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Students' Behaviour in Recycling Used Batteries for Pollution Prevention: A Case Study in Malaysia

Tingkah Laku Pelajar terhadap Kitar Semula Bateri Terpakai untuk Perlindungan Alam Sekitar: Kajian Kes di Malaysia

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ABSTRACT

The best way to manage used batteries without causing adverse effects to the environment is through recycling. The objective of this study to identify relations and factors which encourage the recycling of used batteries by understanding the behaviour and awareness among the students using Theory of Planned Behaviour (TPB). School students in Bangi, Malaysia were selected as case study. A total of 349 respondents from 4 schools located in Bangi (namely SMK Bandar Baru Bangi, SMK Jalan Tiga, SMK Jalan Empat and SMK Dato' Abu Bakar Baginda) had been chosen using cluster sampling method. The study shows that there are a few significant positive relations, which include infrastructure and behavioural control (r = 0.359); responsibility and behavioural control (r = 0.395); attitude and intention (r = 0.182); willingness to pay and behaviour (r = 0.332). By using regression analysis, the social norm factor is the main factor which encourages recycling of used batteries among respondents based on the TPB theory, and followed by the factors of willingness to pay, attitude and behavioural control.

Keywords: Recycling used batteries; students' behaviour; theory planned behaviour; environmental protection

ABSTRAK

Cara terbaik untuk mengendalikan bateri terpakai tanpa menyebabkan kesan buruk terhadap alam sekitar adalah melalui kitar semula. Tujuan kajian ini adalah untuk mengenalpasti hubungan dan faktor yang mendorong kitar semula bateri terpakai dengan memahami tingkah laku dan tahap kesedaran pada kalangan pelajar menggunakan Teori Tingkah Laku Terancang (TPB). Pelajar di sekolah di kawasan Bangi, Malaysia telah dipilih sebagai kajian kes. Seramai 349 responden daripada 4 sekolah di Bangi (iaitu SMK Bandar Baru Bangi, SMK Jalan Tiga, SMK Jalan Empat and SMK Dato' Abu Bakar Baginda) telah dipilih dalam kajian ini menggunakan kaedah persampelan kluster. Hasil kajian menunjukkan beberapa hubungan positif yang signifikan, ini termasuk hubungan di antara infrastruktur dan kawalan tingkah laku (r = 0.359); tanggungjawab dan kawalan tingkah laku (r = 0.395); sikap dan niat (r = 0.182); kesudian membayar dan sikap (r = 0.332). Dengan menggunakan analysis regresi, faktor kebiasaan sosial merupakan faktor utama yang menggalakkan kitar semula bateri terpakai dalam kalangan responden menggunakan TPB, dan seterusnya diikuti dengan faktor kesudian membayar, sikap dan kawalan tingkah laku.

Kata kunci: Kitar semula bateri terpakai; tingkah laku pelajar; teori tingkah laku terancang; perlindungan alam sekitar

INTRODUCTION

Users' awareness and behaviour upon disposal of e-waste are crucial to ensure e-waste are properly managed to avoid health and environmental issues (Sivathanu 2016). Used batteries are part of the e-waste, where used batteries contain heavy metals such as lead, cadmium and mercury that can cause severe effects on human health and the environment (Needhidasan et al. 2014). The best way to manage used batteries without causing adverse effects to the environment is by recycling. Recycling has been perceived widely as a smart waste management method for its potential of reduce disposal and waste transport cost as well as elongating landfills' lifespan (Kremer 2013; Moh & Manaf 2014). In addition, according to Li et al. (2022), the lead industry extracted the lead, mainly from spent and discarded lead-acid batteries) as one of the green circular economy initiatives. However, the collection of used batteries is not well promoted and regulated, hence large number of used batteries ends up as municipal solid wastes (Sun et al. 2015). Used batteries are harmful when they accumulate in solid waste at landfills, such as contributing to the leaching of more metals (e.g., Mn and Zn) (Karnchanawong & Limpiteeprakan 2009); and leachate containing metals from used batteries will go into the ground and contaminate groundwater (Rarotra et al. 2020). Hence, recycling used batteries can reduce waste generation and disposal to the landfills (Bai et al. 2020). Users need to reform their attitude and express their awareness into commitment which protects the environment. There are still a huge number of users who possess knowledge and awareness but still behave irresponsibly towards the environment.

Although there were recycling campaigns conducted in Malaysia, the recycling campaign for used batteries has never been carried out in large scale. This is due to the fact recycling is not a lifestyle among Malaysians thus only a few do practice it (Moh & Manaf 2014). The recycling of used batteries had been carried out by Department of Environment Malaysia (DOE) but only focusing on cellphone batteries. The cooperation between DOE and industrial parties to encourage cellphone collection through service centers, bin services and take back scheme could only collect used batteries in small scale (Soo and Doolan 2014). Used batteries in Malaysia are also collected by licensed contractors under DOE whereby used batteries are one of the controlled scheduled wastes under Environmental Quality (Scheduled Wastes) Regulations 2005. The used batteries collected by licensed contractors are rechargeable, which includes cars' used batteries; used batteries consisting of cadmium metal and nickel or mercury or lithium; and industrial used batteries meanwhile the high total used batteries which are disposed with other solid wastes are not recorded (Department of Environment 2016).

Users prefer to dispose used batteries with other solid wastes or incinerate them because it is easier to manage rather than collecting them (Sun et al. 2015). Typically used batteries which are directly disposed with other solid wastes are non-rechargeable used batteries (primary batteries). In Malaysian context, primary type used batteries are not in scheduled waste category as they are considered as 'non-hazardous waste'. Alkali type primary batteries on the market do not contain mercury metal because mercury consumption is prohibited in a few countries especially in European Union countries (Elena 2016). Even though they do not contain mercury metal, it does not mean that used primary batteries can be disposed with other solid wastes because they still contain other metals. Used primary batteries are harmful when they accumulate in solid waste at landfills hence producing high concentration of leachate and give bad effects to clean underground water (Li et al. 2010). Concentration of leachate will go into the ground and contaminate groundwater (Rarotra et al. 2020); hence recycling process is needed to treat used batteries to reduce pollution (Huang et al. 2010).

The recycling of used batteries should not be underestimated even though users do not fully understand the need to recycle. This is due to the fact recycling used batteries can reduce waste generation and disposal to the landfills (Moh & Manaf 2014). Recycling should be educated as a responsibility to all parties regardless of age (Sun et al. 2015). Normally, the ones who are used to collect recyclable materials are the elderly as they feel the need to protect the environment (Keramitsoglou & Tsagarakis 2013).

The youth are less interested in recycling because they feel it is not their responsibility (Keramitsoglou & Tsagarakis 2013). They believe that used batteries are the same as other wastes which can be directly disposed into the trash bin (91%), incinerated (2%), disposed to the river (2%) and easy solution by keeping the used batteries at home

(5%) (Babatunde et al., 2014). The youth are also less participative in activities related to the recycling of used batteries because they are not exposed to recycling programmes in their surroundings. They think that recycling is insignificant in their lives. If they were educated with the knowledge and information concerning the significance of recycling used batteries, they will easily reform their attitude and behaviour to practice recycling voluntarily. It correlates to Kremer's statement (2013) which suggests behavioural change can transform from influence on individual's intention towards behavioural execution. Besides, only a small number of youths have knowledge and awareness regarding waste reduction which practices recycling (Budhiarta et al. 2012). Even though their knowledge and awareness about environmental protection are lacking and they are uninterested in recycling, these are not the barriers for them to recycle used batteries (Kremer 2013).

The concept of recycling has to be dispersed among youth because they are consumers and future nation leaders, and environmental conservation is an important agenda to all (Ahmad et al. 2011; Ramayah et al. 2012). The youth are easier to invoke interest upon a matter; their attitude and behaviour can also be shaped as they are still at education institution (Gadiraju 2016) in contrary to the adults who are less likely to change their behaviour as they are more experienced hence self-justifying their actions. Awareness is the first step in inculcating attitude and behaviour on the recycling. Before behavioural change is executed, evaluation on students' awareness and knowledge has to be carried out (Haron et al. 2005).

Education plays an important role in exchanging ideas and shaping students' behaviour into more environmentally friendly (Sun et al. 2015). We could educate students to apply recycling behavior by encouraging them to participate proactively in recycling program (Gadiraju 2016). In this study, understanding students' behaviour is an important process before executing any behavioural change to improve the awareness in recycling used batteries. Therefore, the selected method to understand students' behaviour and awareness in recycling used batteries is by using psychological theory known as Theory of Planned Behaviour (TPB).

THEORY OF PLANNED BEHAVIOUR

Theory of Planned Behaviour (TPB) which was developed by Ajzen and it is a well-known and widely used social psychological theory model in explaining various behavioural situations. This theory is an extension from Theory of Reasoned Action (TRA) whereby there is an additional variable in TPB, which is perceived behavioural control. In TPB, Ajzen outlined three main variables; attitude, subjective norm and perceived behavioural control which determine the intention of an individual's true behaviour (Ajzen 1991).

TPB theory is widely used as core theory in studying individual's behaviour towards recycling behaviour. Main dimension which is to be discussed in this study is by understanding students' behaviour and awareness, several additional factors used in this research are suitable for Malaysian students. Furthermore, in this theory Ajzen allowed new factor to be added with condition that factor gives significant contribution to explain the existing behaviour in the model (Ajzen 1991). The additional factors that were incorporated into TPB in this study are knowledge, understanding, infrastructure, responsibility, and willingness to pay (Figure 1). These additional factors suit Malaysian students' behaviour as they are able to drive their behaviour and then encouraging them to recycle used batteries. Table 1 explains the rationale and importance of the selected additional factors in this study. Table 1 indicates that knowledge, understanding, infrastructure, responsibility, and willingness to pay can be served as factors to drive students' behaviour and awareness in used batteries recycling practice.

This study applies a psychological theory built by Ajzen which is TPB to achieve two objectives, i.e. (1) To study the relationships between factors which drive the recycling of used batteries by understanding students' behaviour and awareness on used batteries management and disposal using TPB among school students in Bangi, Malaysia; and (2) To study the main factor which drive the recycling of used batteries by understanding students' behaviour and awareness towards used batteries management and disposal using TPB among school students in Bangi, Malaysia.

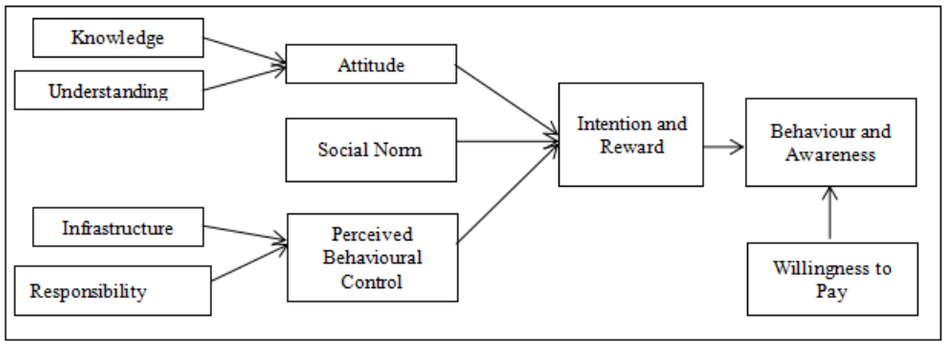

FIGURE 1. Factors which drive students' behaviour and awareness in used batteries recycling practice.

TABLE 1. The rationale and importance of the selected additional factors.

Additional factor	Rationale of the selected additional factors	Importance of the selected additional factors
Knowledge	Most science students lack the knowledge in recycling and disposing used batteries (Celikler and Kara 2015).	Knowledge is vital to improve awareness and attitude which then produces individuals who are more positive towards the environment (Ahmad et al. 2011).
	The number of students in education field at one of the universities in Turkey do not have any opinion or knowledge about the institution and organization which are responsible for collecting, recycling and disposing used batteries is quite high (Yilmaz et al. 2016).	Knowledge is the best method to perform behavioural change. Good knowledge in recycling gives benefits and huge impacts in recycling participation scheme (Clay 2005).
Understanding	Students' understanding on recycling still does not show any obvious change regardless many information sources and campaigns have been carried out.	Individuals who possess the knowledge and comprehension to be applied to positive behavioural form particularly in greener practice in their lives (Mahat et al. 2016).
Infrastructure	Good infrastructure will drive recycling among students (Bailey et al. 2015)	The more infrastructures like recycling bins, the higher the rate of recycling participation (Gilmour et al. 2013).
	The community states that there is no recycling bin nearby meanwhile 41% say only a few are for batteries (Sun et al. 2015).	
	Students and workers in Melbourne University state that the lack of infrastructure impedes them to recycle (Gilmour et al. 2013).	Infrastructure set up and suitable recycling location can shape recycling practice.
Responsibility	The community states that the concerned parties have to play an important role and be responsible for used batteries management such as government (30.7%), users (26.6%), manufacturers (25.6%) and retailers (17.1%) (Sun et al. 2015).	Central and local government parties should be responsible in handling waste management (Timlett and William 2011).
	The community also believes that battery collection is their responsibility, but financial matter and information dispersion are not (Sun et al. 2015).	Responsibility to recycle is not just an individual responsibility but other parties need to play their role in reducing waste flow.
Willingness to Pay	A total number of 64.91% of the community in Macau state that they are willing to pay for recycling (Song 2012).	The youth and uneducated have higher readiness to pay for recycling (OECD 2008).
		Willingness to pay is important to understand the proposed issues in environmental evaluation research (Jones et al. 2010).

METHODOLOGY

This study used quantitative method as its research design. Questionnaire questions were built based on past studies related to attitude management towards used batteries and application of TPB theory. Before conducting the survey, written approvals have been obtained from the Ministry of Education (reference: KP(BPPDP)603/5/JLD.10), State's Department of Education (Ref: JPNS.PPN 600-1/49 JLD 47(58)), and District's Education Office (Ref: PPDHL.UPPS 100-05/08). The population sample for this research was Form 4 secondary school students in Bangi, Malaysia. Form 4 students were selected based on the recommendations from the schools because they already have awareness and knowledge on recycling and environmental protection. The method adopted was cluster sampling method to ensure every individual chosen can really assist the researcher in understanding the studied issue (Chua 2014a). The total number of Form 4 students for all four schools (namely SMK Bandar Baru Bangi, SMK Jalan Tiga, SMK Jalan Empat and SMK Dato' Abu Bakar Baginda) was 1300, and the number of students were informed by respective schools prior to the survey is conducted. Thus, sample size determination was based on Krejcie and Morgan's table of determination in which if a population has 1300 people, the suitable sample size is 297 (Chua 2014a). Therefore, in this research, 400 questionnaires were distributed to four schools in Bangi area. The sampling method is based on group sampling hence more questionnaires were distributed because some of the students might not response to the questionnaires. After the questionnaires were distributed, 349 students returned them completely (87.25%), where 83 respondents from SMK Bandar Baru Bangi, 114 respondents from SMK Jalan Tiga, 79 respondents from SMK Jalan Empat and 73 respondents from SMK Dato' Abu Bakar Baginda. According to Cohen et al. (2007), the questionnaire return rate between 70% to 80% is enough to be analysed and concluded as research finding. In this study, we have analysed responses from 349 students because the sample size from Krejcie and Morgan's table (i.e., 297) is only served as the sample size that the study should achieved to represent the population at the confidence level of 95% and margin of error 5%. When the sample size increased, the findings will have better reflection of the population.

Questionnaires are the main instrument for data collection because they could give accurate information. The questionnaire in this study was segregated into two parts, which are Section A with the aim of collecting research respondents' profile (four items), whereas Section B was to measure the attitude and awareness towards management and used batteries disposal practice (47 item). The items in these questionnaires had been adapted and modified based on a number of past research such as Ramayah et al. (2012); Babatunde et al. (2014); Ercan and Bilen (2014). Item building in questionnaires is prone to utilise several variables or factors, which are i) knowledge; ii) understanding; iii) attitude; iv) intention and reward; v) infrastructure; vi) perceived behavioural control; vii) social norm; viii) responsibility; ix) willingness to pay; x) behaviour and awareness. These questionnaires used five points Likert scale which are from 1 (strongly disagree) to 5 (strongly agree).

The quantitative data obtained for this research was analysed using the software Statistical Package for Social Sciences (SPSS). This research used a few analyses which are frequency analysis, reliability test, factor analysis, correlation analysis and regression analysis. The hypotheses for this study are as below:

1. $H_{0:}$ There is no relationship between knowledge and attitude which drives the practice of recycling used batteries among school students in Bangi.
   $H_{1:}$ There is relationship between knowledge and attitude which drives the practice of recycling used batteries among school students in Bangi.

2. $H_{0:}$ There is no relationship between understanding and attitude which drives the practice of recycling used batteries among school students in Bangi.
   $H_{2:}$ There is relationship between understanding and attitude which drives the practice of recycling used batteries among school students in Bangi.

3. $H_{0:}$ There is no relationship between infrastructure and perceived behavioural control which drives the practice of recycling used batteries among school students in Bangi.
   $H_{3:}$ There is relationship between infrastructure and perceived behavioural control which drives the practice of recycling used batteries among school students in Bangi.

4. $H_{0:}$ There is no relationship between responsibility and perceived behavioural control which drives the practice of recycling used batteries among school students in Bangi.
   $H_{4:}$ There is relationship between responsibility and perceived behavioural control which drives the practice of recycling used batteries among school students in Bangi.

5. $H_{0:}$ There is no relationship between attitude with intention and reward which drives the practice of recycling used batteries among school students in Bangi.
   $H_{5:}$ There is relationship between attitude with intention and reward which drives the practice of recycling used batteries among school students in Bangi.

6. $H_{0:}$ There is no relationship between social norm with intention and reward which drives the practice of recycling used batteries among school students in Bangi.
   . $H_{6:}$ There is relationship between social norm with intention and reward which drives the practice of recycling used batteries among school students in Bangi.

7. $H_{0:}$ There is no relationship between perceived behavioural control with intention and reward which drives the practice of recycling used batteries among school students in Bangi.
   $H_{7:}$ There is relationship between perceived behavioural control with intention and reward which drives the practice of recycling used batteries among school students in Bangi.

8. $H_{0:}$ There is no relationship between intention and reward with awareness level which drives the practice of recycling used batteries among school students in Bangi.
   $H_{8:}$ There is relationship between intention and reward with awareness level which drives the practice of recycling used batteries among school students in Bangi.

9. $H_{0:}$ There is no relationship between intention and reward with awareness level which drives the practice of recycling used batteries among school students in Bangi.
   $H_{8:}$ There is relationship between intention and reward with awareness level which drives the practice of recycling used batteries among school students in Bangi.

FINDINGS

RESPONDENT DEMOGRAPHIC

The total number of 349 respondents were sixteen years old who were Form 4 students. Female respondents were higher in number which was 54.4% than male respondents which was 45.6%. From racial aspect, Malay respondents are higher in number (96.4%) compared to other races. All respondents were the upper secondary school students.

RELIABILITY TEST

To ensure the items used in the questionnaire can be used in this research, reliability test (*cronbach alpha*, α) had been performed to all ten factors (nine predictor variables and one criterion variable) to test the reliability of all items in the questionnaire. This predictor variable (free variable) is a factor which gives impact to the change in criterion variables (bound variable) (Chua 2009). The coefficient value of cronbach alpha is as shown in Table 2. All factors are seen to have alpha coefficient value bigger than 0.65 which is at acceptable level of reliability (Chua 2014b). Based on Table 2, coefficient value for infrastructure; intention and reward are weak but it can still be acceptable, for example, coefficient value in the study conducted by Haron et al. (2005) was also weak but still can be used in the research because this value can be enhanced in future research. The coefficient alpha value for all the variables in measuring students' behaviour in managing and disposing used batteries is 0.853.

TABLE 2. Reliability test

Variable / Factor	Variable code / Factor	α
Knowledge	KW	0.745
Understanding	US	0.791
Attitude	AT	0.825
Intention and reward	IR	0.589
Infrastructure	IS	0.427
Perceived behavioural control	PBC	0.663
Social norm	SN	0.714
Responsibility	RP	0.880
Willingness to pay	WTP	0.748
Behaviour and awareness	BA	0.754

FACTOR ANALYSIS

Factor analysis is an analysis which evaluates whether the collected data is aligned with theoretical predictive pattern which then eases researchers for the measured analysis determination (Matsunaga 2010). Besides, factor analysis is carried out as data reduction technique to reduce the number of variables as well as maximising the number of analytical information (Sivathanu 2016). From confirmatory factor analysis result, researchers observed that load value for all variables is at the range of 0.424 to 0.894 as in Table 3. Load value is usually above 0.50 (Hair et al. 2006) but there are some claims saying the load value is acceptable if it is higher than 0.40 (Poskus 2015). The purpose of this factor analysis is to identify and test the validity of each item into the factor which was used in the questionnaire for the students (Goh and Sandhu 2013). After factor analysis test was conducted, the validity of 47 items was accepted out of 83 items developed by the researcher.

TABLE 3. Factor analysis result

Construct/ Factor / Item		Load value	Variance (%)
Knowledge (K)			28.91
P1	I know that batteries in cellphones can harm humans and the environment.	0.535	
P2	I know that batteries can pollute our water source.	0.587	
P3	I know that batteries in remote control devices can cause harm.	0.453	
P4	I know that unused batteries can be recycled.	0.451	
P5	I know that used batteries are very toxic.	0.694	
P6	I know that used batteries contain heavy metals which can give threats to the environment.	0.683	
P7	I know that the metals contained in used batteries can cause breathing difficulty.	0.631	
P8	I know that the metals contained in used batteries can cause rash problem to the skin.	0.509	
P9	I know that used batteries contain harmful metals such as lead.	0.564	
Understanding (US)			34.06
K1	Used batteries dread the environment.	0.774	
K2	Used batteries harm humans' health easily.	0.778	
K3	Used batteries bring about water pollution problem.	0.735	
K4	Used batteries bring damage to the environment.	0.720	
Attitude (AT)			50.74
S1	I dispose used batteries by sending used batteries to recycling centres.	0.837	
S2	I send used batteries to the nearby stores.	0.809	
S3	If the battery inside my watch is no longer functional, I collect the batteries and send them to recycling centres.	0.860	
Intention and Reward (IR)			33.15
NG1	I will dispose used batteries correctly if I were given a gift reward.	0.773	
NG2	I will dispose used batteries into the provided special separation bin if someone tells me to do so.	0.634	
NG3	I believe that certain parties need to give rewards to encourage the public to collect used batteries which are no longer used.	0.805	
Infrastructure (IS)			34.27
IS1	The facility to collect used batteries such as special bins are provided in my housing area.	0.440	
IS2	I am familiar with the recycling facility in my area, and it helps me to collect used batteries.	0.428	
IS3	I agree if the nearby grocery stores are made as used batteries collection site.	0.667	
IS4	I agree if the district office is made as used batteries collection site.	0.667	
IS5	I agree if schools provide special bins to collect used batteries.	0.513	

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Perceived Behavioural Control (PBC)			23.95
KTL1	I have high level of obedience regarding separation and disposal of recyclable materials.	0.424	
KTL2	I believe that used batteries recycling behaviour can increase environmental quality.	0.619	
KTL3	I feel very proud over recycling used batteries.	0.705	
KTL4	I believe recycling used batteries activity can increase environmental quality.	0.688	
KTL5	Used batteries recycling has been a part of my life to protect the environment.	0.642	
KTL6	I have sufficient space to store recyclable materials including used batteries.	0.522	
Social Norm (SN)			36.06
NS1	My friends expect me to participate in practising the recycling of used batteries.	0.730	
NS2	My family expects me to participate in practising the recycling of used batteries.	0.790	
NS3	I am familiar to collecting used batteries out of home practice.	0.731	
NS4	School activities influence me to collect and recycle used batteries.	0.666	
Responsibility (R)			73.61
TJ1	I believe that the government should be responsible towards the recycling of used batteries.	0.883	
TJ2	I believe that the manufacturers should be responsible towards the recycling of used batteries.	0.813	
TJ3	I believe that the consumers should be responsible towards the recycling of used batteries.	0.862	
TJ4	I believe that the sellers should be responsible towards the recycling of used batteries.	0.812	
Willingness To Pay (WTP)			54.13
KM1	I agree if the payment for the purpose of recycling used batteries is incorporated in battery selling price.	0.872	
KM2	I agree if the payment for the purpose of recycling used batteries is charged to user when disposing batteries.	0.894	
Behaviour and Awareness (BA)			21.50
TK1	I am aware that a number of batteries sold have recycle symbol.	0.444	
TK2	I read the labeling section before purchasing batteries.	0.564	
TK3	I am aware that battery labeling section states that batteries can harm the environment.	0.435	
TK4	I am aware that battery labeling section explicates the content of the battery.	0.509	
TK5	I am aware that awareness campaign on used batteries and cellphones collection carried out by Department of Environment.	0.601	
TK6	I am aware that there are guidelines provided by the government regarding used batteries.	0.726	
TK7	I am aware that used batteries are controlled under scheduled waste disposal regulation.	0.694	

DISCUSSION

THE RELATIONS BETWEEN FACTORS WHICH DRIVE TO STUDENTS' BEHAVIOUR AND AWARENESS IN RECYCLING OF USED BATTERIES

This study uses TPB theory as framework to understand students' behaviour and awareness level in recycling of used batteries. In this study researcher added variables such as knowledge, understanding, infrastructure, responsibility, and willingness to pay to expand the factors in TPB model. Every relation between these factors has been analysed using correlation analysis based on nine hypotheses to answer the first research objective. From these nine hypotheses, only four hypotheses are accepted which are H_3, H_4, H_5 and H_9 as in Table 4.

TABLE 4. The relations between factors.

Num	Hypothesis	Code	Correlation Analysis	Relations	Significance
1	Knowledge → Attitude	H_1	-0.026	No relation	No
2	Understanding → Attitude	H_2	0.032	No relation	No
3	Infrastructure → Perceived Behavioural Control	H_3	0.359**	Positive and weak relation	Yes
4	Responsibility → Perceived Behavioural Control	H_4	0.395**	Positive and weak relation	Yes
5	Attitude →Intention and Reward	H_5	0.182**	Positive and very weak relation	Yes
6	Social Norm → Intention and Reward	H_6	-0.044	No relation	No
7	Perceived Behavioural Control → Intention and Reward	H_7	0.105	No relation	No
8	Intention and Reward → Behaviour and Awareness	H_8	-0.074	No relation	No
9	Willingness to Pay → Behaviour and Awareness	H_9	0.332**	Positive and weak relation	Yes

** significance of correlation at $p<0.01$

Generally, knowledge affects attitude and then gives intention or motivation to users' behaviour who are responsible towards the environment. Understanding, information, and knowledge about recycling used batteries are very meaningful upon recycling behaviour to achieve awareness level (Haron et al. 2005). However, in this study the relation between knowledge towards attitude and understanding on attitude is insignificant. This is due to the fact that respondents received information, but they did not understand all the information clearly. Actually, respondents knew and understood that recycling used batteries is very important, but they did not behave like what they knew. In other words, respondents did not know how to recycle used batteries because there was no driver for them to carry it out.

Infrastructure and responsibility have positive relation towards perceived behavioural control with r value = 0.359 and r = 0.395. Good infrastructure preparation will influence respondents perceived behavioural control as in the study by Pakpour et al. (2014), the presence of recycling bins is one of the strong influence on perceived behavioural control. This is proven when respondents stated that they will recycle used batteries if facility like special bins for used batteries collection is provided in the grocery stores near their housing areas (78.1%).

Respondents also stated schools should take initiative to provide these bins (70.5%). In this issue, respondents will easily access and collect used batteries if recycling bins are placed at school areas or grocery stores near them. Apart from that, respondents also agreed that if the district office at their housing area encourages the residents to collect used batteries weekly (49.6%). By providing recycling bins for used batteries and the authorities managing used batteries, ironically it will help in improving respondents' performance in perceived behavioural control. Respondents believed besides them being users (69.6%), other parties should also be responsible in recycling used batteries, which are the government (69.9%), manufacturers (69.0%) and sellers (66.8%).

The relation between respondents' attitude towards used batteries recycling with their intention on used batteries management is significant. Even though r value = 0.182 is found very weak, there are still positive relation and interrelation. A particular attitude will definitely influence an individual's intention to perform a particular behaviour. If the respondents were used to recycling used batteries, they will indirectly have intention to dispose the waste correctly and willingly. But in this study, respondents preferred and willing to carry out used batteries recycling if they were given reward (47.3%) or any gift (57.9%). Respondents believed that they are more appreciated if they are given gift such as money or daily supply which can drive them consistently to recycle used batteries. A study in conducted by Afrizal and Embong (2013) in Vietnam found that those who carry out recycling activity will be given commission out of the recycled materials sale.

Apart from that, the relation between willingness to pay towards behaviour and awareness is significant (r = 0.332). Almost half of the respondents in this research were willing to pay charge for the process of recycling used batteries when they purchase batteries (45.8%). This means that respondents knew that recycling used batteries require high cost thus they were willing to pay the recycling cost. Even though the respondents did not have stable income due to their status as students, their view on the importance of willingness to pay indicates that they have awareness on recycling used batteries.

Students who do not have permanent payment source will pay services which fit their situation. Therefore, those who are willing to pay are individuals who very considerate towards the environment. Apart from that, study conducted by Eshun and Nyarko (2011) indicated the willingness to pay intension to improve waste management services. On the same note, Awunyo-Vitor et al. (2013) claim that education is an effective way to improve waste management services. The same goes to this study which uses the factor of willingness to pay to enhance used batteries management services by understanding school students' behaviour towards recycling used batteries.

MAIN FACTORS WHICH DRIVE TO STUDENTS' BEHAVIOUR AND AWARENESS IN IMPLEMENTING THE RECYCLING OF USED BATTERIES

Based on multiple regression analysis results as referred in Table 5, there are four main factors which drive to the recycling of used batteries among students which are firstly, social norm factor and is followed by willingness to pay factor, attitude factor and perceived behavioural control factor.

TABLE 5. Factors which contribute to students' behaviour and awareness towards the practice of recycling of used batteries.

Num	Variable	Behaviour and awareness		
		B	Std. error	Sig.
	Constant		.304	
1	Knowledge	.040	.091	.658
2	Understanding	-.005	.054	.919
3	Attitude	.082	.029	.006
4	Intention and reward	-.057	.035	.111
5	Infrastructure	.106	.053	.046
6	Perceived behavioural control	.152	.061	.012
7	Social norm	.163	.044	.000
8	Responsibility	-.015	.043	.729
9	Willingness to pay	.154	.031	.000
	R^2		.273	
	F		14.133	
	P		.000	

Social norm is less important in most studies which using TPB structure (Rhodes et al. 2014). However, social norm is found to be the most significant factor which drives to the behaviour and awareness among students in this study. This social norm refers social pressure in executing or any form of behaviour or not (Tang et al. 2011). In this study, the practice of recycling used batteries among respondents is actually driven by their family and friends. Respondents would carry out used batteries recycling if their family (24.1%) or friends (24.1%) drive them to do so. Family and friends are social pressure which encourages respondents to manage used batteries correctly. Respondents believed that they had to obey and carry out the behaviour if there is social pressure which gives them motivation as in Ifegbesan's study (2010) stating that individuals will become more motivated to execute behaviour of there is social pressure to do so. From this study, it is found that social norm is proven to be very important because of the influence from social pressure which assists in encouraging respondents to manage used batteries correctly, as aligned with the research done by Kremer (2013).

The second factor which influences behaviour and awareness is willingness to pay. Willingness to pay in this study means they need to pay the treatment cost for recycling or disposing used batteries. Those who have willingness to pay are perceived as having high awareness level as they are willing to spend for environmental preservation so that it is protected and pollution-free. This factor of willingness to pay involves cost expenditure whereby it is very influential in the effectiveness of

good waste management (Ali et al. 2012). In this study, respondents stated that they agreed to make payment for the purpose of recycling used batteries and the payment was suggested to be done when purchasing (45.8%) and disposing batteries (41.5%).

This willingness to pay approach is not bringing any profit to any party because it is used for recycling or disposal purpose. The willingness to pay approach aims to see the whole perception of the society who has willingness to pay to improve the environmental quality so that environmental pollution is at minimum level (Dermawan et al. 2011; Song et al. 2012). The willingness to pay among Europeans seems to be the norm and the majority is ready to pay additional taxes for environmental protection and preservation (EPA, 2006). In Kremer study (2013), 84% of them were willing to pay extra bills on collection services of bottles recycling and used batteries. The factor of willingness to pay recycling of used batteries is very important because the process of disposing and recycling themselves are costly. This is supported by Nixon and Saphores' research (2007) which stated the high cost in recycling electronic waste. This process encompasses waste collection, treatment, and disposal as well as external costs such as health and environmental effects (Oyekale 2015).

Apart from that, the third factor which influences behaviour and awareness is attitude. Attitude towards used batteries disposal and their awareness regarding the harms of used batteries give huge effects on used batteries management. This study tests respondents' attitude upon the ways of handling used batteries. Research findings indicate that most of the respondents (43.6%) did not send their used batteries to recycling sites. Only 25.8% recycled used batteries. 50.1% from the respondents did not send used batteries to the nearby stores for recycling process. Therefore, respondents were more comfortable discarding the used batteries rather than recycling the waste. They did not know where the used batteries should be disposed besides the trash bins. Generally, respondents did not participate in used batteries recycling activities because they felt that they did not fully know about the recycling practices. This phenomenon was also reflected in Haron et al. study (2005), where not all communities understand the definition of recycling. Respondents were also not aware of the importance of recycling used batteries and did not have positive attitude towards recycling. Consequently, respondents were less prone to participate in behaviour which involves recycling used batteries activities. This situation is similar to Mccullough's study (2011), those who have negative perception towards recycling will opt to not participate. In addition, the lack of infrastructure becomes the hindrance in encouraging respondents to recycle used batteries.

Perceived behavioural control is the fourth factor which influences behaviour and awareness in recycling used batteries. This factor takes integrated effort drawn by users towards recycling used batteries activities into account (Mccullough 2011). The perceived behavioural control factor in this study evaluates how far the respondents participate in recycling used batteries. Respondents believed they had high obedience upon the process of separation and disposal of recyclable materials (26.7%), and they have sufficient space to store these materials including used batteries (24.3%). Even though the percentage of respondents on their behaviour towards recycling is low yet they believed that by recycling used batteries, the environment can be protected to prevent pollution (33.5%). Next, respondents also believed with recycling used batteries behaviour it can reduce the wastes in landfills (58.2%). In this study, only a small number of respondents carried out the recycling of used batteries activity. Respondents in this study were ready to collect used batteries if they knew more input about the implications of not disposing used batteries correctly. Promoting various programmes related to recycling can drive respondents to act more responsibly towards produced used batteries. Therefore, they will perform recycling used batteries behaviour easily without any problem.

RELATIONS BETWEEN MAIN FACTORS AND RELATIONSHIPS WHICH DRIVE TO RECYCLING USED BATTERIES

From the findings of this study, there are four main factors which drive to students' behaviour and awareness in implementing used batteries recycling. However, other factors still have significant relationship with one another as in Figure 2.

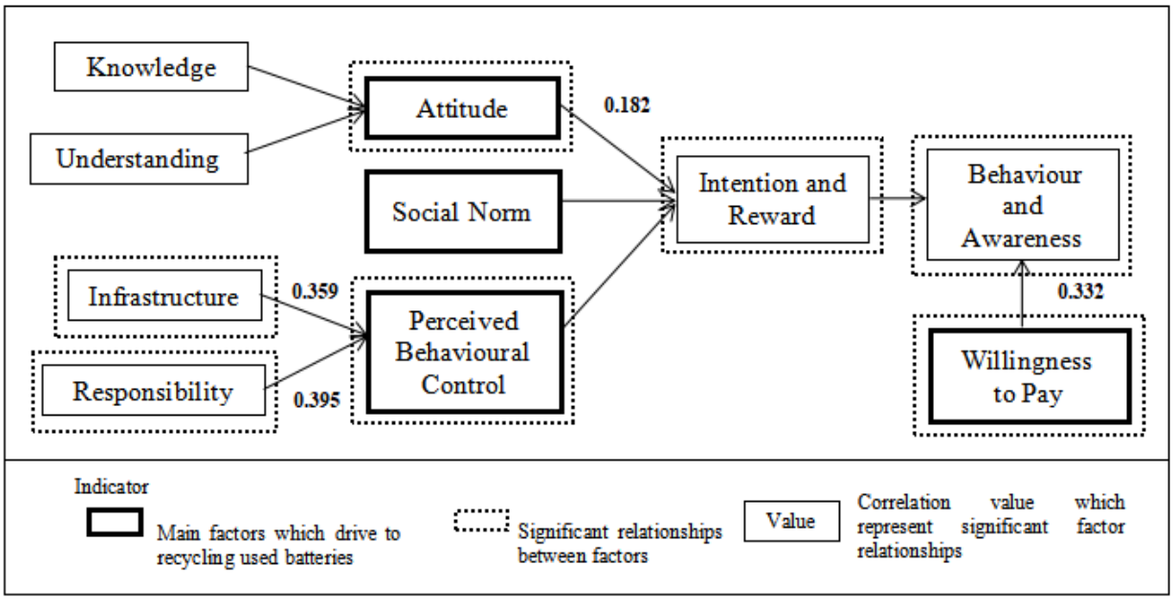

FIGURE 2. Main factors and relationships which drive to students' behaviour and awareness in implementing used batteries recycling.

Based on Figure 2, it is found that willingness to pay factor is the most main factor which drive to the improvement of behaviour and awareness among students in recycling used batteries compared to other factors. This is due to the fact relationships directly influence this improvement because other factors have relationships through stages to improve behaviour and awareness. Infrastructure and responsibility can improve perceived behavioural control but in this study, it cannot improve behaviour and awareness because the relationship between perceived behavioural control with intention and reward is not significant. The same goes to the attitude relationship with intention and reward. Even though attitude relationship with intention and reward is significant but it cannot improve students' behaviour and awareness because there is no relationship between intention and reward with behaviour and awareness. Therefore, the usage of TPB theory is an accurate choice because it can identify the factors which encourage a particular behaviour suitable with the objective of this study. In short, all these factors can be improved, and suitable factors can be added for the purpose of future research.

CONCLUSION

The challenge in recycling used batteries is giving awareness to students to recycle used batteries using the correct way. Besides, students' behaviour also needs to be changed so that recycling used batteries can be made one of their practices. However, in this study most of the studied factors are not able to help in improving students' behaviour and awareness in recycling. Willingness to pay factor does not only improve behaviour and awareness because when they are willing to spend money for the purpose of recycling, it means that they are aware importance of recycling used batteries. Indirectly, their behaviour in recycling used batteries has become their daily practice. To improve other factors, students need various information, and the authorities need to provide multiple infrastructure especially used batteries recycling bins so that students can improve their behaviour and awareness towards recycling. Students need accurate information so they can change attitude to become more prone to and responsible in recycling. Teachers' role in schools is also important to transfer knowledge and giving information regarding recycling among students. It is hoped that this study will assist various parties to improve students' awareness level and change their behaviour in implementing used batteries recycling.

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