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PSYC 421: Environmental Psychology

Take Less, Waste Less: Reducing Plate Food Waste through Food Life-Cycle Signage

Research group: Alex Koronczay, Bonnie Liang, Brighita Mzee, Chloe Levasseur, Jethro Wang, Lorena Pagui, Raissa Neild

Executive Summary

Uninhibited consumerism in an all-you-can-eat dining hall setting generates both environmental concerns and financial difficulties for the business in question, necessitating consumer-based educational strategies to tackle excessive plate waste. This study targets consumer plate waste reduction at UBC's Open Kitchen dining hall through the development and implementation of cost-effective visual posters. Information on the posters included factual data on the process of food production and labour and an emphasis on "mindful consumption". Presented using cheerful language, the displays attempt to evoke a conscious engagement with the consumer through shifting perceived individual involvement in the food lifecycle. Consumer plate waste was measured before and after the study intervention through observation using a Likert scale and quantitative tracking in kilograms. The two stages were then compared and analyzed. The results successfully confirmed a significant correlation between signage that describes the food life cycle and reduction in customer plate waste.

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Introduction

Novel solutions for the modern wasteful consumption of food products and its resulting ecological impacts are needed more than ever—particularly in capitalistic developed countries— with data indicating that consumers in Europe and North America waste substantially more food annually than those in Sub-Saharan Africa (Catalano et al., 2024). In particular, university dining halls featuring all-you-can-eat buffets face significant risk of student overconsumption and food waste. At UBC, 615 tonnes of food waste were generated on campus in 2019 alone (UBC Sustainability, 2022), highlighting a significant need for research focused on food waste reduction in universities. Past research focused on education, policy interventions, and behavioural nudges as effective strategies for post-consumer food waste reduction (Schanes et al., 2018). Illustratively, Pinto et al. (2018) conducted a study utilizing a two-phase educational intervention in a university canteen setting, finding that poster displays with encouraging messages for dealing with food waste correlated with a reduction in plate waste by approximately 15%. This is contrasted by Ellison et al. (2019) implementing a similar food waste campaign—which differed in poster content—focusing instead on food waste-related negative consequences. Despite the latter approach leading to a significant increase in students' awareness, minimal waste reduction was observed, demonstrating the limitations of negative framing. In alignment with Pinto et. al's (2018) strategy, Whitehair et al. (2013) applied a tips and feedback intervention, showing that food waste could be cut by 15% through simple behavioural nudges. Despite extensive research on awareness campaigns and behavioural nudges, limited studies have investigated the direct impact of food life-cycle labelling—visual representations of food production, processing, consumption, and disposal—that can potentially increase consumers' awareness while decreasing consumer waste behaviour. This gap raises questions on how signage describing the food life-cycle could influence consumer food waste. Using the UBC Open Kitchen dining hall as a location, this study hypothesizes that signage that describes the food life-cycle will reduce customer's plate waste in the UBC dining hall compared to no signage at all. Existing literature suggests that as young people's awareness of food waste increases, their likelihood of reducing waste also improves (Principato et al., 2015). By incorporating posters informative of the food life-cycle which evoke conscious engagement, this research aims to assess how information about the food life-cycle influences student food waste behaviour. The findings could offer policymakers actionable insights into feasible food waste interventions that emphasize the role of perceived connection between the individual and their surrounding food systems as a way to motivate responsible consumption.

Methods

Participants

For this study, the required sample size was determined through a priori G*Power analysis. Based on the minimum effect size of d = 0.2, alpha (α) = 0.05, power = 0.80, and a within-subjects design with two groups, a minimum of N=788 participants is required to ensure sufficient statistical power. In our actual study, we surpassed our minimum with a total of 792 participants.

Our sample consists of people (students, dining hall staff, and walk-in customers) using the Open Kitchen dining hall, during dinner time (5-8pm). These participants should represent a diverse group that consumes food at UBC and are therefore relevant for our study on UBC food waste practices. As the study measured food waste at the dining hall level, demographic data of individual participants was not collected. However, it was observed that the sample seemed to be mostly composed of UBC students in the range of about 18-24 years old, diverse in terms of gender and ethnic background, and of a few dining hall staff members

Pre intervention = 396

Post intervention = 396

Conditions

Our study follows a between-subjects design with two conditions: **pre-intervention (control)** and **post-intervention (experimental)**. The independent variable is the presence of signage with food life-cycle labelling, which we operationalized as educational information of food production, processing, and consumption. We displayed a total of seven copies of the same poster in strategic positions within the space - before the serving area and on different buffet walls. The control group consists of customers dining in Open Kitchen prior to our signage being displayed, while the experimental group includes those dining there while the signage is played. Behavioural differences between these groups allowed us to assess the posters' impact on food waste behaviour in the hall.

Measures

We assessed whether the presence of our posters led to an effect on food waste intensity, our dependent variable. Food waste intensity was operationalized using a Likert scale (designed by our team); 0 for no avoidable food waste, 1 for minimal waste (1-2 extra pieces), 2 for moderate waste (3-5 pieces; under half the plate), 3 for significant waste (over half the plate has avoidable food waste), and 4 for severe waste (most of the food on the plate if thrown away). For each level of the scale, we created clear categories through visual examples between waste quantities, aiming for a measure that is practical and consistent. This data was observationally collected (visual records of individual food waste), once daily during dinner time. In addition, baseline food waste data in kilograms were measured against data collected during our intervention.

Procedures

Food waste levels were categorized in both phases of the study following the Likert Scale and added into an Excel Spreadsheet by a pair of researchers. The researchers had to be in agreement for each data point, otherwise it would not be added into the sheet. It was realized that this technique limited the study's validity, which will be discussed later in the paper.

1. The study procedure involved measuring food waste levels in the dining hall at two separate time points: before and after the intervention (poster placement). The data collection process was as follows:

a. Pre-Intervention Data Collection: Before the poster was placed, food waste was measured for three days from 5PM-8PM. We collected data from 192 participants each day. During this time, researchers, in pairs, collected data on the state of participants' plates according to the Likert Scale. All consumers at the dining hall must place their empty plates in shared bins that are taken to the kitchen by the staff. Customers throw away any leftovers in a section of garbage cans which is where we placed ourselves with chairs. In this way, we were able to closely observe the state of their plates before and as they needed to compost any leftovers. Plates that could not be fully visualized were not accounted for in the study.
b. Poster Placement: After the pre-intervention data collection phase, seven food waste reduction posters were strategically placed along visible areas in the dining hall by a pair of researchers.
c. Post-intervention Data Collection: After the posters were in place, food waste was again measured for three days using the same methods. The pair of researchers in the first day of the post-intervention phase did not think posters were placed in highly visible areas and so they repositioned them and data collection was then started.

Some challenges we encountered in the procedures were in relation to plate visibility and poster visibility. The data collection depended on proper view of participants' plates, but it was observed that a lot of customers would have napkins over their leftovers, which made visibility a challenge at times. To account for incorrect inputs of data caused by this issue, it was decided that inputs of data would only occur if plate visibility was full. In addition, there was a discussion whether posters were placed in areas that were properly visible. The impression taken was that since the posters were A3 size and spread out in the large environment of the dining hall, their visibility was quite low. To account for this, a pair of researchers which did not place the posters, reviewed and replaced the posters to more visible areas and we then officially started post-intervention data collection after that adjustment.

Results

Descriptive statistics of our observational data indicate that participants in the experimental group (n=396) created statistically significantly lower food waste intensity (M=1.10, SD=1.14) compared to the control group (n=396), who were not exposed to our poster intervention (M=1.32, SD=1.13). The 95% confidence interval for the control group was [1.21, 1.43], while the confidence interval for the experimental group was [0.98, 1.21], indicating 95% confidence that the true difference between the means of the control and experimental groups falls within these intervals.

To examine the normality of the distributions, Shapiro-Wilk tests were conducted for both the control and experimental groups. Results revealed significant deviations from normality in both the control group, $W(396) = 0.877$, $p < .001$, and the experimental group,

W(396) = 0.836, $p < .001$. Since the p-values for both groups are smaller than the conventional alpha level of 0.05, these results suggest that the data deviates significantly from a normal distribution. Visual histograms show that the control group (see Figure 1) displays a peak frequency at a score of 1, while the experimental group (see Figure 2) shows the highest frequency of 0, revealing a consistent decline trend in food waste ratings among the experimental group.

Given a non-normal distribution, a non-parametric Mann-Whitney U test was performed. The results revealed a statistically significant difference in food waste intensity between the two groups, $U = 68831.00$, $Z = -3.10$, $p = 0.002$ (two-tailed), with a mean rank of 372.32 for the pre-intervention group and 420.68 for the post-intervention group. This suggests that food waste intensity was systematically lower in the group exposed to our food life-cycle poster. The effect size, Cohen's d, was 0.196 (95% CI [0.057, 0.336]), indicating a small effect of the poster intervention behaviour on food waste.

A Levene's test was then performed, which indicated that the variances between the two groups were not significantly different. Specifically, Levene's test based on the **mean** yielded $F(1, 790) = 0.144$, $p = 0.705$; based on the **median**, $F(1, 790) = 0.080$, $p = 0.777$; and based on the **trimmed mean**, $F(1, 790) = 0.433$, $p = 0.511$. As all *p*-values exceeded the conventional alpha level of 0.05, the assumption of homogeneity of variance was satisfied.

These results support our research hypothesis that signage describing the food life-cycle will reduce customers' plate waste in the UBC dining hall compared to no signage at all.

Discussion

The Mann-Whitney U test revealed a statistically significant decrease in observed food waste intensity among diners exposed to our poster intervention. While our observational Likert scale data does not allow us to confirm explicitly that diners read the signage, the results strongly suggest that the presence and visibility of the signage were associated with meaningful reductions in food waste behaviours. Future research could explore the direct relationship between reading signage content and behavioural changes to confirm these findings more conclusively.

Our study faced certain limitations that require careful consideration. Firstly, our posters were introduced shortly after another team's similar signage-based intervention, at the same dining hall, potentially priming diners' behaviours. Another limitation of our study was only having access to half of the kilogram plate waste data, and no card swipe data. Thus, we were unable to analyze the correlation between specific individuals' actions and the amount of food wasted. Additionally, through the design process of producing multiple versions of our poster, the end product included multiple design elements such as educational content on local sourcing and labour, and behavioural nudges like 'Take less, Waste less' and 'You can always come back for more.' Due to these combined elements, it is unclear which aspect(s) had a causal effect or whether it was due to a combination of aspects which produced the causal effect. This provides another area for future research aiming to isolate the different variables that have been proven collectively effective in increasing sustainable behaviours around food

waste.

Despite these limitations, the implications of our study remain significant. Educational signage about the food life-cycle, emphasizing local sourcing and labor, significantly influences diner behaviours by promoting reflection on the broader impacts of their food choices. Such signage can lead to immediate reductions in waste, enhancing operational efficiency, reducing disposal costs, and decreasing environmental impacts that extend beyond just the UBC campus. Furthermore, it increases the collective environmental literacy among students, potentially fostering a deeper cultural shift toward sustainability on campus. Our study uniquely addresses food life-cycle education, opening new avenues for future sustainability interventions. In comparison to our successful results, Avasthi et al. (2025) attempted similar signage interventions using game-like imagery, but they reported an insignificant waste reduction. This disparity highlights the critical role of informational content displayed within the signage supported by Pinto et al. (2018). Their study involving educational signage successfully reduced food waste. Building on their findings, our study provides evidence supporting how food life-cycle education reduces food waste. Additionally, food life-cycle education on signage has not been explored by past studies, offering a probable direction to find a causal new strategy for future interventions.

Future studies could beneficially explore combined interventions (e.g., life-cycle education and portion size nudges) to better understand their respective and combined effects on sustainable dining behaviours. Additionally, simply running an experiment without similar experiments immediately after could help rule out many possible confounding variables.

Recommendations

To reduce food waste and prompt sustainable dining behaviours, UBC's Open Kitchen should take several key actions as supported by the results of this study. First, they should update food waste signage to feature clear and memorable messages, such as the poster nudge "Take Less. Waste Less." This approach has been shown to encourage students to take smaller portions while normalizing the idea of returning for more if needed.

Further updates to signage should integrate a combination of educational messaging about food waste and food life-cycle information, such as where the food they're eating is sourced from and the work and people involved in preparing the food. The messaging should maintain a light-hearted and encouraging tone, using friendly characters like the potato mascot to engage students without inducing guilt.

Reconsider the design and size of plates in relation to how the food is being served, as we observed larger than necessary plates for the self-serve buffet sections. Implementing smaller plate sizes has reliably shown to be one of the most effective interventions for reducing food waste (Reynolds et Al., 2019). This way, diners could fill their plate while still taking a small portion, which may prompt them to consider once again how hungry they are before returning for more.

Expanding community engagement is also crucial; Open Kitchen should continue supporting student-led campaigns alongside staff involvement to foster a sense of shared

responsibility within student social circles. Setting community goals for lowered food waste production could create a greater sense of accountability within the community. By implementing these actions, Open Kitchen can help drive a campus-wide cultural shift towards sustainability, reduce food waste, and align with UBC's broader sustainability goals.

Appendix

Signage

Likert Scale 0-4 measuring Food Waste Intensity

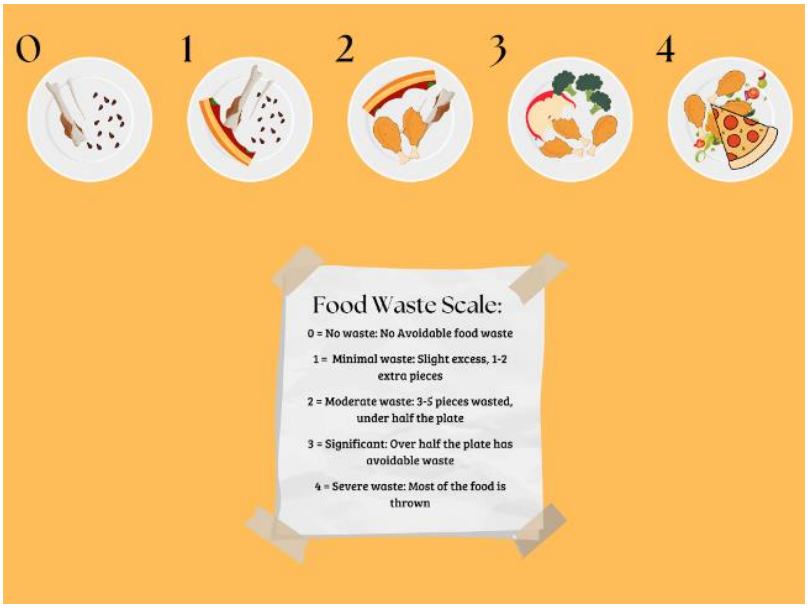


Figure 1. Likert Scale on Food Waste Intensity Frequency (Control Group)

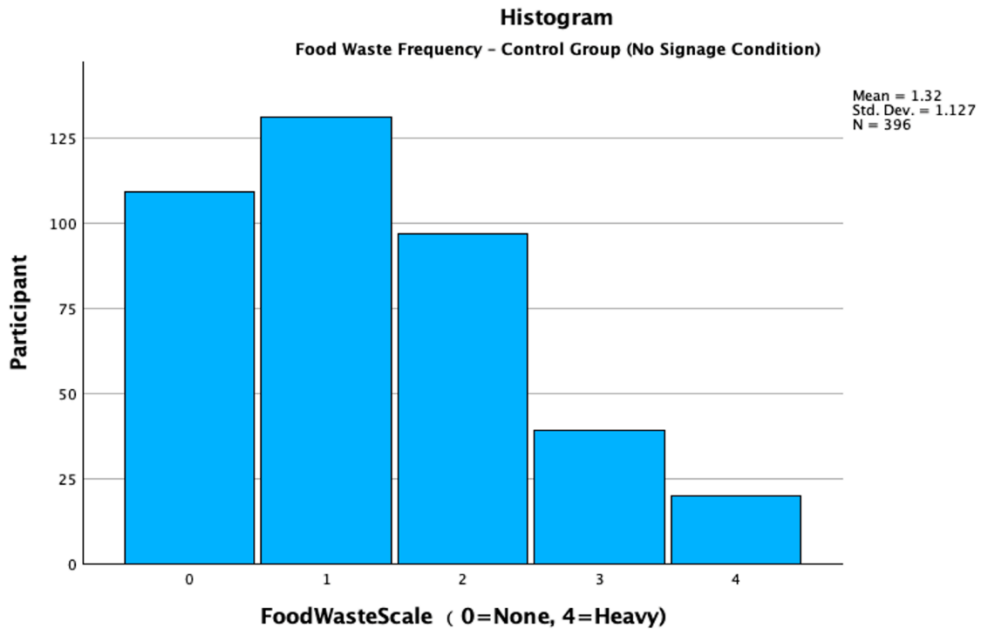
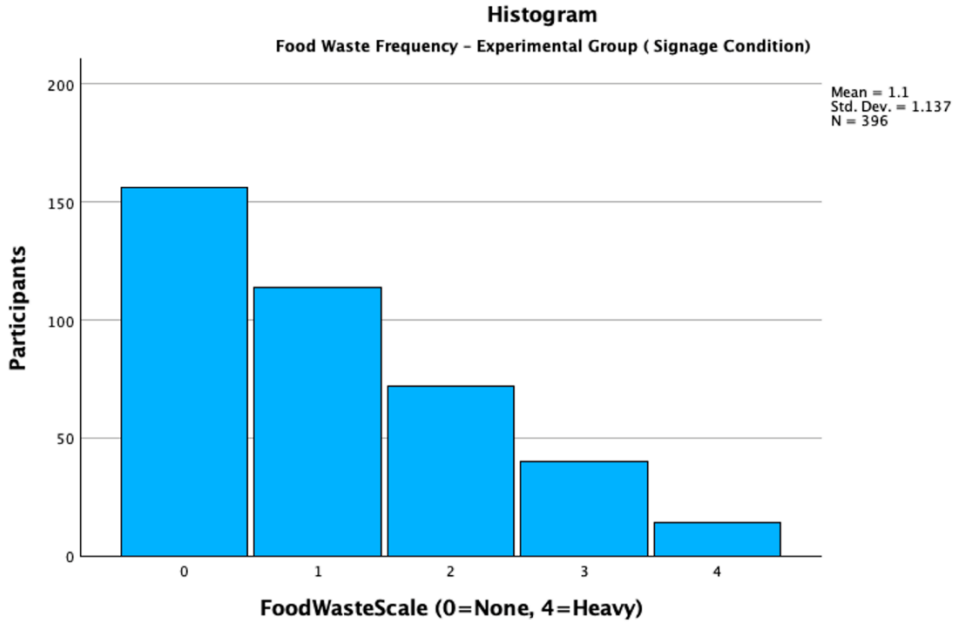


Figure 2. Likert Scale on Food Waste Intensity Frequency (Experimental Group)



- Note: Due to our SPSS being an older version, the system prevented us to add standard error to the histograms

Figure 3. Comparative Dinner Plate Waste Data in Kg

Date	Kitchen	Shift	Spoilage	Preparation	Buffet	Plate	Grand Total
16-March-25	Open Kitchen	Breakfast	26.90	16.55	-	120.70	164.15
17-March-25	Open Kitchen	Breakfast	9.00	30.70	-	-	39.70
18-March-25	Open Kitchen	Breakfast	14.70	26.99	-	541.70	583.39
19-March-25	Open Kitchen	Breakfast	13.31	36.89	-	254.70	304.90
20-March-25	Open Kitchen	Breakfast	-	12.76	3.50	-	16.26
21-March-25	Open Kitchen	Breakfast	1.50	2.95	-	-	4.45
22-March-25	Open Kitchen	Breakfast	13.92	5.18	-	725.20	744.30

Contributions

In the whole of the study, all group members participated in proposal writing, data collection and writing the final report. Koronczay A., Levasseur C., Mzee B., Pagui L., Neild R. and Wang J. worked on the presentation and Liang B. performed the data analysis.

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