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# What drive students to behave more environmentally friendly towards waste?

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# What drive students to behave more environmentally friendly towards waste?

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**Abstract**

Students' behavior towards waste takes a crucial role to successful sustainable waste management at school level. As many scholars mentioned, a proper waste management should not only environmentally effective and economically efficient, but also socially acceptable. Therefore, it is important to know how to drive students to behave more environmental friendly. Using eco-friendly behavior survey for students as part of community engagement program titled "Creating Healthy, Fit and Productive Generation through Comprehensive Mental Revolution Model", this paper aims to identify factors that determine students' eco-friendly behavior. This survey was administered to 797 students from three high schools in the city of Bekasi, SMA N 1 Bekasi, SMA N 2 Bekasi and SMK Korpri. We divided three broad characteristics in determining student's eco-friendly behavior, namely individual characteristics, household characteristics and community characteristics, as mentioned in various researches. The result shows that out of three broad characteristics, individual characteristics play significant role in determining the level of student's eco-friendly behavior. In terms of individual characteristics, knowledge about waste and school course plays positive and significant role in determining the level. For the study course, we conclude that students in the science course have a relatively higher eco-friendly behavior level compared to social course or others. Female students are also more likely to have higher level of eco-friendly behavior rather than male students. Finally, daily expenditure significantly determines the level. On the other hand, we found that environmental concern and class rank do not have significant effect to student's behavior. In addition, none of the household and community characteristics variables were significant in determining the behavior. This result emphasizes the importance of individual characteristics improvement, especially waste knowledge and environmental education, to drive students in dealing waste appropriately.

*Keywords*: waste management; eco-friendly school; eco-friendly behavior

## 1. Introduction

It is estimated that in 2016 waste generation in Indonesia reached 65 tons per year ([1]). As population and income growth increase, the amount of waste is increasing too, and it is expected that the waste grow 0.95% per year until 2025 (Ministry of Environment and Forestry, 2017). In major cities, the figure is even higher, reaching 2-4% (Aprilia et al., 2011: 71). From all waste generated, the amount of municipal solid waste collection rate does not even reach 70% (Waste Atlas, 2017).

Now Indonesia is facing a serious problem on waste management. Indonesia is declared as the second largest emitter of plastic waste to the ocean (Jambeck et al., 2015: 769). This explains waste management in Indonesia that is still poor in implementation. To cope with this problem, Indonesia pledged USD 1 billion per year to curb ocean waste (Langenheim, 2017). At the regulation side, Indonesia has enacted the regulation (2008) that shifted conventional management (namely collect-transport-dispose) to sustainable waste management (reduce-reuse-recycle). The regulation that covers national level must be applied at municipal level, resulting in the need to develop further regulation and action at the local level. Until now, not all the local level government follows the rule.

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Transforming paradigm to sustainable waste management need participation from multi-stakeholders. One of the crucial issues is to change behavior toward waste. As reduce-reuse-recycle became a crucial aspect in sustainable waste management, the knowledge and behavioral change of waste source agents are significantly needed. In 2014, only 8.75% of households conducted waste separation and practiced (National Statistics Agency, 2014). Therefore, spreading the idea of reducing waste from the source and carry out waste separation is important. One way to spread the idea of waste reduction is through education. School is important not only in transforming knowledge, but also shaping behavior (Banks, 1991: 125).

Students are the main agent in school waste generation. In almost all Indonesian high schools, waste generated from students mainly derives from meals. In addition to that, paper is another type of waste that students generate. Several studies have been conducted to analyze waste generation profile in schools (Coyle & Turner, 2008: 8; Phuntsho et al., 2010: 248; Cioci & Farnan, 2010: 21; SCS Engineers, 2010: 8), and the results show that 0.05 to 0.15 kg of waste generated by one individual in schools each day. In Indonesia, student's population is approximately 44.6 millions, contributing to about 16% of the total Indonesian population (Ministry of Education and Culture, 2010). The number is comprised of primary school students at 25.4 millions, and junior high school and senior high school students at 19.2 millions. Given the large number of students, waste generated in school is considerably abundant.

An appropriate and sustainable waste management is culturally specific, meaning that the waste management should consider the cultural, social, and economic characteristics of a community to successfully achieve its objective. Otherwise, it has a high possibility to fail (Schneider & Ragossnig, 2015: 693; Brown, 2015: 41). This paper intends to examine what factors drive eco-friendly behavior towards waste among students. The results are expected to provide inputs for schools to encourage students to take part in sustainable waste management.

There are several studies that explore eco-friendly behavior, most of which are based on the Theory of Planned Behavior (TPB) (Mahmud & Osman, 2010: 120; Tonglet et al., 2004: 202; Stancu et al., 2016: 10; Ghani et al., 2016: 1277; Visschers et al., 2016: 69; Hasan et al., 2015: 196). According to the theory, someone's behavior over a certain thing can be explained well by his/her intentions, which are determined by attitude, subjective norm, and perceived behavior control in doing the action (Ajzen, 1991: 182). Other studies examine the drivers of eco-friendly behavior on several variables, namely gender, knowledge about waste, school rank and course, family characteristics, and facilities in community. These variables have been used extensively in a number of studies to determine eco-friendly behavior (Folz & Hazlett, 1991: 528; Davies et al., 2005: 16; Timlett & Williams, 2008: 626; Martin et al., 2006: 390; Bradley et al., 1999:20). This paper emphasizes the use of three distinctive variables: non-psychological individual characteristics, household characteristics, and community characteristics as the explanatory variables for Indonesian students' eco-friendly behavior.

The survey was a part of a community engagement program titled "Creating Healthy, Fit and Productive Generation through Comprehensive Mental Revolution Model" in 2015. The program was a form of comprehensive efforts in developing positive characteristics of high school students in the city of Bekasi, aiming to create healthy, fit and productive young generation through improvement of three aspects: 1) physical and mental health, 2)

environment, and 3) economy. Several comprehensive projects were held within the program, such as seminars, workshops, training, focus group discussions as well as physical activities. Along with them, an eco-friendly behavior survey was held in accordance to the environment aspect of the program. The survey was important as, to our knowledge, in the context of Bekasi, research on student's eco behavior is extremely lacking. This research would help in explaining the driver of student's eco-friendly behavior.

## 2. Theoretical Background

### *2.1. Role of school in waste management*

School plays a major part in undertaking environmental education. In September 1965, International Union for the Conservation of Nature and Natural Resource/The World Conservation Union (IUCN) made a recommendation to develop environmental education in school, university, and training for professionals (Palmer, 2002: 5; Athman & Monroe, ). In 1968, a conference held by United Nations Educational, Scientific, and Cultural Organization (UNESCO) suggested a curriculum for all educational level and technical training as well as other recommendations about global environment comprehension. Environmental education itself is defined as follows:

> *"Environmental education is the process of recognizing values and clarifying concepts in order to develop skills and attitudes necessary to understand and appreciate the interrelatedness among man, his culture and his biophysical surroundings. Environmental education also entails practice in decision-making and self-formulation of a code of behavior about issues concerning environmental quality"* (IUCN, 1971 in Hesselink, F., & Čeřovský, 2008: 7)

The goal of education is to shape human behavior. Schools, as educational institutions, are bound to achieve this target. Education is not simply about reading and mathematical comprehension. It is far more complex than that as it shapes responsible behavior in individuals (Hungerford & Volk, 1990: 8; Athman & Monroe, 2001: 37). Environmental education, which includes waste-related education, is one of several ways to direct students to be environmentally responsible individuals.

In Indonesia, waste management is regulated under Law No. 18/2008. The law stipulates the shift in Indonesia's municipal waste management approach from collect-transport-dispose to reduce-reuse-recycle (3R) as well as waste reduction and at-source waste separation as the representation action of sustainable waste management. The law also emphasizes the sorting of waste into at least three types: organic, inorganic, and residual waste. Schools, supervised by municipal government, become one of the important agents to implement sustainable waste management.

Waste management in school involves a number of stakeholders, i.e., school management, teachers, students, canteen, and other external parties. School management, representing the owner or highest authority in school, develops policy, while teachers take part in waste management by shaping students' behavior. Hence, school management and teachers should collaborate to produce a well-executed plan.

The next two important stakeholders in the plan are students and the canteen as they produce most of the waste, both organic and inorganic, in school. Students are the main actors in waste generation because they constitute the majority part of the school. Thus, a

change in students' behavior might give significant impact to school. On the other hand, canteen is the source of waste in school. Besides producing food waste, canteen also provides take-away food that creates inorganic waste such as plastic and cardboard packaging and styrofoam.

To ensure sustainability of the plan, school management should also collaborate with external parties, such as local government and community, as many studies have found that community has a role in affecting behavior (Folz & Hazlett, 1991: 530; Ghani et al., 2016: 1281; Omran et al., 2009: 284). Local government has the role of supervisor for waste management in its municipality. Schools need to cooperate with local government, especially the Department of Sanitation, regarding its municipal waste management. Schools may ask for assistance from local government, for instance by requesting the local government to provide a composter machine. In the community, schools may also collaborate with organizations engaged in environmental issue.

### *2.2. Prior studies on eco-friendly behavior*

Numerous studies have analyzed eco-related behavior at individual, household, or community level (Folz & Hazlett, 1991: 526; Davies et al., 2005; Timlett & Williams, 2008: 622; Martin et al., 2006: 357; Bradley et al., 1999: 17; Mahmud & Osman, 2010: 19; Tonglet et al., 2004: 191; Stancu et al., 2016: 7; Ghani et al., 2016: 1276; Visschers et al., 2016: 66; Hasan et al., 2015: 195; Yau, 2010: 2440: del Cimmuto, 2014; 556; Starr & Nicolson, 2015: 7; Cottrell, 2003: 347).

Knowledge has a significant role in determining behavior. Other than beliefs, which were mentioned by Ajzen (1991: 189), knowledge is hypothesized to have an impact on behavior (Hines et al., 1987: 3). The transmission is identical with the TPB; knowledge of issues and action strategies will affect their intention to do a certain thing. Consequently, the intention might drive the person to perform or not perform an action. Hungerford & Volk (1990: 259) extended the model by adding the three level of knowledge which may affect behavior; entry level (e.g. sensitivity, knowledge of ecology), ownership level (e.g. in-depth knowledge, personal commitment & investment in the issue) and empowerment variable (e.g. knowledge and skill in using strategies, locus of control and intention).

Empirically, it is found that knowledge is, indeed, very significant in affecting someone's eco-related behavior. Bradley et al. (1999: 20), through experiments, showed that high school students with enriched environmental knowledge has more favorable environmental attitude. As previously mentioned, attitude shows correlation with behavior. In this case, environmental knowledge may indirectly affect environmental behavior in a positive manner through favorable attitude. However, environmental knowledge sometimes does not have direct impact on behavior, as Liu et al. (2015: 123) and Mifsud (2012: 413) found that people with relatively high environmental knowledge might not translate their knowledge into actions.

Education and knowledge are two different things. Education is a learning process; meanwhile, knowledge is the byproduct of education. In this case, besides directly shaping behavior, education is a way for individuals to gain knowledge. Specific for environmental education, Tbilisi Declaration defined that one of the main objectives of environmental education is to enhance environmental knowledge and the problem within. It is empirically proven that environmental education has a positive effect on knowledge (Manoli et al., 2014: 32). Education generates stronger direct effect on behavior than on knowledge. Olli et al.

(2001: 196) found that the span of formal education individuals received correlates positively with environmental behavior. Poortinga et al. (2004: 85) also found that higher level of education will result in less home energy use (environmental behavior).

However, many schools around the globe do not formally include environmental education in their curriculum. This leads to students having relatively little knowledge about environment. Hausbeck et al. (1992: 31) found that 11$^{th}$ grade students in around 1990-1991 in New York State possessed rather deficient environmental knowledge. It was subsequently affirmed by Gambro & Switzky (1996: 31), who found that American students generally had poor environmental knowledge. The findings hint that formal education might not have direct impact on environmental knowledge if the subject is not incorporated in the curriculum. If so, as Cottrell (2003: 365) found, formal education might not influence an individual's environmental behavior.

Environmental concern has been subsequently hypothesized to have an impact on how individuals behave. Worsley et al. (2015: 52) found that people who are concerned about environment tend to support food policy and have better pro-environmental purchase intention. Rhead et al. (2015: 180) also discovered that eco-centric concern has a positive relationship with pro-environment behavior and, conversely, denial in environmental problems has converse effect. Newton et al. (2015: 1979) added the effect of learning process in environmental concern towards intention, where incidental learning has stronger effect on environmental purchase intention compared to intentional learning. However, Poortinga et al. (2004: 84) found contrasting result that environmental concern does not correlate positively with energy-saving behavior. The finding was also supported by Cottrell (2003: 365).

In terms of individual characteristic, gender is one of several variables used to explain behavior variations. For example, Olli et al. (2001: 196) and Hasan et al. (2015: 198) mentioned that gender plays significant role in determining eco-friendly behavior. They found that women are more involved in reducing plastic usage, waste handling, resource conservation and toxic usage reduction.

Community is expected to shape how individual behaves. Folz & Hazlett (1991: 530) found that the existence of composting program is positively correlated with citizen's participation in voluntary recycling program. Curbside collection facilities also affect recycling participation rate. Ghani et al. (2016: 1281) and Omran et al., (2009: 283) also demonstrated that the availability of facilities such as food waste collection centers and community recycling bins might increase participation in sorting and recycling. To conclude, studies have shown that community can be either a motivator or a hindrance for waste-related behavior.

## 3. Methods

### *3.1. Survey design*

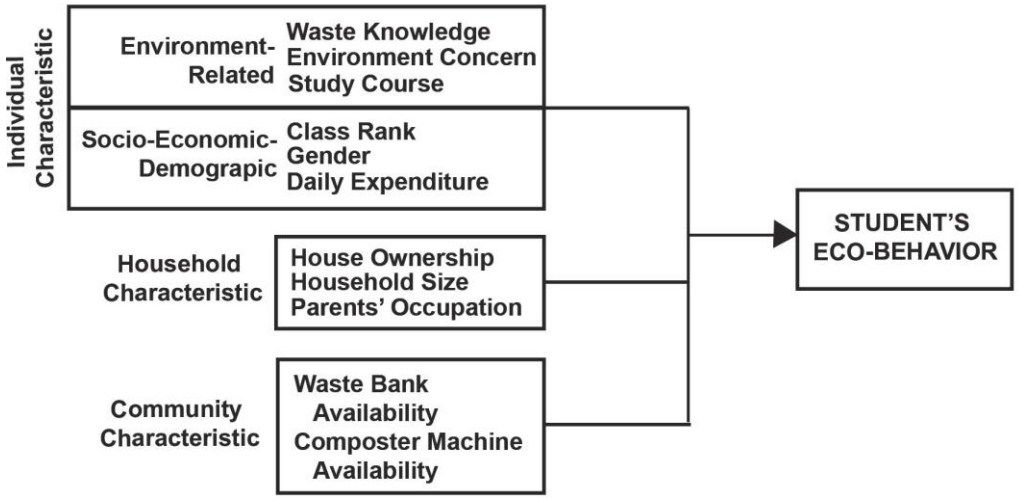
We conducted the survey through self-administered questionnaires. The respondents comprise of students from three high schools: SMAN 1 Bekasi, SMAN 2 Bekasi, and SMA Korpri. In each school, we picked several classes and asked all students in the class to participate in the study. There are twenty-four classes in total, consisting of twelve classes for SMAN 1 Bekasi and six classes each for SMAN 2 Bekasi and SMA Korpri. The survey was conducted in October 2015.

Schools in Indonesia are divided into three courses: science, social, and language courses; and three grades: tenth, eleventh, and twelfth grades. Science course dominates many schools compared to social and language courses. For example, in SMAN 1 Bekasi, there were ten classes for science course, one class for social course, and none for language course in each grade. From the three schools, there was only one class for language course, which was found in SMAN 2 Bekasi in the tenth grade.

The classes were chosen randomly within its course and grade group. In SMAN 1 Bekasi, we took three science course classes and one social course class from each grade , while in SMAN 2 Bekasi, we took one science course and social course class from each grade. In SMA Korpri, we took one science course and social course from the eleventh and twelfth grade. Tenth grade students in the school did not take a specific course and learned both science and social course subjects in general. In this case, we took two classes from the tenth grade. We did not include language course in our analysis as it is a minority in many schools. Students' characteristics in language course also do not differ significantly with social course, so we assumed that the characteristics and behavior are similar. In total, as many as 797 students participated in the survey.

### *3.2. Model and analysis*

We have three broad characteristics to explain the variation in high-school students' eco-friendly behavior in Indonesia: individual characteristics, household characteristics, and community characteristics (Figure 1). The variables for individual characteristics were divided into two types: environment-related variables and socioeconomic-demographic variables. Household characteristics were portrayed through three variables: house ownership, household size, and parents' occupation. Finally, variables for community characteristics include waste bank and communal composter availability.




Fg. 1 Logical Framework of Student's Eco-friendly Behavior Determinants

Stated as functions, student's eco-friendly behavior (EFB) is a function of knowledge about waste (WK), environment concern (CON), study course (SC), class rank (CR), gender

(GEN), daily expenditure in the form of log natural (logDE), house ownership (HO), household size (HS), parents' occupation (PO), communal waste bank availability (WB), and communal composter machine availability (COM). The equation is formulated as follows.

$$EFB = f(WK, CON, SC, CR, GEN, DE, HO, HS, PO, WB, COM) \quad (1)$$

In the questionnaire, student's eco-friendly behavior was measured via four questions about student's waste behavior in school with four level. The score for eco-friendly behavior ranges from 4 to 16 where the higher score portrays better eco-friendly behavior. To measure waste knowledge, students were presented with two tasks: 1) ranking which method (among reduce, reuse, recycle, and waste sorting) is most impactful in reducing waste and 2) classifying twelve wastes by type (organic, inorganic, and residual). The score was obtained by counting the correct answers by total items for each task. The final score is the average sum of the two scores.

Environmental concern was measured by asking students to rank major problems in Bekasi. Students were presented with eight options, including environmental degradation and waste problem and one "other" option, and were then asked to rank three problems with the highest priority to be resolved. We used dummies where 1 shows environmental concern and 0 shows the opposite.

To portray education effect, we added study course and class rank in the model. Study course was considered environment-related as science course includes environmental education. In this case, study course and waste knowledge were employed in the model because we found that the Variance Inflation Factor (VIF) is 1.02 and the Spearman correlation is 0.142, which is relatively low. Therefore, both variables could still be used[1]. Dummy variables were used to describe study course and class rank where 1 shows science course student and top-ten ranked students. Availability of waste bank and communal composter machine were variables representing community characteristics in the form of dummies.

## 4. Result and Discussion

### *4.1. Descriptive statistics*

The respondents comprised of 797 students. Table 1 shows the students individual characteristic. As described in the table, the samples were dominated by female students composing up to 486 students or around 60% of the total sample. The proportion of the sample from SMAN 1 Bekasi, SMAN 2 Bekasi and SMA Korpri was 367 (46%), 210 (26%) and 220 (28%) respectively. No less than half of the students were enrolled in science course, students taking social course make up about 33% of the sample, while 10% are not yet specialized.

Table 1. Students' Individual Characteristics

| Variable | Count | Proportion | Variable | Count | Proportion |
|---|---|---|---|---|---|
| Gender | | | Class Rank | | |

[1] If the VIF values exceed 5 or 10, it indicates that the regression coefficients are poorly estimated because of multicollinearity.

| | | | | | |
|---|---|---|---|---|---|
| Male | 311 | 39.02% | Top Ten | 220 | 27.60% |
| Female | 486 | 60.98% | Non-Top Ten | 577 | 72.40% |
| Total | 797 | 100.00% | Total | 797 | 100.00% |

| School | | | Daily Expenditure | | |
|---|---|---|---|---|---|
| SMAN 1 Bekasi | 367 | 46.05% | ≤ US$ 0.5 | 67 | 8.42% |
| SMAN 2 Bekasi | 210 | 26.35% | US$ 0.5 - US$ 1 | 204 | 25.63% |
| SMA Korpri | 220 | 27.60% | US$ 1 - US$ 1.5 | 200 | 25.13% |
| Total | 797 | 100.00% | US$ 1.5 - US$ 2 | 204 | 25.63% |
| Study Course | | | US$ 2 - US$ 2.5 | 54 | 6.78% |
| Science Course | 451 | 56.59% | US$ 2.5 - US$ 3 | 21 | 2.64% |
| Social Course | 266 | 33.38% | > US$ 3 | 46 | 5.78% |
| Not Yet Specialized | 80 | 10.04% | Total | 796 | 100.00% |
| Total | 797 | 100.00% | Average | | |

| Grade | | |
|---|---|---|
| 10 | 287 | 36.01% |
| 11 | 261 | 32.75% |
| 12 | 249 | 31.24% |
| Total | 797 | 100.00% |

The sample was divided relatively equally based on the grade. Students on 10$^{th}$, 11$^{th}$ and 12$^{th}$ grade composed the sample by 36%, 33% and 31% respectively. Students who are ranked as top ten student were 220 students and accounts for 27.6% of total students. The rest, 577 students or 72.4% of total students, was ranked below top ten. On average, the student's daily expenditure was around US$ 1.40. Only 46 students (5.78%) spend more than US$3 a day, and students with expenditure less than US$ 1.50 was 471 students or approximately 59%.

Aminrad et al. (2013: 1327) suggested that students' awareness and knowledge about environmental issues come from their family, where students from high-income family participate more in pro-environmental behavior. Table 2 captures students' household characteristics pertaining to household ownership, parents' occupation, and household size.

The table describes that in majority the students are living in privately owned house and have actively working parents. Above 90% of the respondents privately owned the house (714 students) and had actively working parents (766 students).

Table 2. Students' Household Characteristics

| Variable | Count | Proportion |
|---|---|---|
| House Ownership | | |
| Privately Owned | 714 | 90.49% |
| Not Privately Owned | 75 | 9.51% |
| Total | 789 | 100.00% |
| | | |
| Parents' Occupation | | |
| Actively Working | 766 | 96.11% |
| Not Actively Working | 31 | 3.89% |
| Total | 797 | 100.00% |
| | | |
| Household Size | | |
| <2 | 8 | 1.01% |
| 3 | 58 | 7.47% |
| 4 | 282 | 36.34% |
| 5 | 287 | 36.98% |
| 6 | 105 | 13.53% |
| 7 | 27 | 3.48% |
| 8 | 8 | 1.03% |
| 10 | 1 | 0.13% |
| Total | 776 | 100% |

If we round up the household size, student's household size was around 5 persons. 141 students live in a house with 5 persons or more, which makes up approximately 18% of the total students, and those living in house with less than 5 persons were 248 students or 44%.

We divided waste knowledge into two broad categories: waste-type knowledge and waste-reducing method knowledge. In the first category, the students were presented with twelve kinds of waste and were required to classify each waste based on its type, whether it is organic, inorganic or residual waste. The second knowledge measurement is on waste

hierarchy, in which each student needed to rank methodologies in dealing with waste: waste separation, reduction, reusing and recycling.

From Table 3, it can be observed that in general students have proper knowledge concerning waste types. The table shows that, in average, the score for student's knowledge of waste types was around 70.45%. Only 9.66% of the students scored higher than 90%, but less than a quarter of the students get a score below 65%. Unfortunately, students have relatively less knowledge regarding waste reducing methods. On average, the score about waste-reducing method knowledge was only 20.89%, much lower than the score for waste-type knowledge. Only less than 5% of students answered the questions perfectly; meanwhile, the proportion of students having a score of 50% and lower was almost reaching 80%.

Table 3. Students' Waste-Related Knowledge

| Waste-Type Knowledge | | | Waste-Reducing Method Knowledge | | | Overall Knowledge | | |
|---|---|---|---|---|---|---|---|---|
| Score | Count | Proportion | Score | Count | Proportion | Score | Count | Proportion |
| 90% - 100% | 77 | 9.66% | 100% | 33 | 4.14% | 90% - 100% | 15 | 1.88% |
| 80% - 90% | 193 | 24.22% | 75% | 139 | 17.44% | 80% - 90% | 11 | 1.38% |
| 65% - 80% | 338 | 42.41% | 50% | 256 | 32.12% | 65% - 80% | 51 | 6.40% |
| 50% - 65% | 90 | 11.29% | 25% | 369 | 46.30% | 50% - 65% | 153 | 19.20% |
| ≤ 50% | 99 | 12.42% | | | | ≤ 50% | 567 | 71.14% |
| Total | 797 | 100.00% | Total | 797 | 100.00% | Total | 797 | 100.00% |
| Mean | 70.45% | | Mean | 20.89% | | Mean | 45.67% | |

Aggregating the value, on average, score of student's waste knowledge was only 45.67%. Students who earned 90% to 100% were only 15 students, which was less than 2%. The students scoring less than 50% were approximately 71%. The result reveals that students were more knowledgeable in terms of waste types rather than waste-reducing methods, yet in general the students' waste knowledge was rather deficient.

As mentioned in the previous part, environmental concern was measured by requiring the students to rank main problems in the city of Bekasi. Students were presented with 8 problems arising in Bekasi: unemployment, poverty, inequality, environmental degradation, waste problem, criminality, congestion and public transportation. Students were also allowed to state other problems. We decided that students ranking environmental degradation and/or waste problem in the top three were regarded to be concerned about the environment. Table 4 explains the proportion of student's environmental concern.

Table 4. Students' Environmental Concern

| Category | Count | Proportion |
|---|---|---|
| Concerned | 666 | 89.28% |
| Not Concerned | 80 | 10.72% |
| Total | 746 | 100.00% |

It shows that in majority, students have concern about environmental condition. Out of 746 students, 666 students ranked environmental degradation and/or waste problem as the top three problems in Bekasi, making up almost 90% of the total students. On the other hand, only 80 students or around 10% put environmental degradation or waste problem as less important problems in Bekasi.

Students' level of eco-friendly behavior is measured by asking four questions on their frequency (measured in four levels) of bringing food and drink or tumblr from home, throwing waste in the garbage bin and separating waste into organic and inorganic waste. The sum of the questions (totaling to 16 if perfectly answered) was then used as the dependent variable of regression. The result of measurement is presented in Table 5.

Table 5. Student's Level of Eco-friendly Behavior

| Questions | Mean | Standard Deviation |
|---|---|---|
| How often do you bring food from your home? | 2.968 | 1.173 |
| How often do you bring tumblr from your home? | 3.183 | 1.191 |
| How often do you put waste in garbage bin? | 3.820 | 0.526 |
| How often do you separate waste based on organic and inorganic waste? | 2.538 | 1.141 |
| Total Score | 12.194 | 3.114 |

The table shows that, in general, students in Bekasi had positive behavior concerning how they put waste in garbage bin. The score on this question was relatively high, which was 3.82, almost reaching the maximum score. The variation was also small as the standard deviation was only 0.53. The behavior of bringing food and tumblr had a lower score compared to the previous question, with a score of 2.97 and 3.18 respectively. Finally, we found that students in the city of Bekasi had relatively low score in how they separate organic and inorganic waste. The score for this question was only 2.54 with a standard deviation of 1.15. Nevertheless, as the average of total score was 12.19, the students were considered to behave in a appropriate way.

### *4.2. Student's eco-friendly behavior determinants*

Out of 797 observations, there were only 725 observations that could be used to analyze the dependent variable for model 1 and 706 observations for models 2 and 3. From the estimation result, we found that out of three broad characteristics, individual characteristics play a major role in determining the level of student's eco-friendly behavior. Within individual characteristics, knowledge about waste, school course gender, and daily expenditure were significant; while environmental concern and class rank were less so. On the other hand, none of the household and community characteristics variables were significant in determining the behavior. Table 6 below shows the result for the three models.

Table 6. Factors Affecting Students' Eco-friendly Behavior

| Variables | Individual Characteristics | | Including Household Characteristics | | Including Household and Community Characteristics | |
|---|---|---|---|---|---|---|
| | β | Rob. Std. Error | β | Rob. Std. Error | β | Rob. Std. Error |
| Dependent Variable: Eco-friendly behavior | | | | | | |
| Intercept | 15.068*** | 1.654 | 15.076*** | 2.331 | 15.258*** | 2.346 |
| WK | 1.464* | 0.764 | 1.485* | 0.793 | 1.580** | 0.801 |
| CON | -0.383 | 0.359 | -0.376 | 0.367 | -0.409 | 0.369 |
| SR | 0.700*** | 0.233 | 0.745*** | 0.238 | 0.738*** | 0.238 |
| SC | 0.347 | 0.245 | 0.329 | 0.249 | 0.314 | 0.248 |
| GEN | 1.236*** | 0.24 | 1.237*** | 0.246 | 1.229*** | 0.247 |
| DE | -0.464*** | 0.164 | -0.524** | 0.207 | -0.556*** | 0.207 |
| HO | | | 0.385 | 0.681 | 0.378 | 0.676 |
| HS | | | 0.292 | 0.701 | 0.325 | 0.698 |
| PO | | | -0.028 | 0.113 | -0.031 | 0.113 |
| WB | | | | | 0.216 | 0.231 |
| COM | | | | | 0.353 | 0.338 |
| N | 725 | | 706 | | 706 | |
| Adj R2 | 0.0719 | | 0.0733 | | 0.0757 | |
| F | 10.13 | | 6.33 | | 5.34 | |
| Prob>F | 0.000*** | | 0.000*** | | 0.000*** | |

Note: */**/*** means that the variable is significant at α=10%/5%/1%

Based on Table 6, it is found that individual characteristics prominently determine student's eco-friendly behavior. As predicted, students' knowledge has positive and significant impact with student's eco-friendly behavior. The result is robust across the three models, although the effect is stronger by accounting household characteristics and community characteristics. This is in line with the theory by Hungerford & Volk (1990: 259) and empirical findings of Liu et. al. (2015: 123) who concluded that knowledge influences students' pro-environmental behavior. Looking back to Table 3, the level of waste knowledge among students in Bekasi is relatively lower. The result should be a justification for the government or schools to incorporate contents concerning waste and environment in the curriculum.

Surprisingly, out of the three environment-related variables, student's environmental concern does not have any relationship with the level of eco-friendly behavior. This finding is in line with Poortinga et al. (2004: 84) and Cottrell (2003: 365), and this result was expected to arise given there were relatively low variation in environmental concern. Based on table 4, 90% of the students were regarded to have concerns for environmental problem. For future research, we suggest to use other concern measurement questions to obtain different results.

Maddox et al. (2011: 2590), Manoli et al. (2014: 32) and Olli et al. (2001: 196) highlighted that education can increase students' awareness about environmental problems and their solutions. We confirm these findings as we found that science course has more positive impact to shape student's eco-friendly behaviour. Since science course is related to environment, it is expected that students majoring in science course receive more subjects about environment and waste. Eventually, this causes students in the science course to maintain better attitudes towards the environment. The estimated coefficient confirms that students from science class tend to possess better eco-friendly behavior compared with their reference group. On the other hand, it is found that student's rank in class does not have any relationship with the level of eco-friendly behavior.

Our findings also confirm the study of Olli et al. (2001: 196) and Hasan et al. (2015: 198) which found that females tend to have more environmental awareness than males. We hypothesize that it happens as females are usually expected to carry out all the cleaning activities at home or school more often than males. Hence, female students are more likely to have positive behavior towards environment. This result shows that the schools need to put more efforts for the improvement of eco-friendly behavior of male students.

With regard to daily expenditure as a proxy of income, we found that income had a negative relationship with students' eco-friendly behavior. It means that students with higher daily expenditure will behave less eco-friendly compared to students with less daily expenditure. The result is consistent with the finding of Murad et al. (2012: 183) that low-income groups tend to have a proactive role in environmental perspective. Therefore, schools need to give more attention to students with higher expenditure.

In contrast, none of household characteristics and community characteristics determine the level of student's eco-friendly behavior . Household size, house ownership and parent's occupation, as variables representing household characteristics, do not have any relationship with student's eco-friendly behavior. The same result is found with regard to waste bank and communal composter availability, variables representing community characteristic.

This might happen because waste management system in household is usually taken care by parents, especially the mother and maid/helpers, regardless of the household size, ownership and parents' occupation. Children are rarely involved in the process of waste management, which nullifies any impact. In addition, waste management in Bekasi, specifically, does not employ a sustainable system. The availability of waste bank and communal composter is not necessarily followed by household participation, especially students. Therefore, the availability of those facilities does not reflect eco-friendly behavior aspects, especially in terms of waste separation.

## 5. Conclusion

Students have a big role in reaching sustainable waste management in school as they are the majority in schools. Given this condition, we think that it is important to encourage students to be more environmentally friendly. This reason underlines why we conducted this research, that is to understand what factors drive students to deal with waste appropriately. We developed a model to examine students' eco-friendly behavior drivers which is based on three broad characteristics: individual characteristics, household characteristics, and community characteristics. From the estimation result, we found a significant relationship between individual characteristics and student's eco-friendly behavior.

In terms of individual characteristics, knowledge about waste, school course, gender, and daily expenditure significantly influence the level of student's eco-friendly behavior. Students with higher knowledge about waste, which comprises of knowledge about waste types and waste reducing method, will have higher level of eco-friendly behavior. Students taking science course also then to be more eco-friendly compared to students from other courses. In addition, female students have rather higher level of eco-friendly behavior than male students, and students with lower daily expenditure will more likely to be pro-active in dealing with it.

The implication of this finding is the urgency for school to raise students' awareness about waste management issues through knowledge enhancement and education, as these two factors are the ones that can be altered in the future. It can be done through seminars, trainings and workshops, or improvement in the curriculum. Extra efforts need to be employed for social students and male students as it is found that both generally have lower level of eco-friendly behavior.

Meanwhile, none of the household and community characteristics variables were significant in determining the behavior. Given this result, it is important to improve students' knowledge toward waste management issues through education.

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