

Food Loss and Food Waste Education for School Students in Krabi Thailand

Mohammad Natsir ^{a,1,*}, Sri Mardiyati ^{a,2}, Ratnawati Tahir ^{a,3}, Irma Sribianti ^{a,4}, Akhmad ^{a,5}, Takeem Kundee ^{b,6}

^a Universitas Muhammadiyah Makassar, Jl. Sultan Alauddin No. 259, Makassar 90221, Indonesia

^b The Association of Education Cultural International, Krabi, Thailand

¹ mohammad.natsir@unismuh.ac.id; ² sri.mardiyati@unismuh.ac.id; ³ ratna@unismuh.ac.id; ⁴ irma.sribianti@unismuh.ac.id; ⁵ akhmad.pide@unismuh.ac.id

* corresponding author

ABSTRACT

Article history

Received
Revised
Accepted

Keywords

Food Loss
Food Waste
Knowledge
Literacy
Students

Food loss and food waste are serious problems that must be dealt with throughout life. As long as living things still need food, the problem of food loss and food waste will continue to be in line with life. Education about awareness of these problems must start early, so that the next generation will continue to be able to solve the problem of food waste. The community service program carried out at Eakkapapsasanawich Islamic School and Adameesuksavittaya School, Krabi, Thailand through food loss and food waste education activities aims to, among others: (1) increase students' understanding and insight into the importance of food loss and food waste, (2) increase awareness and responsible attitudes in managing waste, and (3) increase students' knowledge about the impact of food loss and food waste in the long term. The method of implementing this service is the fun learning method. The stages of implementing this activity include: preparation, interactive learning, and follow-up. The results of the implementation of this service program include: (1) an increase in students' literacy and insight into the importance of food loss and food waste, (2) an increase in awareness and a responsible attitude in managing waste, and (3) an increase in students' knowledge about the impact of food loss and food waste in the long term.

This is an open access article under the [CC-BY-SA](https://creativecommons.org/licenses/by-sa/4.0/) license.



1. Introduction

Food loss and food waste (FLW) have emerged as pressing global issues with far-reaching implications for food security, economic efficiency, and environmental sustainability [1][2]. A substantial proportion of food waste occurs at the consumer and food service levels, including in school environments, where large quantities of edible food are discarded on a daily basis [3][4]. School cafeterias and canteens are recognized as important sites of plate waste generation, making them strategic settings for interventions aimed at reducing food waste [5][6].

Schools are therefore critical environments in which food waste occurs among children and adolescents, and educational interventions in such settings are considered highly strategic [5][6][7]. Research suggests that school and meal characteristics—such as meal timing, menu composition, portion size, and serving style—are closely associated with the amount of plate waste produced by students [6][5]. In addition to structural factors, students' behaviors and habits when serving food, their taste preferences, and their attitudes toward fruits and vegetables significantly contribute to food waste at school [3][4].

Education has been identified as one of the principal levers for changing food-related behavior, especially among children and adolescents whose values and everyday practices are still being formed [8][2]. School-based interventions that integrate classroom-based learning, experiential

activities, and cafeteria-level strategies have shown promising effects in improving nutrition literacy, reducing plate waste, and promoting more sustainable food practices [4][7][9]. For example, the Healthy Planet, Healthy Youth program demonstrated that comprehensive food systems education can simultaneously improve adolescents’ lunch choices and reduce food waste [9].

Food waste behavior is also influenced by psychological and social factors, including subjective norms, attitudes, perceived behavioral control, and self-identity, as evidenced by studies on emerging adults and young consumers [10][11][12]. Among adolescents and young adults, eating out and fast-food consumption are frequently associated with oversized portions and high levels of leftover food [10][11]. These findings reinforce the importance of early interventions at school age to shape more responsible, environmentally conscious consumption habits.

At the policy and program levels, several institutions have underscored the importance of educating younger generations on wasted food. The U.S. Environmental Protection Agency highlights education on wasted food for children and youth as a key strategy to reduce future food waste [13]. Similarly, the Youth Towards Zero Food Waste campaign of the World Food Forum illustrates how global, youth-driven initiatives can strengthen awareness and collective action to reduce food waste [14]. Practical guidance such as Plate Waste Prevention in Child Nutrition Programs also emphasizes the combination of education, portion adjustments, and supportive eating environments as an effective way to reduce plate waste in schools [15].

In Thailand and other Southeast Asian countries, rapid tourism growth, urbanization, and changing dietary patterns have raised concerns about food waste in households, communities, and institutions. However, community service programs specifically addressing food waste management (FLW) education for school-aged children such as those in Krabi are limited, while many documented interventions originate from European and North American settings [3][8][4]. This situation creates opportunities for community service initiatives that not only introduce core FLW concepts but also foster students’ sense of responsibility and encourage concrete actions within the school environment.

In response to this gap, an international community service collaboration was conducted at Eakkapapsasanawich Islamic School and Adameesuksavittaya School in Krabi, Thailand, using a fun learning approach tailored to students’ characteristics. The program aimed to: (1) increase students’ understanding and insight into the importance of food loss and food waste, (2) strengthen students’ awareness and responsible attitudes toward waste management, and (3) enhance students’ knowledge of the long-term impacts of food loss and food waste. This article presents the design and implementation of the program, followed by integrated results and discussion, and situates the findings in relation to recent literature on school-based food waste interventions.

2. Method

2.1. Program Design

The community service program was designed as a school-based educational intervention focusing on FLW, incorporating elements that have been identified as effective in previous studies, such as interactive activities, visual demonstrations, and student involvement in solution-building [3][4][1][9]. A fun learning approach was selected in accordance with recommendations that food waste education for children and adolescents should be engaging, participatory, and closely connected to their everyday experiences [8][9].

The program was implemented at two schools in Krabi: Eakkapapsasanawich Islamic School and Adameesuksavittaya School. At Eakkapapsasanawich Islamic School, 26 students participated, while 21 students took part at Adameesuksavittaya School. Participants were primary and lower secondary students identified in consultation with school administrators and teachers, taking into account each school’s capacity. The intervention was delivered through several sessions that combined classroom-based instruction, group discussions, and simple observational tasks related to food consumption and potential food waste at school.

2.2. Stages of Implementation

The program was implemented in three main stages: preparation, interactive learning, and follow-up. This structure aligns with common phases in school-based interventions, moving from planning to implementation and then to reinforcement and evaluation [4][1][15].

(1) Preparation

The preparation stage involved coordination with school principals and teachers to agree on objectives, schedules, and logistical requirements. During this stage, the team identified students' initial understanding of food loss and food waste through informal conversations and simple pre-activity questions. Educational materials were developed, including illustrated slide presentations, posters explaining FLW concepts, and worksheets for group activities. Language was adapted (simple English and, where needed, local language) to ensure accessibility for students.

In addition, games and interactive tasks were designed, such as sorting images of food according to their use, identifying examples of food waste at school, and reflecting on eating habits at home. This experiential orientation is consistent with programs like Healthy Planet, Healthy Youth, which used food systems education to connect dietary choices, health, and environmental impacts for adolescents [9].

(2) Interactive Learning (Fun Learning)

The core of the program consisted of fun learning sessions that combined brief presentations, group work, games, and demonstrations. The sessions included:

- Introduction to FLW: Facilitators explained the distinction between food loss (occurring before food reaches consumers) and food waste (occurring at the consumer or retail level), using examples from the food supply chain such as farms, markets, households, and school canteens [1][2].
- Causes and impacts: Through stories and visual materials, students explored common causes of food waste, including taking excessive portions, not finishing vegetables, and discarding food due to appearance. Environmental, social, and economic impacts were highlighted, including resource wastage and greenhouse gas emissions [3][8][2].
- Games and group work: Students developed a "day with food" map from breakfast to dinner and identified potential points of food waste. They discussed why food often remains uneaten and proposed ideas to reduce food waste at school and at home. These participatory techniques align with interventions that encourage adolescents to analyze food systems and their own eating behaviors [9].
- Visual demonstration: Where feasible, facilitators and teachers collected food leftovers from a school meal to visually demonstrate the volume of food wasted in a short period, a strategy commonly used to provide impactful feedback [3][5].
- Reflection and commitments: At the end of the sessions, students were invited to formulate simple personal commitments, such as taking appropriate portion sizes, finishing the food they take, and reminding peers not to waste food. Commitment-making is associated with the development of personal norms and stronger intentions to engage in responsible behavior [10][12].

(3) Follow-up

The follow-up stage aimed to reinforce key messages and observe changes in awareness and attitudes. Teachers were encouraged to incorporate brief reminders about food waste into classroom routines, for example before lunch or during homeroom sessions. Simple observations were made regarding how students served food, finished their meals, and disposed of leftovers appropriately.

Teachers were also invited to facilitate student-created posters with "stop food waste" messages to be displayed in eating areas, consistent with practical guidance for plate waste prevention in child nutrition programs [15]. Institutions such as the U.S. Environmental Protection Agency stress the importance of repeated reinforcement and engaging materials to maintain the impact of wasted food education [13][14].

3. Results and Discussion

This international community service collaboration activity in Krabi, Thailand, delivered food loss and food waste education at Eakkapapsasanawich Islamic School (26 students) and Adameesuksavittaya School (21 students). Participants responded positively to the activities, with at least six students actively asking questions and expressing strong interest in understanding FLW and applying the lessons wisely in their daily lives. This active engagement suggests that the fun learning approach successfully created an enjoyable learning environment that stimulated both cognitive and affective involvement.



Figure 1. Implementation of community service: Food Loss and Food Waste Education for Schools at Eakkapapsasanawich Islamic School, Krabi, Thailand.

3.1. Enhanced Literacy and Understanding of FLW

The implementation of the program led to an observable increase in students' literacy and understanding of FLW concepts. Prior to the intervention, many students tended to equate waste primarily with general garbage, without distinguishing food waste or recognizing its broader implications. After the interactive sessions, students were able to describe the difference between food loss and food waste in simple terms and to provide concrete examples from their school and home environments. This mirrors findings from food systems education programs, which indicate that structured exposure to information can improve adolescents' understanding of the links between diet, food waste, and sustainability [9].



Figure 2. Implementation of community service: Food Loss and Food Waste Education for Schools at Adameesuksavittaya School, Krabi, Thailand.

In the broader literature, improved knowledge and literacy about food waste are often identified as essential precursors to more concrete behavioral change [3][1]. Studies among university students and emerging adults show that higher awareness of the consequences of food waste is associated with stronger intentions to reduce food discarding [10][12]. From this perspective, the knowledge gains observed among students in Krabi can be regarded as a valuable foundation for long-term interventions and for the gradual development of new, more sustainable habits.

3.2. Increased Awareness and Responsible Attitudes

Beyond cognitive outcomes, the program contributed to heightened awareness and more responsible attitudes toward food and waste management in the school setting. Teachers reported that students appeared more cautious in serving food, more motivated to finish their meals, and more attentive to separating food waste from other types of waste. These patterns are consistent with evidence that school-based interventions can reduce plate waste through a combination of educational activities and cafeteria strategies, although the magnitude of effects varies across contexts [4][7][5].

Recent studies highlight that the eating environment—such as adequate meal time, appealing presentation, and educational messaging in dining areas—is closely linked with students' behavior and the level of plate waste generated [6][5][15]. In Krabi, although this program did not modify structural aspects of the canteen, its emphasis on educational messaging, concrete examples, and personal commitments generated early signs of attitude change. If complemented by supportive physical environments and school policies, such attitudinal shifts could plausibly translate into more substantial and sustained reductions in food waste.

3.3. Active Participation and Value Formation

The active participation of six students, who asked questions and shared reflections during the sessions, indicates a degree of internalization of values and concern about FLW. Their questions about how to reduce waste in the canteen, manage surplus food at home, and encourage others not to waste food suggest that they have begun to think critically about practical solutions and their own roles as agents of change. Research on food waste among adolescents and emerging adults shows that affective engagement and a sense of responsibility are associated with stronger intentions to change behavior [10][12][11].

The presence of such "role model" students has the potential to trigger a ripple effect among peers, given that social norms and peer influence are important determinants of eating behavior and food waste [11][10]. Global initiatives such as the Youth Towards Zero Food Waste campaign emphasize the role of young people as ambassadors and drivers of change in their communities, a notion that is highly relevant to the Krabi context, where students can transmit messages about food conservation to their families and neighborhoods [14].

3.4 Linkages to Global Efforts and Policy

This community service program aligns with global trends that position youth education as a central pillar of food waste reduction efforts. Organizations such as the U.S. Environmental Protection Agency argue that educating children and youth about wasted food can shape lifelong habits and yield cumulative impacts on food waste reduction [13]. Guidance and programs focused on plate waste prevention in schools emphasize the synergistic effects of combining education with modifications to food service systems [15][5].

Systematic reviews and practice-oriented briefs suggest that interventions integrating education, menu and portion adjustments, supportive dining environments, and student participation tend to be more effective than single-component approaches [2][3][16]. The Krabi program currently focuses primarily on education and student engagement, positioning it as an important first step that could be expanded with additional components such as regular plate waste measurement, portion size adjustments, and parental involvement.

3.5 Limitations and Future Directions

As is typical of many community service initiatives, this program faces limitations related to its relatively short duration and the absence of systematic quantitative measures of changes in food waste volume. By contrast, several school-based studies have employed pre-/post-test designs and plate waste weighing methods to document the impact of interventions more rigorously [4][3][6]. Future iterations of the program could incorporate simple but robust evaluation tools—such as structured questionnaires and food waste weighing protocols—to more objectively monitor behavioral changes and waste reduction.

Moreover, involving parents and the broader community would help strengthen the transfer of learning from school to home, in line with recommendations that multi-level, whole-community approaches are more effective in changing food waste behavior [2][13]. Given Krabi's status as a

tourism destination, collaboration with canteen managers, food business operators, and local authorities could create opportunities for wider initiatives, such as community-level zero food waste campaigns.

4. Conclusion

The food loss and food waste education program implemented at Eakkapapsasanawich Islamic School and Adameesuksavittaya School in Krabi, Thailand, demonstrates that a fun, interactive learning approach can effectively enhance students' literacy, awareness, and sense of responsibility regarding FLW. The participation of 47 students, including at least six highly active and engaged participants, indicates strong acceptance of the program and the potential for value and norm formation related to more prudent food consumption. These outcomes are consistent with the literature emphasizing the role of school-based education in reducing food waste at the consumer level.

Looking ahead, similar programs are encouraged to be extended in duration, supported by quantitative evaluation, and implemented with broader stakeholder involvement, including parents and local communities. In this way, FLW education in schools can evolve from a one-off activity into an integral component of school culture and a long-term strategy for promoting sustainable food consumption.

Acknowledgment

The author team would like to express their gratitude to the University of Muhammadiyah Makassar for their financial support, as well as the Institute for Research, Development, and Community Service (LP3M) and the Office of International Affairs of Unismuh (KUI), which facilitated this community service activity. We also express our gratitude to the Eakkapapsasanawich Islamic School, the Adameesuksavittaya School, and the International Cultural Education Association, Krabi, Thailand, for their excellent facilities and wisdom provided to our community service team.

Data and Software Availability Statements

Data and Software availability statements provide a statement about where data and software supporting the results reported in a published article can be found, including hyperlinks to publicly archived datasets and software analyzed and generated during the study/experiments.

References

- [1] Kaur P, Dhir A, Talwar S, Ghuman K, Malibari A. Systematic literature review of food waste in educational institutions: Current status and future research agenda. *J Clean Prod* 2021;278:123971.
- [2] Liechti C, Huber R, Stauffacher M. A systematic literature review of impactful food waste interventions at the consumer level. *Clean Responsible Consum* 2024;10:100157.
- [3] Galli F, Cavicchi A, Brunori G, Di Iacovo F, Pullman D. No scrap left behind: A school-based food waste reduction program. *Nutrients* 2021;13:1–18.
- [4] Hayes C, Fox TA, Martín A. Food waste in schools: A pre-/post-test study design examining the impact of Smarter Lunchrooms Movement strategies. *Nutrients* 2021;13:1–15.
- [5] Malefors C, Ferreira M, Sonesson U. Understanding food waste generation in school canteens. *Resour Conserv Recycl Adv* 2025;100252.
- [6] Adjapong ES, Fulgoni VL, Mathias KC. School and meal characteristics associated with plate waste in the U.S. National School Lunch Program. *PLoS One* 2024;19:e0299043.
- [7] Fox TA, Hayes C, Martín A, Mitchell DC. Strategies to address food waste in K-12 schools: A narrative review. *J Child Nutr Manag* 2019;43.
- [8] Rohm A, Tuppara A, Rinta-Kanto J. The Food Waste Lab: Improving food waste reduction

- behavior through education. *J Clean Prod* 2022;378:134496.
- [9] O’Kane G, Lally P, Francis C. Healthy Planet, Healthy Youth: A food systems education and promotion intervention to improve adolescent lunch consumption and reduce food waste. *Nutrients* 2019;11:1903.
- [10] Ngo C V, Liu C. Consumer food waste behavior among emerging adults: Application of an extended theory of planned behavior. *Nutrients* 2020;12:1–18.
- [11] Manala-O SD. Food Waste Behavior of Young Fast-food Consumers in the Philippines. *Asia Pacific Soc Sci Rev* 2019;19:121–35.
- [12] Neff RA, Spiker ML, Truant PL. Food waste among young adults: Behaviors, barriers, and opportunities for intervention. *Public Health Nutr* 2025;28:1–12.
- [13] Agency USEP. Educating youth about wasted food. U.S. Environmental Protection Agency; 2025.
- [14] Forum WF. Youth towards zero food waste campaign. Food and Agriculture Organization of the United Nations; 2025.
- [15] Education CD of. Plate waste prevention in child nutrition programs. California Department of Education; 2025.
- [16] Consortium L. Impact of different approaches to reducing plate waste in school catering. *LOWINFOOD*; 2024.