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Evaluating Criteria and Art-Based Interventions for Littering Behavior of Millennials in Yogyakarta

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Abstract
The littering issue and its impact on environmental sustainability has attracted various attempts to prevent it from worsening. Much research has been done to understand the frequent causes of the problems that led to littering behavior. The intervention from many disciplines to cope with this issue also led to artistic movements and creative approaches. However, the littering problem in Yogyakarta still exists due to the assumption of miss identification of the predictors of the littering behavior. To begin evaluating the art intervention and its application, this research uses a quantitative survey that 115 participants filled out to look at the criteria that cause littering behavior among millennials. A correlation test and regression analysis examine the highest possible value of influence to affect the littering behaviors in millennials divided into internal factors (level of awareness and individual differences) and external factors (access and availability of cleaning facilities, product design, environment characteristics, and law/regulation). Through this analysis, the most powerful conscience will be intervened by art or design, which will hopefully lead to further research, such as redesigning the cleaning facility and the product based on user experience and using design approaches to raise awareness and environmental conditioning of the litter problem.

***Keywords**: design intervention, littering behavior, millennials*

Evaluasi Kriteria dan Intervensi Berbasis Seni pada Perilaku Buang Sampah Milenial di Yogyakarta

Abstrak
Persoalan membuang sampah sembarangan dan dampaknya terhadap kelestarian lingkungan telah mendorong banyak upaya untuk mencegahnya menjadi lebih buruk. Banyak penelitian telah dilakukan untuk memahami penyebab umum permasalahan yang mengarah pada konseptualisasi perilaku membuang sampah sembarangan. Intervensi berbagai disiplin ilmu untuk mengatasi masalah ini juga memunculkan gerakan artistik dan pendekatan kreatif. Meski telah dilakukan dengan berbagai cara, permasalahan membuang sampah sembarangan di Yogyakarta masih terjadi akibat adanya asumsi yang salah dalam mengidentifikasi prediktor perilaku membuang sampah sembarangan. Untuk mulai mengevaluasi intervensi seni dan penerapannya, penelitian ini menggunakan survei kuantitatif yang diisi oleh 116 peserta untuk melihat kriteria yang menyebabkan perilaku membuang sampah sembarangan di kalangan generasi milenial. Uji korelasi dan analisis regresi menguji besarnya pengaruh yang paling besar terhadap perilaku membuang sampah sembarangan pada generasi milenial yang dibagi menjadi faktor internal (tingkat kesadaran dan perbedaan individu) dan faktor eksternal (akses dan ketersediaan fasilitas kebersihan, desain produk, karakteristik lingkungan, dan hukum/peraturan). Melalui analisis ini, hati nurani yang paling kuat akan diintervensi oleh seni atau desain, yang diharapkan akan mengarah pada penelitian lebih lanjut seperti mendesain ulang fasilitas pembersihan dan produk berdasarkan pengalaman pengguna dan penggunaan pendekatan desain untuk meningkatkan kesadaran dan pengkondisian lingkungan.

***Kata kunci:** intervensi desain, perilaku membuang sampah sembarangan, generasi milenial*

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INTRODUCTION

As illustrated by several facts, Yogyakarta's waste disposal issue could be much bigger. One of the factors that might influence this phenomenon is the limited trash bins available. Concrete evidence supports this is trash scattered in various public places in Jogja. Despite the government's efforts to provide several trash bins, many areas still need to be cleaned due to scattered trash. For example, a report from Radar Jogja indicates that throughout the Gumaton area, trash can still be scattered about even though efforts have been made to provide trash bins (Fatimah, 2022). Although there is hope that increasing the number of trash bins can overcome this problem, an interesting finding shows that there is only sometimes a correlation between the number of trash bins and the level of littering behavior. This contradiction shows the complexity of efforts to increase awareness and better behavior in waste management in Yogyakarta.

The situation in Yogyakarta indicates a waste emergency, which illustrates a lack of awareness in sorting waste. Even though the government has appealed to segregate waste, this appeal has not received sufficient attention, especially with the closure of the Piyungan Integrated Waste Disposal Site (TPST) (Rinepta, 2023). Other news shows that people in Yogyakarta are still reluctant to sort waste, as seen by piles of garbage that need to be adequately separated (Ria, 2023). The inability to sort this waste significantly impacts the accumulation of waste, which continues to grow without any visible signs of decline.

The high amount of waste found in the riverside also indicates the locals' ignorance of the environment. This phenomenon raises questions about environmental education being applied to residents because if the river is considered the last place to dispose of garbage, this reflects indifference to the surrounding environment (Aldan, 2022). Individual knowledge about the environment significantly impacts littering behavior, and this factor is very influential in causing the problem of accumulation of waste in public spaces.

A design approach is known to have the ability to change behavior in many cases. However, as discussed earlier, the lack of awareness requires a stimulus to encourage behavior change. A study highlights the importance of understanding the underlying factors of littering behavior (Chaudhary et al., 2021). In this context, the knowledge can lead to an inappropriate and appropriate strategy. Therefore, a holistic approach to addressing littering must be based on an in-depth understanding of the underlying problems before designing and implementing an effective strategy according to the context.

The government's lack of waste management innovation in Yogyakarta reflects the need to reduce waste. The data has not improved due to the lack of stringent fines for trash segregation (n.n, 2023). The piling of rubbish in the Piyungan Integrated Rubbish Disposal Site (TPST) and other waste collecting sites

shows the government's poor waste management (Rinepta, 2023). In this case, a design that combines knowledge and aesthetics is needed. Such an approach can improve trash management, making the environment cleaner and more sustainable.

Although convenience alone is not a sufficient reason, examining the littering habit of millennials in Yogyakarta has a distinct value. Their demographic attributes, such as heightened autonomy and technological proficiency, impact their consumption habits and possible openness to digital interventions. Moreover, their heightened ecological consciousness and willingness to embrace change render them a captivating demographic to focus on when implementing behavior modification tactics. Furthermore, considering the distinct millennial demographic in Yogyakarta and the littering issues that this generation faces in the city enhances the study's local significance and applicability to other contexts. By thoroughly examining the existing body of research and emphasizing these distinctive characteristics, we can convincingly justify our decision to concentrate on millennials for this significant and influential study.

The main objective of this study is to identify the factors that influence littering behavior in Yogyakarta, intending to provide suggestions for an effective and optimal artistic approach. A comprehensive understanding of the factors that influence this behavior is crucial because it is needed to design interventions to address this problem effectively. The hypothesis in this study states that art and design interventions can significantly help reduce littering behavior, especially among millennials, provided specific predictive factors can be identified. This hypothesis emphasizes the potential effectiveness of artistic strategies in reducing littering behavior, depending on the proper identification of influencing factors among millennials.

RESEARCH METHODOLOGY

Participants

The participants of this research consisted of 12 (21.7%) Generation X, 67 (58.3%) millennials, 23 (20.0%) Generation Z (N=115, 40 (34.8%) males and 75 (65.2%) females) from four main areas in Yogyakarta: Bantul (n=50), Gunung Kidul (n=3), Central Yogyakarta (n=29), and Sleman (n=33). The chart below shows the diversity of educational backgrounds and occupations among participants.

Materials and Procedures

A questionnaire developed primarily for this study covering five primary factors: littering behaviour as the outcome variable, awareness, accessibility, product design, and environmental conditioning as predictor variables.

The development of the five key factors explored in the questionnaire (littering behavior, awareness, accessibility, product design, and environmental conditioning) involved a two-pronged approach. While initial brainstorming sessions within our team generated initial ideas, the primary foundation for their selection lies in a comprehensive literature review. Chaudhary et al. (2021)'s insightful systematic review on littering behavior provided a strong starting point, and additional studies were explored to gain a holistic understanding of relevant factors. This review process informed our discussions and allowed us to refine and justify each variable based on its (a) prevalence across various sources, (b) relevance to the specific context of littering behavior in Yogyakarta, and (c) feasibility of measurement within our research design. Throughout this process, we meticulously documented and referenced key studies, findings, and theoretical concepts that bolstered the evidence-based foundation for the chosen variables. This dual approach, acknowledging the initial brainstorming while emphasizing the rigor of the literature review, ensures both transparency and academic legitimacy in selecting our research instrument.

The reliability test for each factor is as follows: littering behavior (Cronbach's α=.582), awareness (Cronbach's α=.400), accessibility (Cronbach's α=.491), Product design (Cronbach's α=.342), environmental conditioning (Cronbach's α=.542) and overall scale (Cronbach's α=.446). Based on this result, some factors of the questionnaire lack reliability, such as product design. Meanwhile, the KMO test (.588) showed the adequacy of the sample in this survey.

The items in the questionnaire are divided into two sections. The first section contained identity and demographic questions such as name, birth year, occupation, sex, and educational background. The second section covered the five abovementioned factors using a 5-Likert scale indicating the degree of agreeableness. All questionnaire elements were written in Bahasa Indonesia due to the participant's primary language. The questions in the questionnaire items consisted of statements such as "I know how to do composting" and "I tend to put the trash in a bin." The participants can fill out all of the questionnaire questions in under 10 minutes following the suggestion of online survey length.

Data was collected through an online survey instrument designed and hosted on a Google Form. The instrument comprised 30 meticulously crafted questions, measuring five key factors identified within the relevant literature: littering behavior as the primary outcome variable and awareness, accessibility, product design, and environmental conditioning as the predictor variables. To achieve representativeness across diverse segments of the Yogyakarta population, the survey link was strategically disseminated across various social media platforms, reaching participants from many communities within the city. All participants

actively completed the survey after providing informed consent and acknowledging their comprehension of the research procedures.

Data Analysis

The participants' responses from Google Forms were first converted into CSV files and imported into the Statistical Package for the Social Science v. 26 for further data cleansing and analysis. The level of significance is set to .05 for all statistical tests. The first analysis step is data cleansing to remove unnecessary columns, such as timestamps, that automatically appeared in Google Form extraction. The next step is to reverse the unfavorable items and add the scores from items in the same factor. The questionnaire was tested for reliability by examining Cronbach's alpha and was adapted into SPSS suggestions for better-to-be-deleted items. The following analysis checks the samples' adequacy by investigating the KMO. The principal analysis is Pearson's correlation between the outcome and predictor variables.

RESEARCH RESULT

Pearson's overall correlation of all variables in the questionnaire is shown in the table below:

Table 1. Correlations of Five Factors

Correlations

		litteringbehavior	awarenessT	accessibility	productdesign	environmentalconditioning
litteringbehavior	Pearson Correlation	1	-.255**	-.158	.043	-.337**
	Sig. (2-tailed)		.006	.091	.650	.000
	N	115	115	115	115	115
awarenessT	Pearson Correlation	-.255**	1	.207*	.169	.280**
	Sig. (2-tailed)	.006		.026	.071	.002
	N	115	115	115	115	115
accessibility	Pearson Correlation	-.158	.207*	1	.137	.213*
	Sig. (2-tailed)	.091	.026		.143	.022
	N	115	115	115	115	115
productdesign	Pearson Correlation	.043	.169	.137	1	.264**
	Sig. (2-tailed)	.650	.071	.143		.004
	N	115	115	115	115	115
environmentalconditioning	Pearson Correlation	-.337**	.280**	.213*	.264**	1
	Sig. (2-tailed)	.000	.002	.022	.004	
	N	115	115	115	115	115

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

The Correlation between Littering Behavior and Environmental Conditioning

The analysis showed a significant negative correlation between the participants' littering behavior and environmental conditioning (r=-.337, p=.000). The environmental conditioning, which is operationalized as the habits embodied

in individuals about the positive attitude toward the environment and littering, has the opposite relationship with littering behavior indicated by the negative correlation between the two variables. The more individuals have excellent environmental conditioning about littering issues, the less they litter around. Nevertheless, the correlation is at a low level regarding the correlation coefficient.

The Correlation Between Littering Behavior and Awareness

Awareness, one of the predictor variables operationalized as the tendency of individuals to be aware of climate change and environmental issues due to the exposure to information related to these things, is negatively correlated with littering behavior in significant value. It means that the more individuals are exposed to environmental issues, the less they tend to litter. Even less than the previous predictor, ecological conditioning, this predictor has a lower correlation with littering behavior with r=-.255, p=.006.

The overall correlation between outcome and predictor variables

The other predictors, such as accessibility and product design, showed no significant correlation with littering behavior ($r_{accessibility}$=-.158, p=0.91; $r_{productdesign}$=.043, p=.650). This result might occur due to the lack of a relationship *per se* or the low reliability of the questionnaire used in this study.

DISCUSSION

Key Findings

Based on the results of a questionnaire to assess five littering behavior-related factors: awareness, accessibility, product design, environmental conditions, and littering behavior itself, according to the study findings, environmental conditions and awareness are two major elements associated with trash disposal behavior, as seen by the survey results, which indicate higher numbers when compared to other variables. According to the study, interventions aiming at improving environmental conditions and raising awareness can be beneficial in lowering littering behavior. Thus, raising awareness and improving environmental conditions can be extra elements in addressing Yogyakarta's garbage disposal problem.

The reliability test findings suggest that the questionnaire has low reliability for the littering behavior factor. The KMO test, on the other hand, demonstrates that the sample size is adequate. If the desired outcome is to be used as a predictor, it is recommended to employ a measuring instrument or attitude scale adapted from previous research. Furthermore, remember that the descriptive statistics generated by this research can only offer criteria and cannot establish influences or linkages

(1). As a result, given the low degree of credibility in the survey, the study is more suited to act as an evaluative guide than to provide strong predictions.

The Implications of the Study

The significance of including trash littering behavior in this research is relevant because earlier research has examined it. However, it should be highlighted that garbage disposal behavior differs across industrialized and developing countries, necessitating additional research, particularly in Indonesia a developing country. In prior studies, factors such as trash can availability, environmental cleanliness, and littering norms have been identified as the key predictors of littering behavior However, gaps in prior studies need to be filled, such as collaboration with the government and social marketing techniques to overcome the problem of trash disposal behavior (Chaudhary et al., 2021). As a result, our research focuses on addressing this information gap to provide a more thorough understanding of littering behavior, particularly through designing interventions.

The association between environmental circumstances and littering behavior is an essential subject of this research since a clean environment encourages people to keep their homes clean. Furthermore, environmental factors, referred to as "environmental efficacy," are important in shaping healthy littering behavior since they might affect an individual's long-term cognition. The notion of "Gakko soji," included in the Japanese curriculum, is used to teach pupils environmental principles, emphasizing the necessity of early environmental education (Syakura et al., 2020).

The millennial generation, which accounts for most respondents (58.3%), was also highlighted. This generation is critical in exhibiting the outcomes of previous education and setting a good example for future generations in the context of trash disposal behavior.

With a score of 0.255, the relevance of awareness in the context of littering behavior is the primary emphasis of this research. Awareness is the cornerstone of good habits, and its strong association with littering behavior may be observed by comprehending the importance of environmental cleanliness, protecting nature, and sustaining public health (Aziz et al., 2019). This awareness is established by parental teaching, which builds positive behaviors in children at a young age. In trash disposal behavior, awareness also refers to the ability to characterize one's behaviors for properly disposing of waste (Herdiansyah et al., 2021).

However, more comprehensive environmental education is required in Indonesia to raise awareness about littering behavior. This is required to better prepare future generations for environmental management and to bridge the perception gap in understanding environmental challenges (Dhahir, 2020). Awareness is directly tied to establishing good habits beginning at a young age,

providing an important basis for more effectively conquering the problem of littering behavior.

Figure 1. Smart Bins: Interaction Design for Waste Minimization is an example of a design that provides users with educational understanding.
Source: https://art.washington.edu/research/projects/smart-bins-interaction-design-waste-minimization

The goal of observing littering behavior is to develop a waste management system suitable for the location context and population behavior. Littering has become the source of major waste management issues in Indonesia, which have yet to be handled. Significant reforms in waste management have not been implemented, particularly in the Yogyakarta Special Region Government region (n.n, 2023). Cooperation between government rules and stakeholders is required to give support following community rights through waste management improvements. It is envisaged that in the future, more parties will pay attention to the problem of trash disposal behavior in Indonesia, resulting in new, more effective, and efficient approaches to constructing a waste management system.

Figure 2. Design for more accessible waste sorting in waste management made by Public Design Lab of Hongkong Polytechnic University.
Source: https://globaldesignnews.com/bins-is-more-than-a-line-of-waste-bins-for-nine-categories-of-recycling-its-designers-from-the-public-design-lab-of-hong-kong-polytechnic-university-have-achieved-a-universalized-standard/

Accessibility and product design, in this research, did not reveal a significant association with littering behavior. It should be recognized, however,

that design interventions have the potential to raise awareness and improve conditions in the environment. This is because design and facilities play a key role in facilitating successful waste management. Distance to a trash can, for example, can be a substantial predictor of littering behavior, and providing a trash can that is recognized, highly accessible, and has clear, recognizable messaging can also play a significant role in littering behavior (Schultz et al., 2013). Also, the primary focus is on changing people's behavior to encourage proper littering action; raising awareness will not prevent all littering, said Jens Rupp, the PMI Head of Environmental Sustainability (n.n, 2020).

Although not universally understood by all questionnaire participants, "product design" significantly impacts behavior beyond its literal interpretation. The design choices of waste bins and public spaces subtly shape human behavior. A bin with a convoluted entry or positioning can discourage appropriate garbage disposal. On the other hand, well-designed bins with easily understandable labels, user-friendly characteristics, and an attractive appearance can unconsciously promote responsible behavior. Public space design mitigates littering by implementing designated disposal areas, fostering community pride, and promoting effective waste management practices. Hence, "product design" encompasses more than just the visual appeal of a product. The intentional decisions made in designing and shaping our physical surroundings significantly impact our everyday actions, such as littering, in subtle but major ways.

Figure 3. The design to encourage a better cigarette butts' disposal.
Source: https://www.pmi.com/sustainability/integrated-report-2020/littering-prevention-progress-2020

In industrialized countries with an established waste management system, such as Germany, they seek to construct tools and facilities that support waste management activities to boost their efficacy (Igini, 2023). Another domestic example is Banyumas, which became viral because waste processing necessitates the use of machines designed to segregate organic and inorganic garbage at its TPST (Tempat Pengelolaan Sampah Terpadu) to optimize waste management (Sumarwoto, 2023). As a result, it is claimed that the intervention design can increase environmental awareness and circumstances. In this context, product design focuses on providing facilities that can improve environmental awareness

and circumstances because the waste management system will not function properly if suitable facilities are not provided. Thus, focusing on product design to boost environmental knowledge and conditions is critical in improving waste management efficacy.

Figure 4. Banyumas waste sorting machine design.
Source: https://www.bandung.go.id/news/read/8114/soal-pengelolaan-sampah-pemkot-bandung-belajar-ke-banyumas

Limitations of the Study

It is essential to highlight that there is a chance that the outcomes of this study will be less than expected. As a result, for future research, a qualitative technique using direct interviews at the case study location may be more appropriate. This method is deemed more objective and can provide a better environment for finding answers to important societal problems. This study relied on a self-report questionnaire, which is susceptible to bias. However, the more essential focus of this research is on how design solutions in future research might effectively address existing social problems while accommodating many relevant situations.

Recommendations

The government and its policies are critical in promoting better littering behavior and waste management. However, community involvement and willingness to change are important aspects of this attempt. Collaboration between the government and the community in the framework of more effective waste management can help accomplish mutual goals in eliminating the waste problem.

Environmental issues and public awareness must highly influence Yogyakarta's waste bin design and planning. When it comes to proper waste management, design interventions can be a good substitute that can help advance environmental knowledge and conditions. According to one study (Wever, 2010), the importance of waste reduction before and after design alterations should be investigated as the next step. Because design is essentially science applied to problems, design interventions are expected to positively shape better littering behavior in Yogyakarta.

CONCLUSION

In conclusion, the research on "Evaluating Criteria and Art-Based Interventions for Littering Behavior of Millennials in Yogyakarta" sheds light on the pressing issue of littering in Indonesia, with Yogyakarta serving as a stark reminder of the ongoing challenges in waste management. The primary causes identified through news and articles point to the lack of established waste management practices and the low littering behavior among millennials.

Further investigation revealed that the root causes of this littering behavior problem are the inadequate levels of awareness and insufficient environmental conditioning among millennials in Yogyakarta. These two critical factors, awareness and environmental conditioning emerged as essential criteria that must be enhanced to foster better littering behavior within the millennial population in Yogyakarta.

The awareness aspect relates to early childhood and environmental education, emphasizing the need for comprehensive educational initiatives to instill a sense of responsibility towards the environment. Simultaneously, the environmental conditioning factor is closely linked to the community's ecological efficacy and sensitivity, which can be achieved through widespread environmental education and supportive policies. A clean environment can encourage people to maintain its cleanliness.

While the research findings indicated that the influence of product design on littering behavior is relatively small, it is to be noticed. Design choices can serve as a tool to amplify awareness and contribute positively to environmental conditions. Therefore, integrating design elements that promote responsible behavior could play a role in the broader strategy to improve littering habits among millennials in Yogyakarta.

In conclusion, addressing the littering behavior of millennials in Yogyakarta requires a multifaceted approach that encompasses educational initiatives, environmental awareness campaigns, and thoughtful product design. By prioritizing awareness and environmental conditioning, along with the support of policies and education, we can work towards fostering a more responsible and environmentally conscious millennial population in Yogyakarta and, by extension, contribute to a cleaner and more sustainable Indonesia.

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