

## INVESTIGATION ON THE URBAN AND RURAL STUDENTS' BEHAVIOR FOR PLASTIC WASTE MANAGEMENT IN SOLO REGION

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### Abstract

**Purpose of the study:** The purpose of this study is to find out the involvement and behavior of students attending school in urban and rural areas in the management of plastic waste. Indicators of student behavior in waste management consist of the types of waste disposed of, students' willingness to dispose of plastic waste according to their grouping, as well as frequent disposal of plastic waste.

**Methodology:** The research instrument used was a questionnaire and interview conducted in one school in urban areas and one school in rural areas. Subjects involved in the study were high school students in urban and rural areas of Solo.

**Main Findings:** The results showed that there were enthusiastic differences between rural and urban students in the management of plastic waste; the common concern of urban students was 85%, while rural students were 73%. The research findings show that students who study in urban areas have higher plastic waste care behavior than students who study in rural areas.

**Applications of this study:** The implications of the results of this study can be useful for further research, namely on the management and use of waste as recycling for both rural and urban students.

**Novelty/Originality of this study:** There is no investigation on waste management, in both rural and urban schools. Considering waste is one of the main problems in the world today, so the results of investigations can be useful in reducing waste through education.

**Keywords:** *Adiwiyata, Plastic Waste, Student Behavior, Solo, Urban, Rural.*

### INTRODUCTION

The increase in population and the needs of human life is very influential on the volume of waste generation, especially in big cities ([Indrawati & Purwaningrum, 2018](#)), one of them is in the Solo area. The basic problems in waste management in big cities are limited space, control, pollution, and social problems. Community dependence on the use of plastics, due to the durability of plastics as packaging for food and drinks, is relatively stronger than other materials ([Khoironi et al., 2019](#); [Ledererová et al., 2019](#); [Pavani & Rajeswari, 2014](#)). It is supported by the relatively low cost of plastic production, thus increasing the amount of the plastic output because it is in line with the amount of disposable plastic usage ([Pavani & Rajeswari, 2014](#); [Martín, 2015](#)).

Increasing the number of plastic users from year to year has an impact on disposal and accumulation on the environment ([Khoironi et al., 2019](#); [Kong et al., 2017](#); [Puji & Sumarno, 2019](#)). Most plastic bottles produced end up in landfills or at sea ([Van et al., 2019](#)). The food and beverage packaging industry is the dominant user of plastic products, which accounts for almost 60% of usage while building equipment and household appliances 15%, the automotive sector, 8%, with other areas also contributing to agriculture and horticulture ([Khoironi et al., 2019](#); [Ledererová et al., 2019](#)).

Solving the problem of plastic waste by cleaning or disposing of plastic waste is not the best solution, even by burning it will only increase carbon emissions in the air ([Syafrudie, 2019](#)). One of the more effective ways to overcome the problem of plastic waste is to reduce the production and use of plastics in all aspects of human needs ([Khoironi et al., 2019](#)), especially disposable plastic waste ([Martín, 2015](#)). Plastic waste that pollutes the marine ecosystem will have an impact on marine organisms, and if humans consume seafood that exposed to plastic waste, it will hurt the human organ system ([Van et al., 2019](#)).

Plastic waste pollution has become one of the crucial problems, and the right solution must found immediately ([Gwada et al., 2019](#)). Japan is a developed country, which is successful in handling plastic waste ([Joshi et al., 2019](#)). Three strategies for handling plastic waste in Japan can be applied in Indonesia. First is the high priority of the community in the recycling program, secondly the emergence of social pressure from Japanese society if we do not throw garbage in its place and type. And third, a massive and aggressive educational program is carried out early ([Kong et al., 2017](#); [Quartey et al., 2015](#)).

The key to educating the public about the management and consumption of plastics is to increase awareness of the direct impact of plastic pollution and the health risks of plastic itself ([Anggraini & Karyanto, 2019](#)). The plastic manufacturing process involves a variety of chemical compounds, and plastic can absorb, release, and distribute pollutants to and from the environment ([Teuten et al., 2009](#)), plastic contamination occurs through chemical degradation and washing and macro plastic fragmentation to microplastic ([Ledererová et al., 2019](#); [Martín, 2015](#)).

The idea of innovation in the form of an educational program is one alternative to overcome the problem of environmental pollution due to plastic waste (Puji & Sumarno, 2019). Educational programs that can be carried out early, namely in the management of plastic waste in school life (Rodrigues, 2014). Environmental education, which was implemented in the Adiwiyata School program, highlighted the quality of the environment and pollution from plastic waste (Caddafie et al., 2017; Maryono, 2015).

Schools as a gathering place for many people can become the biggest waste producer besides markets, households, industries, and offices (Desfandi et al., 2017; Fadlilah & Ngabekti, 2018; Puji & Sumarno, 2019). In general, waste can be separated into (1) Organic/rotten waste originating from food scraps, vegetable waste and fruit skins, fish and meat scraps, garden waste (grass, leaves, and twigs). (2) Inorganic rubbish/not easy to rot in the form of paper, wood, fabric, glass, metal, plastic, rubber, and soil. (3) Waste generated by schools is mostly dry waste, and only a small amount of wet waste (Desfandi et al., 2017; Maryono, 2015; Warju et al., 2017).

Dry waste produced mostly in the form of paper, plastic, and a little metal. While wet waste comes from tree leaves, food scraps, and banana leaves that wrap food, in waste management, sorting is done by separating into organic and non-organic waste groups and placed in different containers (Bahrudin et al., 2018). One of them with the 3R concept, namely: *Reuse* is the use of certain rubbish that is still possible to be used [reuse of used bottles]. *Reduce* (reduction) is trying to reduce everything that can cause rubbish and reduce existing rubbish. *Recycle* is to use particular rubbish to be processed into more useful items [organic recycling waste into compost].

For rubbish that cannot be handled within the scope of the school, it is collected to the Temporary Shelter (TPS) that has been provided for later transported by the janitor to the Final Disposal Site (TPA). Waste discharged to the TPS is placed based on the waste sorting that has been done. This is done because organic waste decomposes quickly, while non-organic waste takes longer to rot, so it requires special treatment. For polling stations that are deliberately provided by the school, the polling station should be in the form of a hole that is equipped with a cover system so that rats, insects, and certain animals do not enter into it and also to avoid the smell from garbage that can interfere (Daesusi & Asy'ari, 2019; Fairus et al., 2020). To facilitate the reach, small trash bins are usually placed in places that are easily accessible as temporary waste storage sites before being disposed of at the TPS.

Garbage collection in this garbage bin should also be separated into organic and inorganic waste bins, and when it is full, it must be immediately disposed of at the TPS or immediately taken by the janitor to be disposed of at the landfill. This study wanted to find out the involvement and behavior of students attending school in urban and rural areas in the management of plastic waste. Indicators of student behavior in waste management consist of the types of waste disposed of, students' willingness to dispose of the plastic waste following its grouping, as well as frequent disposal of plastic waste.

## METHODS

### Research Sample

The research subjects were in urban areas as many as 30 students, which were Adiwiyata schools in Central Java Province, and subjects in rural areas were 30 students who were non-Adiwiyata schools. Data collection instruments using questionnaires on teachers and students, and using interviews with several students and teachers.

### Instrument and Procedures

The research method used was a survey method, which was carried out in senior high schools in urban and rural areas. The question items compiled in the questionnaire are intended to find out about respondents' knowledge in using plastic bags, while the interviews conducted aim to find out the respondents' participation in using plastic bags. The questionnaire consisted of ten questions relating to information on knowledge about plastics, the use of plastics, the impact of the use of plastics, and the management of plastic waste. The selected stakeholders in the survey are high school students who study in urban and rural areas in the Solo area.

## FINDINGS

The issue of waste management has long been a global issue; various efforts have been made to try to overcome this waste problem. However, the problem often faced is not only related to technical issues but is closely related to local cultural and socio-political factors. So far, the Indonesian people's awareness of cleanliness is better. It's just that it's still in a small environment, one of which is at home. Displacement of rubbish inside the house can be said to be clean, but the rubbish moves like in a ditch, in a river, even in an empty yard from the neighbor's yard.

One of the waste management strategies in Japan is through a massive and aggressive educational program carried out early (Kong et al., 2017). This innovative idea is one alternative to overcome the problem of environmental pollution due to plastic waste (Puji & Sumarno, 2019). Educational programs that can be carried out early, namely in the management of plastic waste in school life. Environmental education, which was implemented in the Adiwiyata School program, highlighted the quality of the environment and pollution from plastic waste.

The research findings were carried out using a questionnaire consisting of ten questions. The first question aims to find out the use of plastic bags in students' shopping activities in the school canteen. The results of the respondents' analysis are presented in Table 1.

**Table 1:** Results of Analysis of Respondents' Knowledge about the Use of Plastic Bags

School	X <sub>1</sub> f (%)	X <sub>2</sub> f (%)	X <sub>3</sub> f (%)
The Urban	13 (43)	15 (50)	2 (7)
The Rural	12 (40)	10 (33)	8 (27)

Explanation:

X<sub>1</sub> = Necessary and useful but damaging to the environment;

X<sub>2</sub> = Useful but can increase waste;

X<sub>3</sub> = Do not know;

The second question aims to find out the respondent's knowledge about the types of plastic bags, which are commonly used in daily life. The results of the analysis of respondents' responses are presented in Table 2.

**Table 2:** Results of Analysis of Respondents Knowledge About Types of Plastic Bags

School	X <sub>1</sub> f (%)	X <sub>2</sub> f (%)	X <sub>3</sub> f (%)
The Urban	12 (40)	17 (57)	1 (3)
The Rural	11 (37)	14 (47)	5 (17)

Explanation:

X<sub>1</sub> = Recycled plastic and non-recycled plastic; X<sub>2</sub> = Crackle plastic and environmentally friendly plastic; X<sub>3</sub> = Do not know.

The third question aims to find out the respondent's knowledge about the impact of using plastic bags. The results of the analysis of respondents' responses are presented in Table 3.

**Table 3:** Results of Analysis of Respondents' Responses about the Impact of Using Plastic Bags

School	X <sub>1</sub> f (%)	X <sub>2</sub> f (%)	X <sub>3</sub> f (%)
The Urban	11 (37)	16 (53)	3 (10)
The Rural	9 (30)	14 (47)	7 (23)

Explanation:

X<sub>1</sub> = Plastic bags that are difficult to decompose, have a long life to disrupt water and air passages into the ground;

X<sub>2</sub> = When you throw away trash, plastic bags that accumulate can disrupt your aesthetics;

X<sub>3</sub> = Do not know;

The fourth question aims to find out the respondent's attitude towards reducing the use of plastic bags in daily activities. The results of the analysis of respondents' responses are presented in Table 4.

**Table 4:** Results of Analysis of Respondents' Responses about Reduction in Production of Plastic Use

School	X <sub>1</sub> f (%)	X <sub>2</sub> f (%)	X <sub>3</sub> f (%)
The Urban	15 (50)	11 (37)	4 (13)
The Rural	8 (27)	14 (47)	8 (27)

Explanation:

X<sub>1</sub> = Agree; X<sub>2</sub> = Quite agree; X<sub>3</sub> = Not agree

The fifth question aims to find out the respondent's knowledge about the principle of reducing, as one of the strategies in reducing the use of plastic bags. The results of the analysis of respondents' responses are presented in Table 5.

**Table 5:** Results of Analysis of Respondents' Responses about the Reduce Principle

School	X <sub>1</sub> f (%)	X <sub>2</sub> f (%)	X <sub>3</sub> f (%)
The Urban	17 (57)	10 (33)	3 (10)
The Rural	9 (30)	11 (37)	10 (33)

Explanation:

X<sub>1</sub> = Refuse to use plastic bags and use your shopping bag from home instead;

X<sub>2</sub> = Reducing the use of objects that quickly become junk;

X<sub>3</sub> = Do not know;

The sixth question aims to find out the respondent's knowledge about the use of personal shopping bags when shopping at shopping centers. The results of the analysis of respondents' responses are presented in Table 6.

**Table 6:** Results of Analysis of Respondents' Responses about the Use of Shopping Bags

School	X <sub>1</sub> f (%)	X <sub>2</sub> f (%)	X <sub>3</sub> f (%)
The Urban	15 (50)	12 (40)	3 (10)
The Rural	8 (27)	10 (33)	12 (40)

Explanation:

X<sub>1</sub> = Can reduce the use of plastic bags, so that plastic waste is also reduced;

X<sub>2</sub> = The use of shopping bags does not have any positive impact;

X<sub>3</sub> = Do not know;

The seventh question aims to find out the respondent's understanding of using items that can be reused repeatedly. The results of the analysis of respondents' responses are presented in Table 7.

**Table 7:** Results of Analysis of Respondents' Responses regarding the use of goods

School	X <sub>1</sub> f (%)	X <sub>2</sub> f (%)	X <sub>3</sub> f (%)
The Urban	16 (53)	12 (40)	2 (7)
The Rural	7 (23)	9 (30)	14 (47)

Explanation:

X<sub>1</sub> = Agree; X<sub>2</sub> = Quite agree; X<sub>3</sub> = Not agree;

Question eight aims to find out the respondent's knowledge of the reuse principle. The results of the analysis of respondents' responses are presented in Table 8.

**Table 8:** Results of Analysis of Respondents Knowledge about Reuse

School	X <sub>1</sub> f (%)	X <sub>2</sub> f (%)	X <sub>3</sub> f (%)
The Urban	16 (53)	11 (37)	3 (10)
The Rural	8 (27)	13 (43)	9 (30)

Explanation:

X<sub>1</sub> = Reusing goods/objects that can be used for a long time;

X<sub>2</sub> = Using recycled goods;

X<sub>3</sub> = Do not know;

Question nine aims to find out the application of the reuse principle in shopping bags. The results of the analysis of respondents' responses are presented in Table 9.

**Table 9:** Results of Analysis of Respondents' Knowledge of the Application of the Reuse Principle

School	X <sub>1</sub> f (%)	X <sub>2</sub> f (%)	X <sub>3</sub> f (%)
The Urban	16 (53)	12 (40)	2 (7)
The Rural	9 (30)	11 (37)	10 (33)

Explanation:

X<sub>1</sub> = Shopping bags that are brought by yourself from home can save the use of plastic bags, and shopping bags have a long usage life;

X<sub>2</sub> = Shopping bags with unique designs make users look cool;

X<sub>3</sub> = Do not know;

The tenth question aims to determine the willingness of the respondents to bring their shopping bags from home. The results of the analysis of respondents' responses are presented in Table 10.

**Table 10:** Results of Analysis of Respondent Responses to Willingness to Carry Personal Shopping Bags

School	X <sub>1</sub> f (%)	X <sub>2</sub> f (%)	X <sub>3</sub> f (%)
The Urban	14 (47)	10 (33)	6 (20)
The Rural	6 (20)	9 (30)	15 (50)

Explanation:

X<sub>1</sub> = No need to reason because you are aware and care about the environment;

X<sub>2</sub> = If the store/retail does not provide plastic bags anymore;

X<sub>3</sub> = If the plastic bag is no longer free;

## DISCUSSION

Management of plastic waste management in many cities, especially in developing countries, the waste management system developed by the government and the private sector is not able to overcome the number of existing landfills (Yintii et al., 2018; Mihai, 2017). The city of Solo has a role as the center of all activities; this is an attraction that causes the city growth to grow rapidly over time. The higher utility that is successfully obtained by a city will affect the population growth of the city.

Increased urban population growth is proportional to the use of plastic as a medium used in everyday life (Procházková et al., 2019). Disposable plastic material is an important part of most Indonesian people; this is because it is easy to carry, portable, strong, abundant in size and shape, inexpensive, and easy to obtain (Khoironi et al., 2019; Ledererová et al., 2019). The use of plastic as a drink bottle is a simple example that is widely used, one of which is by students who are not only students in urban or rural schools.

The findings in the field show that the average response rate of respondents attending urban schools was 85% while rural students were 73%. The research findings show that students who attend schools in urban areas have higher waste care behavior than students who attend schools in rural areas. The results of the interviews of researchers (RS) with respondents (SJ) who attend urban schools are as follows:

RS: How many times a month do you shop at the supermarket?

SJ: Usually once a month!

RS: How many plastic bags do you use every day?

SJ: Not sure, sometimes five bags and sometimes only one bag

RS: After you use it, what do you do with the plastic bag?

SJ: Disposed in the trash, sometimes stored for reuse

RS: Do you carry out any recycling of the plastic bags?

SJ: Yes, because it can still be utilized

RS: Do you currently use shopping bags when shopping?

SJ: Yes!

RS: Do you want to accept the seller's policy of not providing plastic bags for free when shopping?

SJ: Yes!

RS: Do you want to carry environmentally friendly shopping bags wherever you go when you do your daily activities as a storage container for groceries?

SJ: Yes!



The findings and interviews of researchers with respondents who study in urban areas show the concern of urban students in the management of plastic bag waste that they use in their daily lives. Since plastic waste accounts for 13.39% of the total garbage in Solo City, which reaches 265 tons per day, the environmental service through the implementation of the Adiwiyata school educates students to be wise in using plastic bags.

Plastic waste, including plastic bags, is affected by socio-economic developments, and the level of industrialization (Saldana & Messiana, 2016; Singh & Sharma, 2016). Municipalities, municipalities, and city communities who are driven by laws and regulations have made regulations for waste management, which aim to reduce the amount of waste thrown into landfills, and for recycling. In cities in developed countries, where the plastic waste management system is concerned with using the principle of Reuse, recycling, and incineration (Issahaku et al., 2014; Singh & Sharma, 2016).

The management of plastic waste in the city of Solo has the support of entrepreneurs in shopping centers and modern shops in Solo. One of the strategies implemented is through tightening or suppressing the use of plastic bags by charging special fees for requests for issued plastic bags, and some are willing to give discounts to customers who carry green bags. Respondents in the study also agreed if the use of plastic bags in shopping centers was not given free of charge.

Unlike the case with waste management in rural areas, the majority of rural residents prefer waste management by burning. The classic reason for burning rubbish is that rubbish does not accumulate (Mihai, 2018). In this way, there is no mountainous rubbish heap, plus in rural areas, there is no village plastic waste management like in urban areas. Singh & Sharma's research results (Singh & Sharma, 2016), that when plastic waste accumulates, it can be possible to meet other substances such as chloride (in food scraps), if these substances meet then burned then dioxins and furans can be produced which if inhaled can cause coughing, shortness of breath and dizziness (Rahmawati & Suwanda, 2015).

The role of villagers in sorting organic and inorganic waste is still low. These results in mixed garbage dumped into the Landfill (TPS), not yet separating organic and non-organic waste. The results of the interview of researchers (RS) with respondents (SJ) who attend rural schools are as follows:

RS: How many times a month do you shop at the supermarket?

SJ: Rarely, usually only in a neighbor's shop!

RS: How many plastic bags do you use every day?

SJ: Not necessarily, sometimes two bags and sometimes only one bag

RS: After you use it, what do you do with the plastic bag?

SJ: Burned!

RS: Do you carry out any recycling of the plastic bags?

SJ: No!

RS: Do you currently use shopping bags when shopping?

SJ: No!

RS: If not, what is the reason you don't use shopping bags when shopping?

SJ: A plastic bag has been provided by a store clerk.

RS: Do you want to accept the seller's policy of not providing plastic bags for free when shopping?

SJ: Disagree!

RS: If not, what is the reason you do not want to accept it?

SJ: Because staples are expensive, they are burdened by paying plastic bags

RS: Do you want to carry environmentally friendly shopping bags wherever you go on your daily activities as a storage container for groceries?

SJ: No!

RS: If not, what is the reason you do not want to carry shopping bags wherever you are during your daily activities?

SJ: Trouble bringing it.

The findings and interviews of researchers with respondents who study in rural schools show less concern for rural students about the environment, especially in the management of plastic bags. This is because the use of plastic has unconsciously played an important role in all aspects of human needs given the various advantages of plastic materials more than using other materials, such as glass (Puji & Sumarno, 2019).

Besides, it has become a tradition for rural communities to use plastic bags when shopping at neighbor's free stalls. The pattern adopted by the village community in disposing of the waste is in the vacant land, the garden behind the house, or in the litter ([Muflihaini & Suhartini, 2019](#)). Some students who study in rural areas use plastic bottles as a place to drink. Most used plastic bottles for mineral water and other soft drinks are made from polymer polyethylene terephthalate (PET) material, which is highly recyclable ([Khoironi et al., 2019](#); [Sushma, 2018](#)).

Habits that arise in rural students when the plastic bottles are no longer suitable for use, then immediately discarded. This shows the lack of education of rural students about the concept of recycling. The type of plastic made from PET is recommended for disposables because of the risk of bacterial growth that results if used again ([Mortula, 2013](#); [Sushma, 2018](#)). However, by using PET-based plastics thus increasing the number of uses of PET-based plastic throughout the world.

Used beverage bottles made from PET can be recycled into plastic pellets. Likewise, used beverage cans made of metal. This type of waste should also be sorted, collected, and then sold ([Sadino et al., 2016](#)). Children can also be creative in arranging them into handicrafts or wall hangings. With this sorting system students are expected to learn how trash that was originally dirty and disgusting turned out to have a sale value. Economic subjects can be learned from a pile of garbage at school.

Students will realize that there are work opportunities around them, not only sought but can also be created. In designing waste management in schools, students need to be actively involved. This can be done by forming teams on duty on a scheduled basis. Periodic exhibition and competition activities can be carried out to increase awareness of waste management. Writing on a blog or wall magazine is a good exercise to grow the souls of managing waste. So that new awareness appears that "Trash is not a problem, but an opportunity".

## CONCLUSION

The results showed that there were enthusiastic differences between rural and urban students in the management of plastic waste; the average concern of urban students was 85% while rural students were 73%. The research findings show that students who attend schools in urban areas have higher plastic waste care behavior than students who attend schools in rural areas. The tradition of rural communities exacerbates this in using plastic bags when shopping at neighboring stalls given free. Management of plastic waste management in many cities, especially in developing countries, the waste management system developed by the government and the private sector is not able to overcome the number of existing landfills. The city of Solo has a role as the center of all activities; this is an attraction that causes the city growth to grow rapidly over time. The higher utility that is successfully obtained by a city will affect the population growth of the city.

## LIMITATION AND STUDY FORWARD

The limitations of the discussion of this article are carried out only in the Solo area so that in other regions it cannot be reached given the limited time and research funding. For further studies an analysis of student behavior at the Adiwiyata School, related to the attitude of disposing of garbage at Adiwiyata at the national, provincial, or city level. So that it can be mapped one indicator of success in the Adiwiyata school goals.

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## AUTHORS CONTRIBUTION

The first author contributed to the selection of research topics, data collection, and data analysis. The second and third authors contributed to increasing the depth of discussion. Whereas the fourth author contributes to the improvement provided by reviewers, increasing the depth of discussion and presentation of data.

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