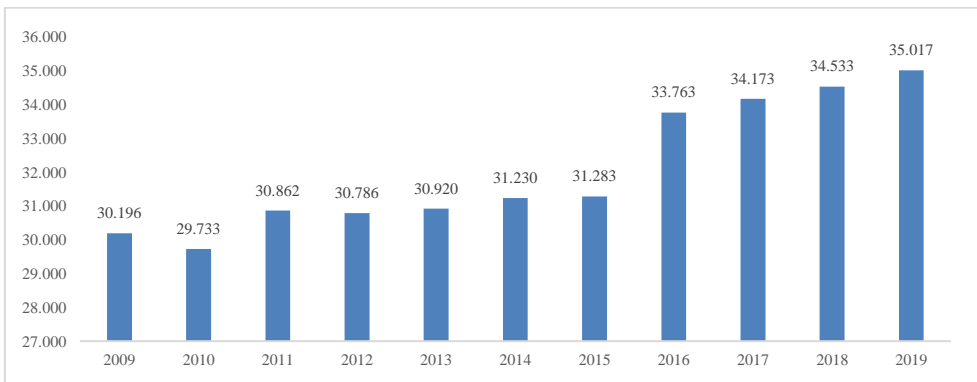
Source: OECD Database, 2021.

Due to the increasing daily waste generation, sustainable waste management should be adopted worldwide. Owing to today's immediate consumption habits, it is almost impossible not to produce waste, but it is up to every human being to correctly evaluate the waste produced. The wastes spread to the environment adversely affect the health of humans and all other creatures. If not treated or disposed of in time, accumulated waste can hurt the environment and humans. It also causes rapid depletion of natural resources. For this reason, correct waste management should be adopted, and one of the main approaches to be adopted in waste management is recycling. A robust waste management system and a thorough examination of individual behaviour relating to its disposal can help prevent the rapid depletion of natural resources caused by negligence.

Recycling offers a viable solution to protect the environment and save energy. It helps mitigate the harmful effects of greenhouse gas emissions from unsustainable and improper waste disposal. For instance, recycling can help reduce the toxic fumes produced by the incineration of plastic waste. These toxic gases, such as dioxins, mercury, furans, and polychlorinated biphenyls, pose grave threats to vegetation and human and animal health. Moreover, recycling also helps promote energy efficiency by reducing the steps involved in traditional methods. For instance, the energy required to recycle paper is 50% of the energy needed for normal operations.

When it considers the recycling rate, it is observed that Türkiye has low recycling rates compared to the average of OECD countries (Figure 2). This statistic highlights how far behind Türkiye is when addressing recycling. Moreover, Türkiye has the lowest recycling and recovery rate among OECD member countries. (OECD, 2020a). Thus, sustainable waste management is indispensable to Türkiye.

Figure: 2
The Recycling Rate of Municipal Waste in Türkiye, OECD-Europe, The United States and OECD Countries, 2017 (%)
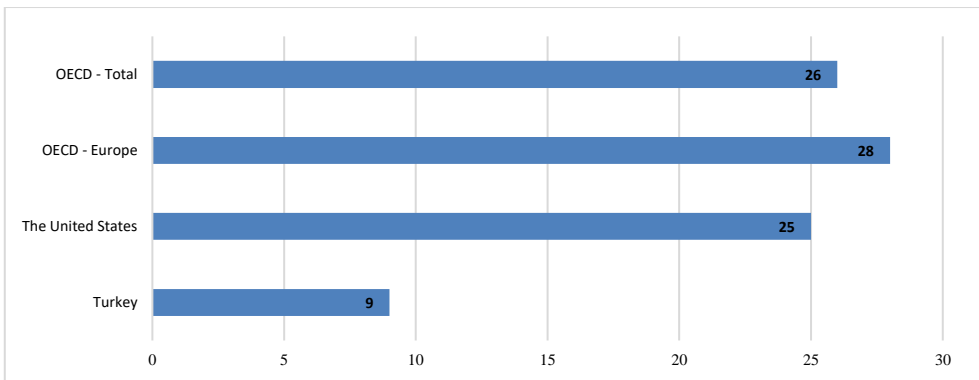
Source: OECD Database, 2020.

In Türkiye, waste has been collected on the streets under primitive and unsanitary conditions. However, some of the wastes collected cannot be evaluated since they are mixed with wet garbage. The essential condition of creating a healthier and more efficient recovery system is to collect the recyclable wastes separately. Thus, cleaner and larger waste can be collected economically (Banar & Ozkan, 2005).

Since students often develop new habits in universities and explore the world around them, it is crucial to understand what factors shape their behaviour towards waste management at this formative stage and try to instil positive habits that allow for better waste management. Investigating individuals' environmental behaviour is critical before deciding on a waste management method. This study explores and attempts to define the recycling behaviours of students. In the survey, Hacettepe University, Beytepe Campus was selected since it is a large campus with green areas where many students study and live simultaneously. Moreover, before the study, detailed observation was made on the campus in the ten months up to October 2019, and it was observed that waste is common malpractice on the campus. Therefore, a questionnaire was conducted with students from the Faculty of Economics and Administrative Sciences between March 2020 - July 2020. 37% of the questionnaires were delivered in classes, and 67% were sent via e-mail. The data obtained were analysed using Structural Equation Modelling.

The remainder of the paper is organised as follows: Section 2 describes the effect of behavioural economics tools on recycling behaviour and the study's theoretical perspective. Section 3 contains the methodology. Section 4 combines the results of the data analyses. Section 5 discusses the policy implications and explains the limitations of the study. Section 6 presents the conclusion.

2. Literature Review

2.1. Behavioural Economics Applications on Recycling Behaviour

Behavioural economics tools are vital for shaping individuals' preferences. In other words, it helps individuals to gain a new perspective. Nudge, a behavioural economics tool, is one of the most frequently used tools to guide individuals to a particular behaviour. Thaler & Sunstein (2017: 17) explained nudge as "any aspect of the choice architecture that predictably alters people's behaviour without forbidding any options or significantly changing their economic incentives". For instance, an advertisement was given at the University of Montana that "most of the Montana youth (70%) do not smoke", and this strategy provided a large decrease in the proportion of students who smoke (Thaler & Sunstein, 2017: 93).

Although most people express the importance of recycling, contributing to environmental cleanliness and natural resources protection, such perception and awareness often need to be linked to action. Wang et al. (2020) conducted a study to measure public awareness of recycling behaviour. According to the results, almost all the respondents stated that they were aware of the harmful effects of municipal solid wastes on the environment.

However, only 55% of the participants expressed their willingness to participate in recycling behaviour. Therefore, it is necessary to direct individuals to recycle behaviour. Behavioural economics tools are vital to guide individuals. Thus, a nudge can help individuals gain recycling behaviour.

Various studies were carried out using nudge to adopt recycling behaviour; for example, in the survey conducted by Cosic et al. (2018), two experiments were conducted to measure the effect of nudging on recycling behaviours among students at a university in Pisa, Italy. In Experiment 1, a poster was hung where the recycling bins and trash can were. The poster stated that 70% of university students recycle, recycling is easy, and they choose the correct recycling bin for cardboard glasses. In experiment 2, the size of the garbage can was reduced, and instead of multiple recycling bins, a large green recycling bin was placed where they could only throw coffee cups.

Moreover, the same poster was placed. However, the statement that chooses the correct recycling bin for cardboard glasses on the poster was removed. As a result, they observed an increase in the number of coffee cups thrown away for recycling and increased recycling during 2nd experiment weeks compared to the weeks of the 1st experiment.

In another study, Linder et al. (2018) investigated the impact of an information leaflet designed by the researchers with the light of environmental psychology and behavioural economics theories on food waste recycling behaviour in a city district in Stockholm. Before the experiment, food waste recycling stations were installed in the area. Then, the selected urban area was separated into control and treatment groups. After more than a year of the stations' instalment, the information leaflet sends out to the people living in the treatment group area. After distributing the leaflet, they found increased waste collected from food waste recycling stations.

2.2. Theoretical Background of the Study

To understand the determinants of recycling behaviour, it is necessary to define what preferences are involved in household waste disposal (Davies et al., 2002). Psychology-based models provide a better understanding of the effect of intention on behaviour. Theory of Planned Behaviour (TPB) is the most suitable and appropriate model to explain recycling behaviour (al Mamun et al., 2018) since TPB tries to present a wide variety of social behaviours (Bamberg et al., 2007). Moreover, TPB was used in over 4.200 empirical studies until April 2020 (Bosnjak et al., 2020). The model was developed by Icek Ajzen and used four different elements to explain the behaviour, as it is observed in Figure 3. The model's primary assumption is that behaviour is determined directly by the intention to fulfil the behaviour (Klöckner, 2013).

Moreover, the intention is defined by three conceptual ideas: Attitude towards the behaviour, subjective norm, and perceived behavioural control. The sufficient the attitude, the subjective norm, and the perceived behavioural control, the stronger the intention to

perform the behaviour (Bosnjak et al., 2020). Ajzen (1991) describes the attitude towards the behaviour as "the value appraised whether it is appropriate to perform and not to perform a behaviour". Subjective norm is "the perceived social pressure that is felt to perform or perform a behaviour", according to Ajzen (1991). It represents the rating of noticed social pressure to participate in or not participate in a behaviour (Fu et al., 2018). It reflects an individual's feelings of social anxiety to drive behaviour. In this regard, the approach of people who are important to an individual on a behaviour influence that behaviour of the individual. Ajzen (1991) also describes perceived behavioural control as "the perceived ease or difficulty of performing the behaviour". It also includes past experiences and barriers. Tan (2013) revealed that the perception that easy or difficult behaviour significantly affects intention. According to the model, the more opportunities and resources individuals think they have, the more their beliefs about performing a behaviour are. Latif et al. (2012) found that restricting access to recycling facilities is the key indicator of residents' intentions. In other words, the fewer recycling opportunities, the fewer residents are willing to participate. They confirmed that the more recycling opportunities, the more residents are eager to participate. Furthermore, some behaviours do not depend on freedom because there is some constraint to act the behaviour, such as ability and money (Ajzen, 1991).

Figure: 3
Theory of Planned Behaviour adapted from Ajzen* (1991)
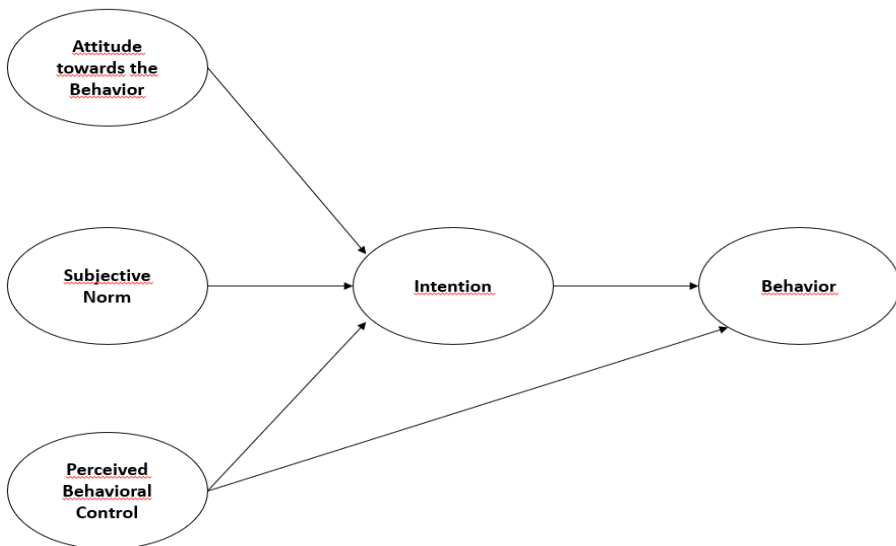
* The figure was drawn by the authors based on the Theory of Planned Behaviour created by Ajzen.

People's families, friends, neighbours, and an essential person or group can influence people's intentions and specific behaviours. Moreover, perceiving that it is easy or difficult to perform a behaviour and easy access to opportunities is quite useful in intention and

behaviour. Within the scope of TPB, it is stated that the more appropriate it is for individuals to perform a behaviour and the more social pressure they feel to adapt to that behaviour, the more likely it is to perform the behaviour (Chan & Bishop, 2013). Tonglet et al. (2003) investigated the factors that encourage recycling behaviour intention among Brixworth residents based on TPB. The findings show that social pressure to recycle, knowledge about recycling, and opportunities positively affect residents' recycling attitudes. It examined the factors affecting residents' waste separation behaviour by Zhang et al. (2015). The results suggest that attitude, subjective norm, and perceived behavioural control positively and significantly affect waste separation intention.

Moreover, Zhang et al. (2015) demonstrated that waste separation behaviour could improve as the intention increases. In the study investigated by Mamun et al. (2019), the findings suggest that subjective norm has an insignificant effect, and perceived behavioural control positively affects the intention to recycle. The results also indicate that recycling intention significantly affects recycling behaviour.

2.3. Structural Equation Modelling

Structural Equation Modelling (SEM) deals with a simple single or multi-directional linear regression and a regression equation system (Nachtigall et al., 2003). Unlike an ordinary regression analysis, many equations are made simultaneously in SEM. In the SEM model, while unobserved concepts which cannot be directly observed are defined as latent variables or constructs, observed concepts that can be directly observed are defined as observed variables or indicators. It is important to add the concept of the latent variable to the model since only some concepts are visible when examining human behaviour. While the observed variables reflect the latent variables, they do not have perfect measuring power. Moreover, error terms are related to the reliability estimates of each variable.

3. Methodology

3.1. The Model and Hypotheses of the Study

SEM, frequently preferred in psychology-based studies, was used as the modelling method in the study. Moreover, SPSS AMOS 23, which offers a graphical interface, was used for validity and hypothesis testing analyses. The Theory of Planned Behaviour was used while creating the hypotheses. It was stated that the model uses three determinants, attitude, subjective norm, and perceived behavioural control, to explain intention towards the behaviour. However, the study utilised subjective norms and perceived behavioural control. Sabri et al. (2019) investigated the mediating relationship between pro-environmental workplace (PEW) intention and PEW attitude, PEW subjective norms, and PEW perceived behavioural control on PEW behaviour. They found that PEW intention partially mediates only between PEW subjective norm and perceived behavioural control on PEW behaviour. In other words, PEW attitude has no significant impact on PEW behaviour.

Studies have revealed that social pressure influences intention towards the behaviour. Nguyen et al. (2018) found that social pressure positively and significantly impacts e-waste recycling intention. In a study conducted by Fan et al. (2019), they found that people are affected by the thoughts of people around them. Thus, the following hypothesis was developed:

H1: Subjective norm has a positive impact on intention.

Zhang et al. (2015) suggest that perceived behavioural control positively and significantly affects waste separation intention. Mamun et al. (2019) found that perceived behavioural control and perceived self-identity significantly and positively affect purchase intention for green and sustainable homes. Thus, the following hypothesis was developed:

H2: Perceived behavioural control has a positive impact on intention.

Recyclable express packaging means adopting recycled packaging products. Wang et al. (2020) reveal that subjective norms and perceived behavioural control positively and significantly impact recyclable express packaging intention. Tan (2013) examined the factors affecting residents' waste separation behaviour in Guangzhou, China. The results suggest that subjective norms and perceived behavioural control positively and significantly affect waste separation intention. Therefore, the following hypothesis was developed for the assumption that intention triggered by the two variables (subjective norm and perceived behavioural control) influences recycling behaviour:

H3: Intention has a positive impact on recycling behaviour.

The study examines the mediating effect of intention on behaviour through subjective norms and perceived behavioural control. Sabri et al. (2019) found that pro-environmental workplace (PEW) intention mediated PEW perceived behavioural control and subjective norm on PEW behaviour. Mamun et al. (2018) stated that perceived behavioural control significantly mediates recycling intention. Thus, the following hypotheses were developed:

H4: Intention mediates the positive relationship between subjective norm and recycling behaviour.

H5: Intention mediates the positive relationship between perceived behavioural control and recycling behaviour.

Moreover, the direct effect of variables on recycling behaviour was examined. Razali et al. (2020) affirmed that subjective norm significantly impacts waste separation behaviour. It indicates that the individuals around them influence students in terms of recycling behaviour. In the study conducted by Fan et al. (2019), it was confirmed that people are affected by the thoughts of people around them. Moreover, Meng et al. (2019) revealed that convenient access to environmental facilities and services significantly affects household solid waste recycling. Meng et al. (2019) express that convenient access to environmental

facilities and services significantly impacts household solid waste recycling. Thus, the following hypotheses were developed:

H6: Subjective norm has a positive impact on recycling behaviour.

H7: Perceived behavioural control has a positive impact on recycling behaviour.

3.2. Constructs and Indicators in the Study

The study has five constructs: Subjective norm, perceived behavioural control, intention, and recycling behaviour. Different constructs were measured using different numbers of indicators. Subjective norm has five indicators (SN1, SN2, SN3, SN4, SN5); Perceived behavioural control also has five indicators (PBC1, PBC3, PBC4, PBC5, PBC6); Intention has seven indicators (IN1, IN3, IN4, PEB1, PEB2, PEB3, PEB4) and recycling behaviour has four indicators (RB1, RB2, RB3, RB4) (Appendix).

3.3. Survey Design

Before the research, the constructs, survey questions, and indicators were investigated based on previous studies. Constructs on perceived behavioural control, subjective norm, intention, and recycling behaviour were modified from past studies (Fu et al., 2018; Paul et al., 2016; Tonglet et al., 2004; B. Zhang et al., 2019; D. Zhang et al., 2015). While some items were taken directly from earlier studies, some were modified (Appendix). Since the survey questions used in previous studies are intended for households, they have been revised by university students in Türkiye.

The questionnaire consists of two sections. The first section reveals demographic information, including gender, the year students are in, and students' and household income. Moreover, whether the students have relatives who recycle and whether they received an environmental education before starting university are also asked, as it was thought to affect recycling behaviour. The second section measures the determinants of students' recycling behaviour. For this, the Five-Point Likert Scale was adopted with labels stating (1) Strongly disagree, (2) Disagree, (3) Neither agree nor disagree, (4) Agree, (5) Strongly agree.

3.4. Data Collection and the Demographic Characteristics of the Students Participating in the Study

Students studying at Hacettepe University, Beytepe Campus, were selected for the study. Teaching and encouraging students to recycle regularly can improve their behaviour and inculcate a conscientious approach towards waste management. Many students studying at the university also contribute to their families and immediate environment regarding recycling. In other words, the more students adopt recycling behaviour, the more people around them can transmit it.

A preliminary observation on campus was made in ten months up to October 2019. Canteen and garden areas where students are concentrated in the Faculty of Economics and

Administrative Sciences, student bus stops, and dormitory areas were closely examined for the study. The investigation revealed that large quantities of packaging waste in the form of plastic, paper, glass, and metal were dumped by students around the premises. Most of the canteen's food is packed in plastic, but some are covered or served in paper or glass packaging. Three of the most popular products -tea, coffee, and water- are sold in cardboard cups or plastic bottles. This is the main reason why the study aims to examine the determinants of Hacettepe University students' recycling behaviour.

The pilot study was applied to 78 students who were selected randomly at Hacettepe University Beytepe Campus and analysed before the main study. The questionnaire forms were distributed to 249 Faculty of Economics and Administrative Science students for the current study. While 93 were distributed in the classroom, 156 were collected through e-mails due to the cancelled classes during the COVID-19 pandemic[3]. Eight questionnaire forms were excluded from the analysis since five students still needed to fill out most of the questionnaire, and three students gave inconsistent answers. In the end, 241 valid responses were used in the study. The summary of the demographic variables is reported in Table 1.

Table: 1
Demographic Characteristics of the Students Participating in the Study

Variables	Category	Number	Percentage
Gender	Female	162	67.2
	Male	79	32.8
Year	1st	49	20.3
	2nd	65	27
	3rd	37	15.4
	4th	68	28.2
	Master student	22	9.1
Monthly Household Income	<3.000 TL	38	15.8
	3.000 TL - 5.000 TL	70	29
	5.000 TL - 7.000 TL	57	23.7
	> 7.000 TL	76	31.5
Student's Income	0	61	25.3
	< 500 TL	51	21.2
	500 TL - 1.000 TL	79	32.8
	1.000 TL - 3.000 TL	38	15.8
	> 3.000 TL	12	5

Our sample over-represents female students (67.2%). Of all, 65% of classroom-survey and 72% of online-survey were answered by female students. Unequal gender representation is, however, not expected to significantly affect our general findings since gender has not been found to affect recycling behaviour in this study significantly.

As for the distribution of the year in university, 20.3% of the students are 1st year, 27% of the students are 2nd, 15.4% of the students are 3rd year, 28.2% of the students are 4th year, and 9.1% are master's students (Table 1).

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[3] *T-Test was applied to prove that the answers from two different methods are not different.*

Almost one-third of the student's household (31.5%) has a monthly income of more than 7.000 TL (1 USD = 5.7 TL in 2019 (OECD database)). In addition, approximately one-third of the students (32.8%) earn between 500 TL - 1.000 TL (Table 1).

4. Data Analysis and Results

4.1. Demographic Analysis

The effect of students' selected demographic characteristics on recycling behaviour was examined using IBM SPSS 25.

T-Test was used to examine whether the students' recycling behaviour varies according to their gender, their relatives who recycled, and whether they had received an environmental education before.

Table: 2
Test Results of the Study

Variables	Category	N	Mean**	P
Gender	Female	162	3.114	0.292
	Male	79	2.977	
Relatives who recycled	Yes	161	3.321	0.000
	No	80	2.562	
Environmental education*	Yes	103	3.196	0.054
	No	133	2.958	

* It refers to the environmental education students attended before starting university.
** The mean value indicates the value between 1 and 5 for the effect of each category on the variable.

According to the test results, the students' recycling behaviour does not differ according to their gender (p > 0.05). However, recycling behaviour differs among students with relatives who recycle around (p < 0.05). It is confirmed that students who have relatives who recycle are recycling more. Moreover, the environmental education variable is borderline (p = 0.054). Therefore, it can be stated that recycling behaviour differs between students with and without previous environmental education (Table 2).

The one-way analysis of variance (ANOVA) test was conducted to determine the effect of students' and their family's income on recycling behaviour. Besides, the impact of the year of students on their recycling behaviour is examined.

ANOVA results show that the recycling behaviour of the students participating in the study does not differ according to students' income, monthly household income, and the year they are studying (p > 0.05) (Table 3). Zhang et al. (2015) also revealed that gender and income do not influence recycling behaviour.

Table: 3
ANOVA Results of the Study

Variables	Category	N	Mean[b]	p
Student's Income*	0	61	2.934	0.603
	< 500 TL	51	3.069	
	500 TL - 1.000 TL	79	3.098	
	1.000 TL - 3.000 TL	38	3.132	
	> 3.000 TL	12	3.375	
Monthly Household Income**	< 3.000 TL	38	2.947	0.522
	3.000 TL - 5.000 TL	70	2.982	
	5.000 TL - 7.000 TL	57	3.132	
	> 7.000 TL	76	3.164	
Year***	1st	49	3.092	0.518
	2nd	65	2.919	
	3rd	37	3.196	
	4th	68	3.066	
	Master student	22	3.261	

*: What is your monthly income? (For example, if you have a part-time job or student scholarship)
**: What is your monthly household income?
***: Please indicate what year you are studying.
b: The mean value indicates the value between 1 and 5 for the effect of each category on the variable. This study did not consider the mean values since the ANOVA test results were insignificant.

4.2. Validity Analysis

4.2.1. Model Fit Indices

The proposed model used in the study was tested by confirmatory factor analysis using AMOS 23. The maximum likelihood method was used since the data showed normal distribution. Model fit gives how well the proposed model explains the correlations between variables in the data set. As a result of the analysis, goodness of fit values indicate that the proposed model was confirmed (Chi-square=328,237; Degrees of freedom=146; CMIN/DF=2,248; CFI=0.917; RMSA= 0.072; SRMR= 0.065). CFI index can be accepted above 0.85, but values above 0.95 indicate a better fit (Hair et al., 2010).

Table: 4
Model Fit Indices

Index	Model 2	Threshold	Source
CMIN/DF	2.248	$x^2/df \leq 3$	Gaskin J. (2016)
CFI	0.917	$0.95 \leq CFI$	Tabachnick et al. (2013)
RMSA	0.072	$RMSA \leq 0.08$	Hair et al. (2010)
SRMR	0.065	$SRMR \leq 0.08$	Hu & Bentler (1999)

4.2.2. Convergent Validity

Convergent Validity states that items representing the same structure are related to each other and measure a single conceptual design. Three indicators are widely used to determine Convergent Validity: Standardized Loading Estimates, Average Variance Extracted (AVE), and Construct Reliability (CR). The value of AVE must be 0.50 or greater to have sufficient convergent validity. If the AVE value is greater than 0.50, it can be said that the factor has convenience validity. The value of CR must be 0.70 or greater to have sufficient convergence or internal consistency. It can be noted that the factor with a CR coefficient greater than 0.70 has high structure reliability and, therefore, compliance validity (Hair et al., 2010) (Table 5).

Table: 5
Convergent Validity

Construct	Items	Factor Loadings	AVE	CR
Subjective Norm	SN1	0.72	0.50	0.77
	SN2	0.56		
	SN3	0.69		
	SN4	0.72		
	SN5	0.84		
Perceived Behavioural Control	PBC3	0.52	0.50	0.74
	PBC4	0.87		
	PBC5	0.78		
	PBC6	0.59		
Intention	IN1	0.56	0.57	0.85
	IN4	0.55		
	PEB1	0.77		
	PEB2	0.94		
	PEB3	0.90		
	PEB4	0.70		
Recycling Behaviour	RB1	0.80	0.51	0.81
	RB2	0.70		
	RB3	0.67		
	RB4	0.69		

4.2.3. Discriminant Validity

Whether the factors in a multi-factor measurement structure measure independent and different structures are examined with the Discriminant Validity; for this, the AVE values of the constructs must be greater than the square of the correlation coefficient between constructs (Kartal & Bardakçı, 2018). Discriminant Validity was confirmed for the model (Table 6).

Table: 6
Discriminant Validity

Constructs	Subjective Norm (AVE=0,50)	Perceived Behavioural Control (AVE=0,50)	Intention (AVE=0,57)	Recycling Behaviour (AVE=0,51)
Subjective Norm (AVE=0.50)	1			
Perceived Behavioural Control (AVE=0.50)	0.28	1		
Intention (AVE=0.57)	0.13	0.11	1	
Recycling Behaviour (AVE=0.51)	0.40	0.45	0.16	1

4.3. Hypothesis Testing Analysis

The outputs of the study are shown in Figure 4. The results suggest that subjective norm ($\beta = 0.250$; $p < 0.01$) and perceived behavioural control ($\beta = 0.204$; $p < 0.05$) have a significant impact on intention. Therefore, H1 and H2 are confirmed. However, the subjective norm has slightly more effect on intention than perceived behavioural control.

Figure: 4
Model Drawing*
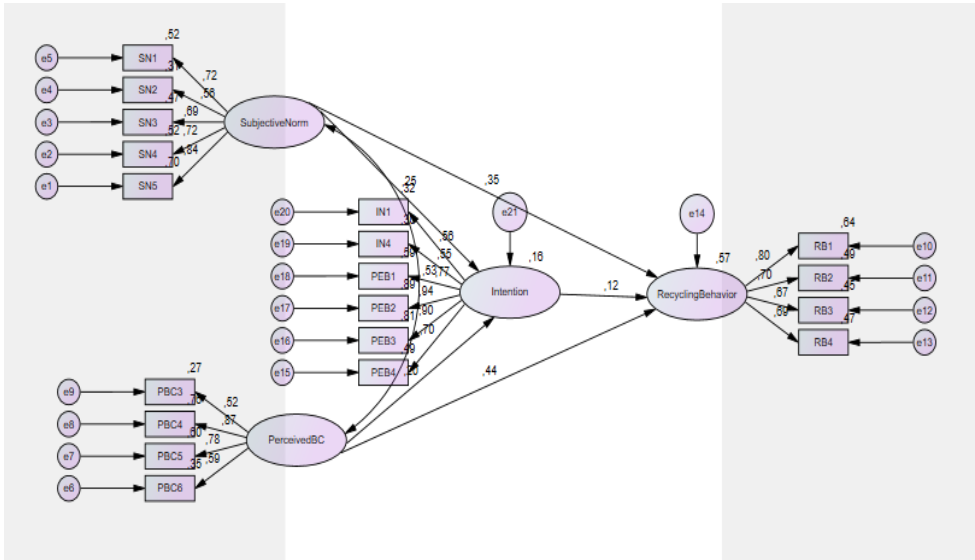
* The model was drawn by authors using SPSS AMOS.

Furthermore, intention mediates the positive relationship both between subjective norm and recycling behaviour ($\beta = 0.031$; $p < 0.05$) and between perceived behavioural control and recycling behaviour ($\beta = 0.025$; $p < 0.10$). Thus, H4 and H5 are confirmed. However, it was mentioned that there were two types of mediation relationships: Full and partial mediation. Firstly, the exogenous variables in the model without a mediator should significantly affect the endogenous variable. Secondly, after the mediator variable is included in the model, the exogenous variables significantly affect the mediator variable. Thirdly, there is partial mediation if the exogenous variables still substantially impact the endogenous variable. If not, there is complete mediation. Consequently, since direct and indirect effects are significant in the model, it is stated that there is a partial mediating.

When the impact of the mediator on recycling behaviour is examined, it is expressed that H3 is confirmed, but the intention has a weak effect on recycling behaviour ($\beta = 0.123$; $p < 0.10$). In other words, the direct impact on recycling behaviour is stronger than the indirect effects.

When the direct effects of subjective norm and perceived behaviour control on recycling behaviour are examined, it is stated that subjective norm ($\beta = 0.350$; $p < 0.01$) and perceived behavioural control ($\beta = 0.441$; $p < 0.01$) have a significant impact on recycling behaviour. Thus, H6 and H7 are confirmed. Moreover, it is stated that the direct effect of perceived behavioural control on recycling behaviour is greater than the direct effect of

subjective norms on recycling behaviour. Therefore, the impact of subjective norm and perceived behavioural control on intention is less than the immediate effect of these two factors on behaviour.

While the magnitude of the subjective norm is greater on intention than perceived behavioural control, the importance of perceived behavioural control on recycling behaviour is greater than the subjective norm. Since the mediating effect on intention between perceived behavioural control and recycling behaviour is weaker than the mediating effect on intention between subjective norm and recycling behaviour.

Table: 7
Hypothesis Testing Results

No	Hypothesis	Estimates	P Values	Results
H1	SubjectiveNorm --> Intention	0.250***	0.006	Supported
H2	PerceivedBC --> Intention	0.204**	0.026	Supported
H3	Intention --> RecyclingBehaviour	0.123*	0.089	Supported
H4	SubjectiveNorm --> Intention -->RecyclingBehaviour	0.031**	0.041	Supported
H5	PerceivedBC --> Intention -->RecyclingBehaviour	0.025*	0.060	Supported
H6	SubjectiveNorm --> RecyclingBehaviour	0.350***	0.001	Supported
H7	PerceivedBC --> RecyclingBehaviour	0.441***	0.001	Supported

*Significance levels: * p < .10. ** p < .05. *** p < .01*

According to the study's findings, the subjective norm positively affects recycling behaviour. Students' opinions about recycling's feasibility substantially influenced their waste disposal behaviours. For instance, if a student's friend collects paper waste and throws it in recycling bins, that student tends to do the same behaviour. Moreover, perceived behavioural control has a positive effect on recycling behaviour. In addition, knowledge of recycling opportunities and how to recycle impacts recycling behaviour. For instance, if students know the recycling possibilities in their environment, they are more willing to recycle.

5. Policy Implications

According to this study, the direct effects of subjective norm and perceived behavioural control on recycling behaviour are more significant than the indirect effects of the two variables on recycling behaviour. Therefore, intention and the two variables have no strong mediation effect. The research findings reveal that students' behaviour towards waste management is mainly shaped by the behaviour of their friends and their personal opinions about waste management. As such, it is essential that recycling be adopted as a way of life among students and be viewed as an environmental imperative. Campuses that practice this lifestyle can set the trend for larger academic circles to emulate for the good of the environment and raise awareness about the advantages of recycling from a sustainability point of view. Therefore, it is necessary to raise awareness about recycling behaviour. Small, incremental steps to create awareness can significantly benefit the environment. For instance, a poster can be put on the canteen's walls and the student boards inside the faculty to attract the students' attention. Posters highlighting the benefits of recycling can draw students' attention and spark a change in behaviours towards sustainable recycling. Such

awareness can help lay the groundwork for systemic changes in behaviours and responses towards recycling and bring about lasting behavioural change. College cafeterias and mess halls are ideal places to raise awareness about environmental causes from the ground, as students frequent them and have the potential to influence the lifestyles of everyone living on campus. Since people are affected by the behaviour of the people around them, messages such as "Hacettepe University students throw their waste into recycling bins! Join them" can positively impact students' behaviour. This may encourage students to emulate the behaviour of their peers who actively recycle waste. When students see their fellow students recycling waste regularly, they, too, will develop a collective sense of responsibility and follow in the footsteps of their peers.

Students drinking tea, coffee, and other beverages should make a concerted effort to responsibly dispose of waste after consuming their snacks. Specific messages can be given to indicate that these products are waste and should be thrown into recycling bins. For instance, "Recycle your coffee cup here". However, it is also important not to reduce the attention to other types of waste and not create a perception that only sample wastes should be disposed of. Attempts should be made to responsibly discard all kinds of waste, not just sample waste. A clear and concise message about the same can help instil such habits among students.

While there is no definite consensus in academic research on the link between how environmental issues are portrayed and the behavioural changes it triggers, some studies have shown that showing a positive outcome of recycling has a stronger effect on people's recycling habits than a negative one. For instance, Chatelain et al. (2018) found that positive expressions are more effective in environmentally friendly behaviour. Therefore, emphasising preserving the campus's beauty can also help instil stronger recycling behaviours. Hacettepe University has a lush green campus and Yeşil Vadi (Green Valley: a place with a lake and plenty of trees) that hosts many species. It can be emphasised that the existing beauties of Hacettepe University can continue with a clean environment.

Waste collection activities have been organised at Hacettepe University for some periods. Since these activities are carried out as a team, it positively affects students. However, occasional waste collection activities should be replaced by regular ones to help cultivate recycling behaviour. Varotto and Spagnolli (2017) examined the studies investigating the effects of psychological intervention strategies on households' recycling behaviour in academic studies. Here, it has been determined that the most effective methods are environmental alteration and social modelling. Environmental alteration covers adjusting the physical environment to make recycling behaviour more appropriate, such as putting recycling bins closer or making them more. Social modelling involves learning behaviour by observing the people act. For example, universities' waste collection activities can enable students who have never collected waste before to learn by seeing. Besides, Moore and Boldero (2017) argue that most behaviours need to be sustained to be efficient in the long term.

Consequently, they examined the factors affecting the adoption and sustainability of a behaviour. Accordingly, these factors are expressed as "low cost of an activity, easy to carry out the activity, carrying out activities similar to that activity and repeating the activity regularly" to increase adoption and sustainability. Besides, according to researchers, educational campaigns and social norms efficiently adapt to behaviour and maintain that behaviour in the long term.

Alongside raising awareness about the importance of recycling, students should also be made aware of the very practice and basics of recycling, which they often need to be made aware of. Students who are unaware of recycling may be under the impression that such a practice does not even exist. Informing them directly can help change this. Moreover, individual messages can have a far greater impact on affecting behaviours rather than seminars, which many find cold and impersonal. For example, the university administration can apprise students about the basics of recycling, preparing small information notes, and they can notify them via e-mails. This behaviour provides that it is informed many students to be aware of the activities. Instead of sending generic e-mails to all students, each e-mail should be personalised and addressed to individual students to create a greater impact. This is a more compelling call to action and can help instil a better sense of responsibility. Many leaflets are distributed at the university. However, it led to increased paper waste generation as most of it is thrown into the environment. In this way, paper waste can be prevented.

When the demographic findings were examined, the effect of the environmental education students received until the beginning of university was considered significant. Knowing environmental issues is important for their recycling behaviour. It should be underlined that environmental education is an important issue. In addition to education, it is necessary to support this education. For instance, after sending an informative e-mail to students about how to recycle at the university, regular waste collection activities should also be organised. Ramayah et al. (2012) conducted a study among 200 university students. The results emphasised the need to educate students about the environment and to be encouraged positive environmental behaviour.

The limitations of the study and future works include the following matters. The current study was planned to be conducted through questionnaires distributed to three student groups studying Economics, Computer Engineering, and Law. However, during the data collection period, because of the university's interruption of education due to Covid-19, it was restricted to students studying at the Faculty of Economics and Administrative Sciences. In other words, merely this faculty students' recycling behaviours were examined in the study. Besides, after the university interrupted face-to-face education, some questionnaires were sent to the students via e-mail. Characteristics of the responses collected in the classroom and by e-mail are not different. However, the following study aims to include students from the other departments in the questionnaire. In this way, it will examine the determinants of recycling behaviours of students with different profiles. Moreover, the policy suggestions presented in the study are aimed to be implemented at Hacettepe University, Beytepe Campus, once the universities begin face-to-face education.

6. Conclusion

Waste generation creates many adverse effects on the environment. It affects human and environmental health through littering, dumping, and disposal. An increase in consumption fuelled by overpopulation and aggressive urbanisation has afforded a commensurate spike in daily waste. If not treated or disposed of in time, accumulated waste can hurt the environment and humans. Waste mismanagement affects all countries, but its worst effects are felt by those with a poor waste disposal system. While the primary goal is to prevent waste generation by reusing purchased products, recycling is an essential waste management issue. Recycling is an inevitable solution method to protect the environment and save energy.

Studying waste management behaviours on university campuses can provide valuable insights into the effects of efficient waste disposal on a statistically meaningful scale since they are large enough to yield vast quantities of solid waste. Hacettepe University is one of the largest universities in Türkiye, with 5.877.628 m^2. This study was designed to examine the determinants of recycling behaviours of Hacettepe University students.

The Theory of Planned behaviour was used while creating research hypotheses. A structural equation modelling analysis was used to test the hypotheses. According to the results of the research, it is stated that the main determinants of students' recycling behaviour are the subjective norm and perceived behaviour control. Consequently, it can be noted that students are highly influenced by the behaviour of the people around them recycling behaviour. Moreover, students' opinions about the feasibility of recycling also played a vital role in governing their behaviours concerning waste disposal. Furthermore, Intention partially mediates the positive relationship between Subjective norm and recycling behaviour and between perceived behavioural control and recycling behaviour.

Foreign dependency is a severe problem for a country's economy. With the increase in population, the consumption of natural resources is increasing daily. Waste of resources is reduced thanks to recycling. Generating a product requires more energy consumption than recycling. Moreover, providing raw materials from waste to yield a product is a significant contribution. For instance, producing fibres from plastic waste offers raw materials for the textile industry. Therefore, the more students recycle, the more economic contribution will be made.

The disposal of waste is a costly process. Moreover, wastes dispose of without separation and mixed with garbage through rain and wind. Wastes that cannot be separated are transmitted to facilities for disposal. Separating the waste on the campus and recycling it will ensure that less waste is delivered to the disposal facilities. This will contribute to the reduction of waste disposal costs.

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Appendix

Table: A.1
Indicators Used in the Study

Construct		Indicator	Source
Subjective Norms	SN1	My families expect me to separate waste	Zhang D. et al., 2015
	SN2	My neighbours expect me to separate waste	Zhang D. et al., 2015
	SN3	The community expects me to separate waste	Zhang D. et al., 2015
	SN4	Most people think I should recycle	Tonglet et al., 2004
	SN5	Most of the people important to me want me to recycle	modified from Paul et al., 2016
Perceived Behavioural Control	PBC3	I know how to recycle my household waste	Tonglet et al., 2004
	PBC4	I know where to take my household waste for recycling	Tonglet et al., 2004
	PBC5	I know the services that municipalities provide for recycling	modified from Tonglet et al., 2004
	PBC6	I have plenty of opportunities to recycle	Tonglet et al., 2004
Intention	IN1	I am willing to participate in environmental programs held by the governmental agencies	modified from Zhang D. et al., 2015
	IN4	I am interested in environmental publications in the media	modified from Fu et al., 2018
	PEB1	I talk about environmental problems with my immediate circle	modified from Fu et al., 2018
	PEB2	I encourage my classmates and colleagues to save resource	modified from Fu et al., 2018
	PEB3	I encourage my classmates and colleagues to participate in environmental activities like planting trees.	modified from Fu et al., 2018
	PEB4	I encourage my classmates and colleagues to support policies to protect the environment.	modified from Fu et al., 2018
Recycling Behaviour	RB1	Please indicate how often you throw plastic waste into recycling bins, such as pet water bottles.	modified from Zhang et al., 2019
	RB2	Please indicate how often you throw your glass waste recycling bins, such as beverage bottles and jars.	modified from Zhang et al., 2019
	RB3	Please indicate how often you throw your paper waste into recycling bins such as notepads and cardboard coffee cups.	modified from Zhang et al., 2019
	RB4	Please indicate how often you throw your metal waste into recycling bins, such as aluminium beverage cans and canned food cans.	modified from Zhang et al., 2019

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