



Educational model for prevention and management of food waste generation: A systematic literature review

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ABSTRACT

Background: This research aims to analyze educational models for preventing and managing food waste for communities such as households, schools, or other downstream sectors. **Methods:** The research method used is a literature review of international journal articles indexed by Scopus related to the research theme in the 2020–2023 time period. The initial search obtained 168 journal articles, and then 64 articles were selected with educational targets in the downstream sector such as households, schools, and others. Then 11 articles were selected again using the criteria of empirical study results. So the final screening results obtained 11 articles for further analysis. **Findings:** The results of the study show that in educational efforts to prevent and manage food waste for downstream sectors such as communities, households, and others, it is necessary to pay attention to the educational approach model used, namely the mentalistic approach and the conditional approach, taking into account the objective coverage of educational targets, namely changing behavior towards food waste and reducing the amount of food waste generation. The research results also show that there are obstacles that arise during the educational process of preventing and managing food waste so to minimize obstacles it is necessary to pay attention to essential factors to change the behavior of a group of people. **Conclusion:** The study emphasizes that effective food waste education requires appropriate approach models and careful consideration of behavioral change factors to achieve sustainable waste reduction outcomes in downstream sectors. **Novelty/Originality of this article:** The novelty lies in synthesizing empirical studies to identify specific educational approach models and key behavioral factors that influence the success of food waste prevention and management in downstream community sectors.

KEYWORDS: education; prevention; management; food waste; community.

1. Introduction

Indonesia has a population growth trend that continues to increase every year. Based on data from the Central Statistics Agency, in mid-2023 the population will reach 278.69 million people. This figure increased by 1.05% from the previous year. Even though the population growth rate has decreased, the population growth trend continues to increase every year. As population growth continues to increase, various socio-economic problems emerge, one of which is waste. Waste is a social problem that is often experienced in both urban and rural environments. Because every human socio-economic activity is not free from waste generation. Based on data from the Ministry of Environment's National Waste Management Information System (SIPSN), in 2022 the amount of waste generated will reach 35 million tons of waste, an increase from the previous year of 29 million tons of waste generation. This shows that the increasing population in Indonesia is accompanied by

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complex and diverse human socio-economic activities, the higher the waste generated every day.

Based on data from the Ministry of Environment and Forestry, it is revealed that waste management in Indonesia still relies on landfills. 69% of waste management is transported and stored in landfills, 10% is buried, 7% is composted and recycled, 5% is burned and 7% is unmanaged. The high level of community dependence on the landfill is not commensurate with the durability of the landfill itself because the heavier the burden on the landfill to accommodate waste, the shorter the lifespan of the landfill. The high level of community dependence on landfills for waste management is caused by several things. The first is the public's mistake in understanding the function of the landfill as a final disposal site. According to law constitution Number 18 of 2008 concerning waste management, landfill usage is for a Final Processing Place, not as a Final Disposal Place. So the main function of a landfill according to this law is as a place to process final residual waste and return the waste to environmental media that is safe for the environment itself and humans.

Second, the traditional perception of society in waste management, namely the collection-disposal-transport system, is the cause of high dependence on landfills. According to the same law regarding waste management, it is explained that waste management is carried out systematically, comprehensively, and continuously, which includes efforts to reduce and handle waste generation and involves all levels of society. This change in public perception of waste management is important because public perception of waste management participation is directly proportional to the level of waste management participation. The better public's perception of participation in household waste management (Mondéjar-Jiménez et al., 2016; Richter & Bokelmann, 2017; Roodhuyzen et al., 2017), the higher the level of participation in household waste management (Amirudin & Gim, 2019; Nugraha et al., 2018).

If we look at the comparative percentage of each sector that generates waste, households are the highest sector that generates waste. Based on data from the Ministry of Environment's National Waste Management Information System (SIPSN), it is stated that at the national level, the household sector contributes 38.27% of waste. Likewise, at the Yogyakarta Special Region Province level, the household sector is also the highest in generating waste, even reaching 50.17%. This is also in line with the opinion according to (Aktas et al., 2018; Gustavsson et al., 2014). The highest type of waste produced based on SIPSN data from the Ministry of Environment at the national level is food waste at 40.81% of the total type of waste produced. This is followed by plastic waste at 17.75%, the rest are other types of waste such as paper/cardboard, twigs, rubber/leather, metal, cloth, and others. Likewise, at the Yogyakarta Province level, food waste is the highest type of waste produced at 56.13%, followed by plastic waste at 23.84%. So, both nationally and at the DIY provincial level, the type of waste that dominates is food waste.

Even though food waste is organic waste that can decompose, if the accumulation of food waste is excessive and not managed properly it can become a global issue that has social, economic, and environmental impacts. The socio-economic issue that can arise due to food waste is the food crisis. According to Munesue et al. (2015) and Notarnicola et al. (2017), when food waste is wasted, these resources are also wasted. Apart from that, there are environmental problems caused by food waste, such as pollution from food waste, an increase in various types of digestive and respiratory tract infections and even hampering groundwater processes. According to Osterback et al. (2015) Once in landfills, human discarded food has negative effects on water quality, wildlife, and climate change.

Various factors can cause the high generation of food waste originating from the household sector. According to Porpino et al. (2015) and Silvennoinen et al. (2014), the generation of food waste at the household level is caused by sociodemographics, attitudes, and behavior. Based on previous studies regarding primary factors that cause the generation of household food waste in South Africa conducted by Ramukhwatho et al. (2018) and Stöckli et al. (2018) show that the factors causing the generation of food waste in households are buying too much, cooking too much, poor storage, poor purchase planning and special offers/discounts. This is based on the results of the study Food Loss and Waste

(FLW) Ministry of National Development Planning (2021) the main causes and drivers of food waste in Indonesia at the consumer level are lack of information/education for consumers, excess portions and consumer behavior, misinterpretation of expiry times and good before, preparation of food ingredients which is not yet optimal, the quality of storage space is less than optimal and there is a lack of food waste regulations.

Food waste is a complex issue. You don't just need a single solution to overcome this problem. Educational efforts are an urgent and important need to make people aware of how valuable food is and the impact of food waste on the economy, inflation, impact on the environment, and other causes of problems (Al-Zahrani et al., 2018; Saputro & Santoso, 2021). Community support regarding the management of food waste needs to start with the behavior of reducing the generation of food waste. According to Saputro & Santoso (2021), Efforts to tackle food waste can be made through campaigns related to wise consumption of food. This means that efforts to prevent the large amount of food waste generated are an important factor in the success of food waste management education.

Many educational efforts on food waste management have been carried out but have not had a significant impact on public awareness about food waste. The results of research conducted by Sa'pang et al. (2023) related to the results of socialization to reduce food waste households in the working area of the Parung Panjang Community Health Center, Bogor Regency. Based on the results of this research, it was revealed that outreach activities did not have an impact on increasing knowledge of food waste management. Efforts that are more than just outreach are needed to increase public knowledge regarding food waste management accompanied by changes in behavior for the better (Graham-Rowe et al., 2015; Quested et al., 2013). According to Wharton et al. (2021), research using a variety of intervention strategies must be carried out to understand the right strategy to contribute to sustainable food waste management.

Therefore, this research aims to examine and explore the results of empirical studies on food waste management education for the community through a literature review. Literature reviews regarding the issue of food waste have been widely carried out, but the focus of the literature reviews carried out is more on the factors that cause the generation of food waste that occurs. So through a literature review with a focus on educational models, it is hoped that it will reveal the objective approach and targets used, the results and the obstacles to the educational model carried out from previous research. Another hope of this research is that it can provide recommendations for researchers to develop educational models for preventing and managing food waste.

2. Methods

2.1 Literature review procedure and article selection

This research uses a literature review method with stages that include identifying the scope of the research topic, exploring literature reference sources that are relevant to the problem topic being studied, reviewing selected reference sources, developing an outline structure, compiling the results of the literature review, and drawing conclusions. The data collection process for the literature review uses a database from Scopus. The Scopus database was chosen as a data source because Scopus is a trusted journal indexing and provider service. Journal articles indexed by Scopus are articles of high quality and internationally recognized. The data collection process uses keywords "food waste" AND "education" OR "empowerment" OR "intervention" OR "training". In the screening process, literature review inclusion and exclusion criteria are used as a reference for researchers in selecting appropriate journal articles. The inclusion and exclusion criteria for the literature review in this study can be seen in Table 1 below:

Table 1. Inclusion and exclusion criteria

Type of Criterion	Criteria	Inclusion	Exclusion
Type of publication	Journal articles	✓	
	Conference papers		✓
	Reports		✓
	21st-century frameworks		✓
	Dissertations		✓
	Books		✓
Access	Online	✓	
	Paper		✓
Publication period	2020-2023	✓	
Place of publications	Worldwide	✓	
Type of Study	Empirical investigation	✓	
	Theoretical studies		✓
Research methods	Qualitative	✓	
	Quantitative	✓	

This research used 11 articles from screening results according to the research topic. The topic of this research is education on the prevention and management of food waste, which can be in the form of direct education, counseling, outreach, or other types of educational models. The literature collected is in the form of international journals indexed by Scopus in the 2020-2023 period. Through an initial search on the Scopus page with the words “food waste” AND “education” OR “empowerment” OR “intervention” OR “training” thus collected 168 articles. Then the researchers added the keywords household, school, or downstream sector as the location settings for implementing the educational model so that 64 journal articles were selected. Next, the researchers reviewed the abstracts using empirical study criteria so that in the third screening they found 11 suitable articles (table 2). The literature review scheme for this research is depicted in the flow diagram in Figure 1.

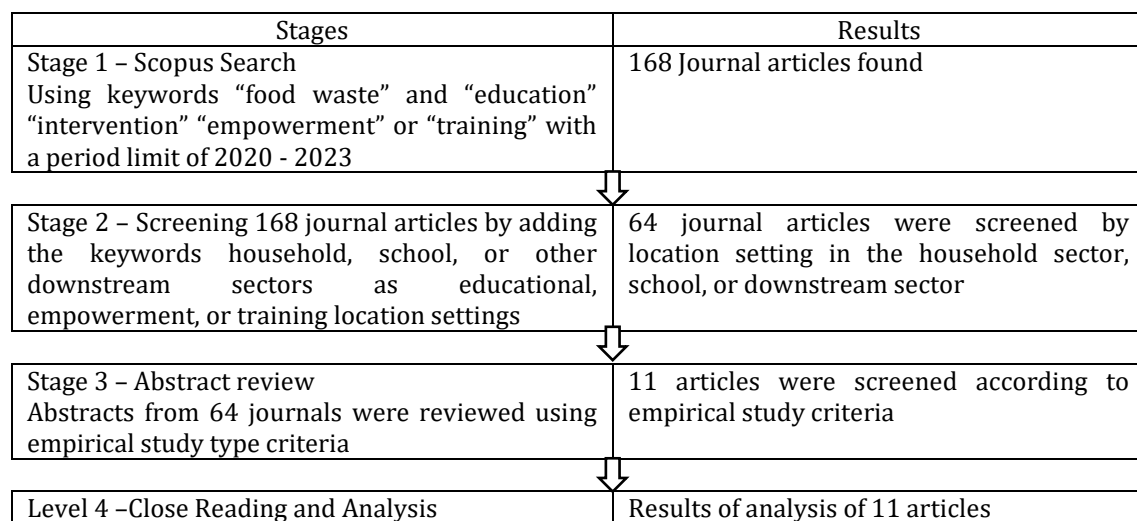


Fig. 2. Literature exploration flow diagram

2.2 literature analysis framework

At the analysis stage, questions help researchers focus on reviewing the literature. The research questions are What type of research? Who is the population and sample? What approach is used? What are the objective goals of education? What are the educational results? What obstacles do you face? The results of the analysis concerning research questions will be summarized in a matrix table of the results of the literature review analysis.

Table 2. List of scopus indexed articles literature review source

Writer	Year	Rank	Journal Name
Jenkins et al.	2023	Q1	International Journal of Environmental Research and Public Health
Gittlin et al.	2023	Q2	Natural Sciences Education
Mariam et al.	2022	Q1	Journal of Cleaner Production
Boulet et al.	2022	Q1	Journal of Environmental Management
Karpouzis et al.	2021	Q1	BMC Public Health
Elnakib et al.	2021	Q1	International Journal of Environmental Research and Public Health
Frank et al.	2021	Q2	Journal of Hunger and Environmental Nutrition
Wharton et al.	2021	Q1	Resources, Conservation, and Recycling
Yazdankhah et al.	2020	Q2	Journal of Education and Health Promotion
Neff et al.	2020	Q1	Nutrients
Favuzzi et al.	2020	Q1	International Journal of Environmental Research dan Public Health

3. Results and Discussion

3.1 Results

The literature review in this research focuses on revealing the approaches and objective targets used as well as the results and obstacles experienced in the education process for preventing and managing food waste. Based on the results of the literature review, the approaches revealed are in the form of training, learning, projects, social campaigns, and policies. The objective targets revealed are behavior, awareness, concern, and reducing the amount of food waste. The educational results obtained also vary, some educational results can have an impact on achieving all or part of the objective targets and some of them do not have an impact on achieving the objective targets. Apart from educational outcomes, the obstacles faced also vary with different causes. All literature results will be summarized in Table 3 below.

Table 3. Literature review results matrix

Journal	Types of research	Population, Sample, and Location	The approach used	Objective Goals	Results	Obstacle
Jenkins et al. (2023) International Journal of Environmental Research and Public Health	Quantitative and Qualitative	Parents and Grade 8 School Students (aged 13-14 years) with a sample size of n=79 Location: Melbourne, Victoria, Australia	Re-Licious (Adolescent education model for turning leftover food into delicious and healthy food)	- Adolescents' awareness and knowledge about food waste and making healthy food recipes - Adolescents' ability to utilize food waste - Reducing food waste	Intervention using methods Re-Licious can change student behavior towards food waste by increasing initiative, intensity to reduce food waste and motivation and interest in health and healthy eating patterns	The main obstacle in this research was that the implementation of the intervention was carried out online during the COVID-19 pandemic. Participants had difficulty communicating with other participants, especially in group work.
Gittlin et al. (2023) Natural Sciences Education	Qualitative	Graduate student	Training graduate students with an interdisciplinary approach to addressing the issue of food waste	Products or solutions to cross-disciplinary based food – energy – water problems	The results of training with a cross-disciplinary approach produce different skills and perspectives for understanding the topic of food waste. Produce campaign products related to food waste via social media	No obstacles found
Mariam et al. (2022) Journal of Cleaner Production	Qualitative and quantitative	Student Preparatory secondary school and high school Number of samples n = 81	The Food Waste Lab Food waste intervention through education	Food waste reduction behavior	There has been an increase in awareness among participants about food waste which can cause climate change, encouraging the use of the sense of taste as a criterion for assessing food suitability and	There was a decrease in the perception of the goal of reducing food waste as the intervention progressed

Journal	Types of research	Population, Sample, and Location	The approach used	Objective Goals	Results	Obstacle
Boulet et al. (2022) Journal of Environmental Management	Quantitative and qualitative	Location: Luneburg and Berlin, Germany Parents and students from 5 schools	Intervention with a multilevel perspective of household behavior toward school-based food waste	Parental behavior to involve children in selecting and making food to take to school is the key to reducing food waste in Australian schools	willingness to eat/utilize food waste. The intervention can increase student involvement in choosing and making food as well as reducing the generation of food waste at school	Some parents are worried that their children will be embarrassed because the parents cannot participate optimally and the children bring food that is not homemade
Karpouzis et al. (2021) BMC Public Health	Quantitative and Qualitative	Location: Australia 20 elementary schools grade 5-6 aged 10-12 years	Program FEAST (Food Education and Sustainability Training)	Food literacy consists of knowledge of food nutrition, food preparation skills, knowledge of food security such as food waste	The FEAST program as a school-based approach has an important role in increasing students' awareness of health and food security	No obstacles found
Elnakib et al. (2021) International Journal of Environmental Research and Public Health	Quantitative and Qualitative	Location: New South Wales, Australia 15 primary and secondary schools in the CEP area (community eligibility provision)	Training food service employees with strategiesSmarter Lunchrooms Movement (SLM)	Changes in the condition of food waste at schools	Overall, employee training sessions using SLM strategies can reduce food waste in schools	It is difficult to assess the effects of training in individual aspects due to the complexity of the SLM strategy
Frank et al. (2021)	Qualitative	Location: Northeast, United States Student	CampaignFree Food on Campus (FFOC) uses a	Food saving initiative by sharing	Utilizing the campus learning management system platform for the	No obstacles found

Journal	Types of research	Population, Sample, and Location	The approach used	Objective Goals	Results	Obstacle
Journal of Hunger and Environmental Nutrition		Location: University in the United States	campus learning management system platform		FFOC event campaign is effective in connecting students with quality food waste and students who need food. This method is easy and cheap.	
Wharton et al. (2021) Resources, Conservation, and Recycling	Quantitative and Qualitative	Households, sample size n = 53 Location: Phoenix City, Arizona, United States	A multifaceted, virtual, website-based educational approach	Reducing food waste	After the intervention was carried out, there was a significant increase in behavior towards food waste and a significant reduction in household food waste by 27.85% of participating households. There was an increase in awareness, attitudes, and behavior toward food waste after the intervention	Households with low incomes are more likely to drop out of the research process than households with high incomes
Yazdankhah et al. (2020) Journal of Education and Health Promotion	Quasi Experiment	Clients, staff, and students of Sabz Restaurant and Shahid Beheshti University Medical School Location: Iran	Restaurant Staff: Prerequisite training on collecting, categorizing, and managing the amount of food waste Client: Individual intervention through pamphlets, posters, and leaflets Restaurant environment intervention:	Consumption behavior and food waste production in Shahid Beheshti University restaurants	The amount of food waste was reduced from 341.37 kg/week to 224.98 kg/week after the intervention	No obstacles found

Journal	Types of research	Population, Sample, and Location	The approach used	Objective Goals	Results	Obstacle
Neff et al. (2020) Nutrients	Quantitative and Qualitative	South Carolina (intervention) and North Carolina (Control) households	coordination with universities and restaurants such as providing food storage and heating facilities Healthy food policy for preschool children	The influence of policy on food waste production behavior	PolicyEarly Care and Education(ECE) in healthy food for preschool children can increase the consumption of healthy food without increasing the production of food waste	The ECE policy intervention only had an impact on increasing consumption of healthy food but did not have a significant reduction in the overall percentage of food waste production (only significant for food waste such as drinks and milk).
Favuzzi et al. (2020) International Journal of Environmental Research dan Public Health	Quantitative and Qualitative	Location: United States Students, Teachers, Canteen Employees, and Parents from 13 schools Location: Bari, Italy	ProjectLove Food, Not Waste (LFNW) intervention through press conferences and school websites	Food choice behavior and evaluation of food waste generation in school canteens	The intervention has not succeeded in having a strong impact on the generation of food waste in school canteens	Parent and child participants continue to return to their original habits after school ends Difficulties in implementing monitoring of participants' food waste generation are due to organizational reasons

3.2 Discussion

Discussion is the most important part of the entire contents of scientific articles. The objectives of the discussion are: answering research problems, interpreting findings, integrating findings from research into existing sets of knowledge and composing new theories or modifying existing theories. In addition, the discussion section allows researchers to compare their results with previous studies, identify limitations of their own research, and propose future research directions. It is a crucial part of the scientific article as it provides a platform for researchers to critically analyze their findings and their implications. Through discussion, researchers can also highlight the significance of their work and its potential impact on the scientific community. Discussion is the most important part of the entire contents of scientific articles. The objectives of the discussion are: answering research problems, interpreting findings, integrating findings from research into existing sets of knowledge and composing new theories or modifying existing theories. Based on the data from the literature review in Table 3, it is revealed that educational efforts to prevent and manage food waste include the approaches used, objective targets, educational results, and obstacles. This can be explained in the following figure 2.

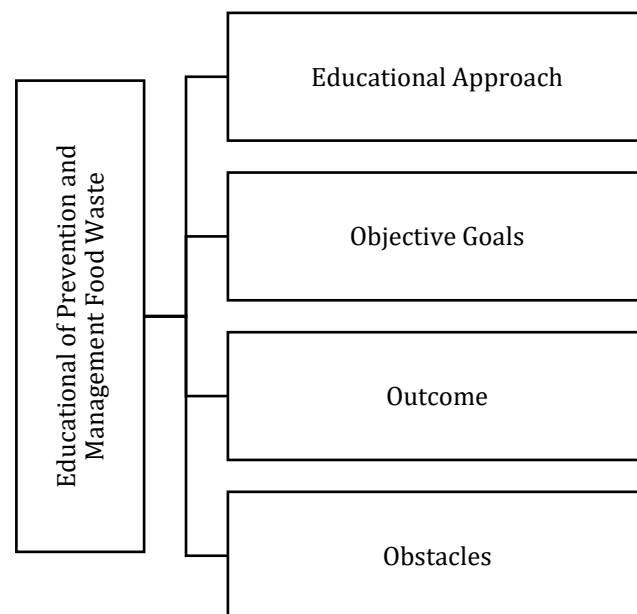


Fig. 2. Results of the literature review

3.2.1 Educational approach

The educational approach to preventing and managing food waste based on the results of a literature review revealed that there are 2 types, namely education with an educational and policy approach. The educational approach takes the form of learning, training, projects, and the like. Meanwhile, the policy approach can take the form of social campaigns, government or private policies, and the like. The results of a literature review of education on the prevention and management of food waste using an educational approach amounted to 81.8% of all research results reviewed. The approach through education is in the form of learning, training, and projects (Boulet et al., 2022; Elnakib et al., 2021; Favuzzi et al., 2020; Gittlin et al., 2023; Jenkins et al., 2023; Karpouzis et al., 2021; Mariam et al., 2022; Wharton et al., 2021; Yazdankhah et al., 2020). Approaches through policy include 18.2% in the form of social campaigns and policies (Frank et al., 2021; Neff et al., 2020). Therefore, the approach used in education on the prevention and management of food waste can be reviewed in Table 4. In carrying out education on the prevention and management of food waste, educators are involved as agents of change (agent of change) and students as targets

of change (target of change) which can be individuals, small groups, and communities up to the macro level. The relationship between the agent and the target of change has the potential to influence the results of the education carried out. So the role of the approach becomes important to help change agents maximize the results of the education they carry out.

Table 4. Results of literature review based on educational approach

Educational approach	Journal name
Education	(Boulet et al., 2022; Elnakib et al., 2021; Favuzzi et al., 2020; Gittlin et al., 2023; Jenkins et al., 2023; Karpouzis et al., 2021; Mariam et al., 2022; Wharton et al., 2021; Yazdankhah et al., 2020)
Policy	(Frank et al., 2021; Neff et al., 2020)

The results of the literature review include two approaches to education, namely through education and policy. Education through education has various models such as learning and training (Boulet et al., 2022; Elnakib et al., 2021; Favuzzi et al., 2020; Jenkins et al., 2023; Karpouzis et al., 2021; Mariam et al., 2022; Wharton et al., 2021; Yazdankhah et al., 2020) as well as educational models with projects (Gittlin et al., 2023). Apart from education, there are approach models in the form of policies to influence objective targets (Frank et al., 2021; Neff et al., 2020). According to Muttaqin et al. (2020) approaches in social education when viewed in terms of targets include a mentalistic approach, namely an approach that attempts to influence and change attitudes and behavior by directly influencing the mentality of the person concerned.

The conditional approach is an approach that attempts to change the conditions and situations around the person concerned which can have a direct influence on his appreciation. For example, in a mentalistic approach to social education, a teacher may use persuasive techniques to change students' attitudes towards recycling and encourage them to adopt more sustainable behaviors. In a conditional approach, an organization may improve the infrastructure of a community by providing better access to recycling facilities, ultimately leading to increased participation in recycling programs. If we refer to this opinion, we can approach the educational model (Boulet et al., 2022; Elnakib et al., 2021; Favuzzi et al., 2020; Gittlin et al., 2023; Jenkins et al., 2023; Karpouzis et al., 2021; Mariam et al., 2022; Wharton et al., 2021; Yazdankhah et al., 2020) which can be called a mentalistic approach because through the education carried out there is an effort to have a direct influence on the research sample. Meanwhile, the policy model approach (Frank et al., 2021; Neff et al., 2020) is included in the conditional approach.

3.2.2 Objective goals

Based on the objective targets of education, can be categorized into three types, namely behavior, concern, and awareness towards food waste; reducing the amount of food waste generated; and behavior, concern, awareness, and reduction of the amount of food waste generated. Behavior, concern, and awareness can be grouped under "Food Consumption Behavioral (FCB)" towards the generation of food waste while reducing the amount of food waste generation in the form of quantity can be referred to as "Food Waste Amount (FWA)". This difference arises because there is a monitoring stage for food waste generation using each measurement method during the education process. Educational efforts to prevent and manage food waste will be better if they can reach FCB and FWA targets from the household, school, or other downstream sectors. Journal classification based on objective targets is summarized in Table 5.

The objective targets in the results of the educational review that have been carried out can be broadly divided into two groups, namely the objective targets for food consumption behavior and the amount of food waste generated. Food consumption behavior can take the form of initiative and encouragement to reduce food waste, motivation and interest in

healthy eating patterns (Jenkins et al., 2023; McCarthy & Liu, 2017; Van Geffen et al., 2020; Visschers et al., 2016), concern for food waste as a factor of climate change (Mariam et al., 2022), food security (Karpouzis et al., 2021). In efforts to prevent food waste from arising, knowledge of food consumption behavior is very important because a lack of knowledge of food consumption behavior is a challenge in it self in efforts to prevent food waste (Tedrow, 2018) with this knowledge we can understand the causes of food waste generation to design potential solutions (Campbell & Munden-Dixon, 2018).

Table 5. Results of literature review based on objective targets

Scope of Objectives	Journal Name
Food Consumption Behavioral (FCB)	(Boulet et al., 2022; Frank et al., 2021; Gittlin et al., 2023; Karpouzis et al., 2021; Mariam et al., 2022; Neff et al., 2020)
Food Waste Amount (FWA)	(Elnakib et al., 2021; Wharton et al., 2021)
Food Consumption Behavioral (FCB) and Food Waste Amount (FWA)	(Favuzzi et al., 2020; Jenkins et al., 2023; Yazdankhah et al., 2020)

Apart from food consumption behavior which is an objective target, there is also education that is carried out which has an objective target in the form of reducing the amount of food waste or even covers both objective targets, namely food consumption behavior and reducing the amount of food waste. Whether or not the amount of food waste has decreased after education can be determined by monitoring and measuring food waste before and after education is carried out. To provide maximum results in the education process, it is highly recommended to monitor food waste that arises during the education process (Favuzzi et al., 2020). Efforts to prevent and manage food waste through education and policy need to pay attention to these two objective targets because this is important when it comes to food waste, including health, environmental, and economic aspects (Schanes et al., 2018). By addressing both consumer behavior and supply chain inefficiencies, significant progress can be made in reducing food waste. Educating consumers about proper food storage, portion control, and utilizing leftovers can help minimize waste at the household level. On the other hand, implementing policies that encourage food donation, standardizing expiration date labeling, and incentivizing food producers to reduce surplus can tackle waste within the supply chain. This multi-faceted approach can lead to a more sustainable and efficient food system while also benefiting society as a whole.

3.2.3 Educational outcomes

Educational success is seen from the achievement of the objective targets of the research conducted. Based on this, the results of the literature review reveal that educational outcomes have an impact on achieving all or part of the objective targets that have been determined. However, there are also educational outcomes that do not have an impact on achieving the predetermined objective targets. The classification of journals that have been reviewed based on educational results is summarized in Table 6 below.

Table 6. Results of literature review based on educational results

Educational outcomes	Journal name
Provides an impact on the achievement of all objective targets	(Boulet et al., 2022; Frank et al., 2021; Gittlin et al., 2023; Karpouzis et al., 2021; Mariam et al., 2022; Elnakib et al., 2021; Wharton et al., 2021; Jenkins et al., 2023; Yazdankhah et al., 2020)
Provides an impact on achieving some objective targets	(Neff et al., 2020)
Does not have an impact on achieving objective targets	(Favuzzi et al., 2020)

Success in education carried out with diverse approaches and targets certainly produces diverse results. If we look at the achievement of the objective targets of the educational process carried out, three groups are found, namely all achieved (Boulet et al., 2022; Elnakib et al., 2021; Frank et al., 2021; Gittlin et al., 2023; Jenkins et al., 2023; Karpouzis et al., 2021; Mariam et al., 2022; Wharton et al., 2021; Yazdankhah et al., 2020) or partially (Neff et al., 2020) and not achieving objective targets (Favuzzi et al., 2020). Education with the results of achieving all objective targets has a mentalistic approach with learning, training, and project models. The results of education with a conditional approach in the form of healthy food policies for preschool children (Neff et al., 2020) have an impact on some of the objective targets. The objective target achieved was the healthy food consumption behavior of preschool children, but the percentage of food waste generation did not decrease significantly overall.

The results of the review also revealed that there was education that failed to have an impact on the objective targets that had been carried out (Favuzzi et al., 2020). These targets are behavior in selecting and evaluating food as well as evaluating the generation of food waste in the school canteen. If viewed based on the obstacles experienced during education, the failure of education to have an impact is due to the perception of participants who always return to their initial condition after the education is carried out and the absence of monitoring of the amount of food waste during educational efforts to prevent and manage food waste due to organizational constraints.

3.2.4 Obstacles

Education on the prevention and management of food waste in downstream sectors such as households, schools, and others has obstacles or obstacles that have been revealed in several research results. Based on the results of the literature review, 63.6% of all research results reviewed experienced barriers or obstacles during education (Boulet et al., 2022; Elnakib et al., 2021; Favuzzi et al., 2020; Jenkins et al., 2023; Mariam et al., 2022; Neff et al., 2020; Wharton et al., 2021). If further analysis is carried out, the obstacles experienced are based on the causes such as communication (Jenkins et al., 2023), length of time (Mariam et al., 2022), participant perception (Boulet et al., 2022), complexity of strategy education (Elnakib et al., 2021), economic conditions of participants (Wharton et al., 2021), educational approach models (Neff et al., 2020), and implementation of monitoring educational results (Favuzzi et al., 2020). Educational efforts to change the behavior of a group of people need to pay attention to important factors that can influence the results of educational efforts. According to Borek et al. (2015), 26 essential factors can influence group-based behavior change intervention efforts. These 26 factors are divided into 4 aspects, namely intervention design (educational program), intervention materials (educational program), participants, and facilitators.

If we look at the obstacles found based on the results of the literature review, the obstacles to the length of time and educational approach models can be overcome by paying attention to aspects of educational program design. The obstacles to the complexity of educational strategies and monitoring of educational results are included in the material aspects of educational programs. The participants' economic conditions and participants' perceptions are included in the participant aspects. Meanwhile, communication can be handled through the facilitator aspect because it includes professional background factors, personal characteristics, and the number of facilitators available. Apart from the need to pay attention to essential factors in efforts to change the behavior of a group, other things must be considered during the education process for preventing and managing food waste. These include fostering a culture of sustainability and responsibility, promoting awareness of the environmental impact of food waste, and providing practical tips for reducing waste in everyday life. Additionally, creating incentives for individuals and communities to minimize food waste can be a powerful motivator for change. By addressing these various aspects in a comprehensive education program, we can work towards a more sustainable future and reduce the amount of food that ends up in landfills. The process of implementing

educational programs can pay attention to processes that take into account the three main phases of (Lombard et al., 2018; Luka, 2020), namely insight and inspiration, creating ideas, and implementation as attached in the following table 7.

Table 7. The guidelines for group-based behaviour change interventions

Insight and Inspiration	Creating ideas	Implementation
Understanding, seeing, reflecting	Creating ideas, prototypes, evaluation	Narrative development, proof of concept, practice, and build
Repeated throughout the process		

Educational efforts also need to pay attention to the model of the approach used to reduce existing obstacles. According to (Wharton et al., 2021), a multi-faceted educational approach is effective in reducing food waste by up to 27.85% of all participants. So, in educational efforts to prevent and reduce food waste, it is necessary to use both approaches, namely the mentalistic and conditional approaches with the objective target of changing consumption behavior and reducing the amount of food waste generated. Monitoring education results through measuring food waste generation both before and after education is an important thing that must be done (Favuzzi et al., 2020), recommend these activities to maximize the impact of the education carried out. This also shows that it is easy for participants to try because the trial aspect influences that participants will receive an educational process related to the issue of food waste.

This study acknowledges several limitations that shape the interpretation of its findings. The literature search relied exclusively on the Scopus database and was limited to publications from 2020–2023, which may have excluded relevant empirical studies from other databases or earlier periods. The final selection of only 11 empirical articles also restricted the diversity of educational models available for analysis. Moreover, many studies used non-experimental or quasi-experimental designs and did not consistently provide quantitative measurements of food waste, thereby limiting the ability to draw strong conclusions about the effectiveness of the interventions. Several articles also lacked detailed reporting on contextual factors, intervention duration, and implementation barriers, which constrained cross-study comparisons.

Given these limitations, future research should broaden the scope of data sources, employ more rigorous research designs, and integrate objective measures of food waste to strengthen the evidence base. Scholars are encouraged to examine contextual influences—such as socio-cultural norms, economic conditions, and institutional support—that may moderate intervention outcomes. Developing multifaceted educational strategies that combine mentalistic and conditional approaches may enhance both behavioral change and reductions in food waste. Long-term monitoring is also essential to assess the sustainability of educational impacts beyond the intervention period. Such improvements will contribute to establishing more robust and adaptable models for food waste prevention and management in downstream sectors.

4. Conclusions

The conclusion obtained based on the results of this literature study is that in educational efforts to prevent and manage food waste, an educational approach needs to be used, namely a mentalistic approach or conditional approach with objective targets which include changing behavior toward food waste and reducing the amount of food waste generated. These two things, namely determining approaches and targets, can influence the results of educational efforts to prevent and manage food waste.

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Author Contribution

M.F. conceived the study, collected and analyzed the literature, and drafted the manuscript. H. supervised the research process, reviewed the manuscript, and contributed to revisions and final approval.

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During the preparation of this work, the author(s) used Grammarly to assist in improving grammar, clarity, and academic tone of the manuscript. After using this tool, the author(s) reviewed and edited the content as needed and took full responsibility for the content of the publication.

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References

- Aktas, E., Sahin, H., Topaloglu, Z., Oledinma, A., Huda, A. K. S., Irani, Z., Sharif, A. M., Van't Wout, T., & Kamrava, M. (2018). A consumer behavioural approach to food waste. *Journal of Enterprise Information Management*, 31(5), 658–673. <https://doi.org/10.1108/JEIM-03-2018-0051>
- Al-Zahrani, K. H., Baig, M. B., & Straquadine, G. S. (2018). Food waste in the Kingdom of Saudi Arabia: Implications for extension education. In *Climate Change, Food Security and Natural Resource Management: Regional Case Studies from Three Continents* (pp. 73–101). Springer International Publishing. https://doi.org/10.1007/978-3-319-97091-2_4
- Amirudin, N., & Gim, T. H. T. (2019). Impact of perceived food accessibility on household food waste behaviors: A case of the Klang Valley, Malaysia. *Resources, Conservation and Recycling*, 151, 104335. <https://doi.org/10.1016/j.resconrec.2019.05.011>
- Borek, A. J., Abraham, C., Smith, J. R., Greaves, C. J., & Tarrant, M. (2015). A checklist to improve reporting of group-based behaviour-change interventions Biostatistics and methods. *BMC Public Health*, 15(1). <https://doi.org/10.1186/s12889-015-2300-6>

- Boulet, M., Grant, W., Hoek, A., & Raven, R. (2022). Influencing across multiple levels: The positive effect of a school-based intervention on food waste and household behaviours. *Journal of Environmental Management*, 308. <https://doi.org/10.1016/j.jenvman.2022.114681>
- Campbell, D., & Munden-Dixon, K. (2018). On-farm food loss: Farmer perspectives on food waste. *Journal of Extension*, 56(3). <https://doi.org/10.34068/joe.56.03.23>
- Elnakib, S. A., Quick, V., Mendez, M., Downs, S., Wackowski, O. A., & Robson, M. G. (2021). Food waste in schools: A pre-/post-test study design examining the impact of a food service training intervention to reduce food waste. *International Journal of Environmental Research and Public Health*, 18(12). <https://doi.org/10.3390/ijerph18126389>
- Favuzzi, N., Trerotoli, P., Forte, M. G., Bartolomeo, N., Serio, G., Lagravinese, D., & Vito, F. (2020). Evaluation of an alimentary education intervention on school canteen waste at a primary school in Bari, Italy. *International Journal of Environmental Research and Public Health*, 17(7). <https://doi.org/10.3390/ijerph17072558>
- Frank, L. B., Finkbinder, E. M., & Powell, V. S. (2021). "Free Food on Campus!": A Novel Use of Instructional Technology to Reduce University Food Waste and Feed Hungry Students. *Journal of Hunger and Environmental Nutrition*. <https://doi.org/10.1080/19320248.2020.1850389>
- Gittlin, M. L., Clarizio, T., Lamino, P., Michels, A., Opejin, A., & Barrera, E. L. (2023). Transdisciplinary approaches to graduate student training for food-energy-water challenges. *Natural Sciences Education*, 52(1). <https://doi.org/10.1002/nse2.20119>
- Graham-Rowe, E., Jessop, D. C., & Sparks, P. (2015). Predicting household food waste reduction using an extended theory of planned behaviour. *Resources, Conservation and Recycling*, 101, 194–202. <https://doi.org/10.1016/j.resconrec.2015.05.020>
- Gustavsson, J., Bos-Brouwers, H., Timmermans, T., Hansen, O. J., Møller, H., Anderson, G., ... & Redlingshofer, B. (2014). *FUSIONS Definitional framework for food waste-full report*. Project report FUSIONS. <https://hal.science/hal-02800861/>
- Jenkins, E. L., Brennan, L., Jackson, M., & McCaffrey, T. A. (2023). Re-Licious: Co-Design with Adolescents to Turn Leftovers into Delicious and Healthy Meals—A School-Based Pilot Intervention. *International Journal of Environmental Research and Public Health*, 20(16). <https://doi.org/10.3390/ijerph20166544>
- Karpouzis, F., Lindberg, R., Walsh, A., Shah, S., Abbott, G., Lai, J., Berner, A., & Ball, K. (2021). Evaluating OzHarvest's primary-school Food Education and Sustainability Training (FEAST) program in 10–12-year-old children in Australia: protocol for a pragmatic cluster non-randomized controlled trial. *BMC Public Health*, 21(1). <https://doi.org/10.1186/s12889-021-10302-0>
- Lombard, C., Brennan, L., Reid, M., Klassen, K. M., Palermo, C., Walker, T., Lim, M. S. C., Dean, M., McCaffrey, T. A., & Truby, H. (2018). Communicating health—Optimising young adults' engagement with health messages using social media: Study protocol. *Nutrition and Dietetics*, 75(5), 509–519. <https://doi.org/10.1111/1747-0080.12448>
- Luka, I. (2020). Design Thinking in Pedagogy. *Journal of Education Culture and Society*, 5(2), 63–74. <https://doi.org/10.15503/jecs20142.63.74>
- Mariam, N., Nina, L., Fabian, B., Florence, Z., Simone, A., Ulf, S., & Daniel, F. (2022). The Food Waste Lab: Improving food waste reduction behavior through education. *Journal of Cleaner Production*, 370. <https://doi.org/10.1016/j.jclepro.2022.133447>
- McCarthy, B., & Liu, H. B. (2017). Food waste and the 'green' consumer. *Australasian Marketing Journal*, 25(2), 126–132. <https://doi.org/10.1016/j.ausmj.2017.04.007>
- Mondéjar-Jiménez, J.-A., Ferrari, G., Secondi, L., & Principato, L. (2016). From the table to waste: An exploratory study on behaviour towards food waste of Spanish and Italian youths. *Journal of Cleaner Production*, 138, 8–18. <https://doi.org/10.1016/j.jclepro.2016.06.018>

- Munesue, Y., Masui, T., & Fushima, T. (2015). The effects of reducing food losses and food waste on global food insecurity, natural resources, and greenhouse gas emissions. *Environmental Economics and Policy Studies*, 17(1), 43–77. <https://doi.org/10.1007/s10018-014-0083-0>
- Muttaqin, A. A. Z., Ainusyamsi, F. Y., & Iswanto, P. (2020). Nilai-nilai pendidikan sosial dalam al-qur'an surat ali imran ayat 134 (Analisis Tafsir Al-Qur'an Al-Azhim Karya Ibnu Katsir). *Bestari: Jurnal Studi Pendidikan Islam*. <https://doi.org/10.36667/bestari.v17i1.470>
- Neff, R. A., Zaltz, D. A., Hecht, A. A., Pate, R. R., Neelon, B., O'Neill, J. R., & Benjamin-Neelon, S. E. (2020). Preschool healthy food policy did not increase percent of food wasted: Evidence from the carolinas. *Nutrients*, 12(10), 1–10. <https://doi.org/10.3390/nu12103024>
- Notarnicola, B., Sala, S., Anton, A., McLaren, S. J., Saouter, E., & Sonesson, U. (2017). The role of life cycle assessment in supporting sustainable agri-food systems: A review of the challenges. *Journal of Cleaner Production*, 140, 399–409. <https://doi.org/10.1016/j.jclepro.2016.06.071>
- Nugraha, A., Sutjahjo, S. H., & Amin, A. A. (2018). Analisis persepsi dan partisipasi masyarakat terhadap pengelolaan sampah rumah tangga di Jakarta Selatan. *Jurnal Pengelolaan Sumberdaya Alam Dan Lingkungan (Journal of Natural Resources and Environmental Management)*, 8(1), 7–14. <https://doi.org/10.29244/jpsl.8.1.7-14>
- Osterback, A. M. K., Frechette, D. M., Hayes, S. A., Shaffer, S. A., & Moore, J. W. (2015). Long-term shifts in anthropogenic subsidies to gulls and implications for an imperiled fish. *Biological Conservation*, 191, 606–613. <https://doi.org/10.1016/j.biocon.2015.07.038>
- Porpino, G., Parente, J. G., & Wansink, B. (2015). Food Waste Paradox: Antecedents of Food Disposal in Low Income Households that Cook from Scratch. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.2563622>
- Quested, T. E., Marsh, E., Stunell, D., & Parry, A. D. (2013). Spaghetti soup: The complex world of food waste behaviours. *Resources, Conservation and Recycling*, 79, 43–51. <https://doi.org/10.1016/j.resconrec.2013.04.011>
- Ramukhwatho, F., duPlessis, R., & Oelofse, S. (2018). Preliminary drivers associated with household food waste generation in South Africa. *Applied Environmental Education and Communication*, 17(3), 254–265. <https://doi.org/10.1080/1533015X.2017.1398690>
- Richter, B., & Bokelmann, W. (2017). Explorative study about the analysis of storing, purchasing and wasting food by using household diaries. *Resources, Conservation and Recycling*, 125, 181–187. <https://doi.org/10.1016/j.resconrec.2017.06.006>
- Roodhuyzen, D. M. A., Luning, P. A., Fogliano, V., & Steenbekkers, L. P. A. (2017). Putting together the puzzle of consumer food waste: Towards an integral perspective. *Trends in Food Science & Technology*, 68, 37–50. <https://doi.org/10.1016/j.tifs.2017.07.009>
- Sa'pang, M., Harna, H., Dhyani, P., Hartanto, D., Cindiana, V., Dewi, A. D. P., ... & Farhana, F. (2023). Sosialisasi Upaya Pencegahan Anemia Pada Remaja Putri di Kelurahan Cempaka Putih Barat, DKI Jakarta. *Ahsana: Jurnal Penelitian dan Pengabdian kepada Masyarakat*, 1(1), 20–25. <https://doi.org/10.59395/ahsana.v1i1.309>
- Saputro, W. A., & Santoso, A. P. A. (2021). Factors affecting food waste behavior (case study of Surakarta City community). *AGRITEPA: Jurnal Ilmu Dan Teknologi Pertanian*, 8(2), 165–174. <https://doi.org/10.37676/agritepa.v8i2.1658>
- Schanes, K., Dobernig, K., & Gözet, B. (2018). Food waste matters-A systematic review of household food waste practices and their policy implications. *Journal of Cleaner Production*, 182, 978–991. <https://doi.org/10.1016/j.jclepro.2018.02.030>
- Silvennoinen, K., Katajajuuri, J.-M., Hartikainen, H., Heikkilä, L., & Reinikainen, A. (2014). Food waste volume and composition in Finnish households. *British Food Journal*, 116(6), 1058–1068. <https://doi.org/10.1108/BFJ-12-2012-0311>
- Stöckli, S., Niklaus, E., & Dorn, M. (2018). Call for testing interventions to prevent consumer food waste. *Resources, Conservation and Recycling*, 136, 445–462. <https://doi.org/10.1016/j.resconrec.2018.03.029>

- Tedrow, A. M. (2018). The Georgia Master Composter Program: Increasing small-scale waste reduction and education. *Journal of Extension*, 56(4).
<https://doi.org/10.34068/joe.56.04.16>
- Van Geffen, L., van Herpen, E., & van Trijp, H. (2020). Household Food waste—How to avoid it? An integrative review. *Food Waste Management: Solving the Wicked Problem*, 27–55. https://doi.org/10.1007/978-3-030-20561-4_2
- Visschers, V. H. M., Wickli, N., & Siegrist, M. (2016). Sorting out food waste behaviour: A survey on the motivators and barriers of self-reported amounts of food waste in households. *Journal of Environmental Psychology*, 45, 66–78.
<https://doi.org/10.1016/j.jenvp.2015.11.007>
- Wharton, C., Vizcaino, M., Berardy, A., & Opejin, A. (2021). Waste watchers: A food waste reduction intervention among households in Arizona. *Resources, Conservation and Recycling*, 164. <https://doi.org/10.1016/j.resconrec.2020.105109>
- Yazdankhah, Z., Mehrabi, Y., Rakhshanderou, S., Safari-Moradabadi, A., & Ghaffari, M. (2020). Behavioral approach to food consumption and waste production: A quasi-experimental study. *Journal of Education and Health Promotion*, 9(1).
https://doi.org/10.4103/jehp.jehp_506_20

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