



Plan, Prepare and Practice - Developing a Handbook on Sustainable Food Waste Management

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Abstract

Addressing food waste is a major thrust in education on sustainable living. This study sought to explore the food waste management needs of Maltese households and then develop a holistic educational resource targeting adults and youth on the cusp of independence. The study drew inspiration from Bronfenbrenner's socio-ecological theory to initially conduct a survey via online questionnaires identifying the perceptions, challenges, and practices of Maltese household managers regarding food waste management. The findings from the 52 completed surveys revealed a lack of awareness, knowledge and skills related to food waste, particularly its prevention and its negative environmental and societal consequences. These findings informed the creation of an original educational handbook, following andragogy principles, with a learner-centred approach. Key features included sections on food storage and preservation, a collection of seasonal recipes, and multiple practical, motivational tips interspersed throughout the book. In alignment with national policy on lifelong learning and with foundational Home Economics objectives, this booklet can be used as a tool for community-based, in-person, and/or online workshops to help nurture individuals with competencies to minimise food waste and promote sustainability in their households.

KEYWORDS: FOOD WASTE MANAGEMENT, SUSTAINABLE PRACTICES, HANDBOOK DEVELOPMENT, ADULT EDUCATION, FOOD WASTE EDUCATION

Introduction

A healthy diet is a fundamental human right (United Nations Human Rights, 2019); however, a stark reality persists, as highlighted in the 2023 State of Food Security and Nutrition in the World report (FAO et al., 2023) with 691 million people confronting daily food insecurity. Amid pressing global concerns such as just food supply, availability and accessibility, the issue of food waste demands attention.

Defining Food Waste

The term *food waste* has various definitions. The UN Environment Programme defines it as unconsumed food that crosses the entire food chain but remains uneaten due to spoilage, expiration, or disposal (Zellner et al., 2014). Conversely, the FAO (2013) defines it as the disposal of edible food products at retail and consumer stages, primarily observed in developed nations. Food waste can also encompass unconsumed food repurposed as animal feed, compost, or landfill disposal, resulting in resource loss (Gjerris & Gaiani, 2013). Diverse interpretations of "food waste" exist across cultures as well. For instance, some categorise animal by-products like organs and intestines as waste, while others do not (Gjerris & Gaiani, 2013).

Amount and Types of Food Waste

In 2022, 40% of global food production was wasted (Pearson & Cappa, 2022). Eighty-eight million tonnes of food are wasted in the European Union each year, costing 143 billion Euros (Stenmarck et al., 2016); and in 2020, Malta generated 33,213 metric tonnes of food waste (European Environment Agency, 2021). Much of this waste is nutritious and edible (Food Print, 2018) and occurs throughout the supply chain, from harvest to homes (Food Print, 2018). Households generate 53% of the total food waste in Europe, as compared to 19% by the processing industry, 12% by food services, 11% by the primary production sector and 5% by the retail/wholesale sector (Racz et al., 2018). Sadly, over 95% of this food waste ends up in landfills (Melikoglu et al., 2013). In Malta, a 2016 study found that individuals often discard food out of fear due to a lack of information, skills and experience in assessing food safety (Attard, 2016).

Indeed, food deterioration is the main cause of household food loss, often as a result of delayed consumption though other factors also contribute (Raak et al., 2017). According to Kiely (2017), factors that can cause food to decay at home include poor storage, a lack of access to refrigeration, the usage of partially consumed components, and an incorrect assessment of the amount of food needed. The latter often results in excessively prepared meals, with greater servings often surpassing the capability for ingestion. In addition, a lot of people throw away leftovers because they forget or have no idea how to reuse them (Gunders & Bloom, 2017).

Lifestyle and the Food Waste Link

Food waste has significantly increased because of lifestyle changes, notably those brought on by consumerism and the spread of convenience foods (von Massow et al., 2019). Notably, even in settings like Malta, changes in culinary practises and food choices have an impact on people's emotional relationships to food (Caruana et al., 2018). Some people discard food without hesitation since it has no emotional resonance for them (Ringland, 2022). This behaviour is influenced by a disconnection from food providers and a lack of a strong connection between food and one's "human identity." Additionally, not paying attention to the origins of meals and the specifics of the ingredients when making a purchase can result in food waste, especially when these factors conflict with individual and cultural preferences (Raak et al., 2017). The Ecological Systems Theory by Bronfenbrenner, published in 1979, offers a useful framework for understanding the many aspects involved in generation and management of food waste (Ringland, 2022). Based on this theory, the family's meal preparation, grocery shopping, and food storage routines make up part of the microsystem for food waste at the household level. Lack of meal preparation may result in impulsive food purchases and waste. Additionally, family food values like thriftiness and resource conservation contribute to decreased food waste in households by using leftovers and composting (Robinson, 2018).

Food Waste Education

A strategy, which emphasises how human activity and the environment interact is in line with concepts of sustainable education (FAO, 2017). Food waste reduction is integral to this action. Children and teenagers who grew up in stable food environments might not understand the significance of avoiding food waste when they reach adulthood (Schanes et al., 2018). Young people, as future household managers, need to be motivated to understand their position as global citizens and agents of change, boosting their self-assurance and self-esteem (Schanes et al., 2018). Education on food waste avoidance needs to be a priority for lifelong education.

Changing Behaviour

Awareness-raising efforts like the *Love Food, Hate Waste* campaign are remarkable in scope and complexity, and several have successfully promoted food waste reduction at home (Stöckli et al., 2018). However, these programmes usually lack a theoretical basis, enough monitoring, and effectiveness evaluations, making it impossible to pinpoint the exact causes of behaviour change (Stöckli et al., 2018). People are internally or externally driven to change their behaviour and go through a multiphase process called behavioural transformation (Bamberg, 2013). Goal setting and goal striving are the first two phases of goal-directed behavioural change (Nielsen, 2017). On the other hand, goal proving is the process of putting intentions to change into action (Bamberg, 2013).

People have different goals about their food-related behaviours, such as supplying enough food for their family, consuming safe and healthy meals and enjoying the eating experience. While individuals may intend to change their behaviour, simply having the intention does not guarantee that they will follow through (Sheeran & Webb, 2016). It becomes necessary for people to prioritise their goals since they have limited time, money and cognitive capacity to allocate towards their food choices (Mann et al., 2013).

One of the most straightforward and efficient actions to save money, lessen the impact of climate change, and save natural resources is to ensure that food does not go to waste (Gunders, 2012). Various forms of intervention can be used to help implement a desire to decrease food waste (Matthies, 2012). Such interventions emphasise reminding people of their goal to reduce food waste levels and making this purpose simpler to act upon rather than raising their motivation. The strategies used by the interventions vary; some help reinforce intentions, while others help make intentions more precise. Other interventions are more procedural and advise individuals on how to minimise food waste (instructions) effectively, track the impact of their behaviours (feedback), or assist them by making the behaviours easier to conduct.

Empowering Adults to Change

In any educational intervention with adults, knowing what works best with adults as 'teaching' and 'learning' processes is important. According to Malcolm Knowles' theory, andragogy comprises five critical assumptions regarding how adult learners process information differently from children (Smith, 2010). These assumptions include adult learner experience, self-concept, readiness to learn, learning orientation and learning motivation. Being sensitive to these assumptions can facilitate creation of effective training programmes.

First and foremost, learning must be based on experience. Adults gain more from taking note of their prior experiences, even their shortcomings. Secondly, adults must be actively involved in developing, delivering, and evaluating the training content. Additionally, adult education is

problem-focused rather than content-focused. Finally, adults are interested in acquiring knowledge or skills to enhance their quality of life, careers, or social relationships (Chao, 2009; Smith, 2010).

Study Purpose and Design

This study departed from the notion that it is essential to educate users about food waste to eventually eradicate it. A two-phase study was conducted which sought to develop an educational resource for adults to help in the avoidance and minimisation of food waste at household level in Malta (Figure 1). First a survey was carried out with members of households in Malta to gather data on current perceptions, experiences and practices related to food waste. The specific research questions were:

- 1) What are the common perceptions, challenges, and good practices in Maltese households with respect to food waste reduction?
- 2) What information and practical tips would adults who are the main food managers in their household find useful in an educational handbook on sustainable food waste management?

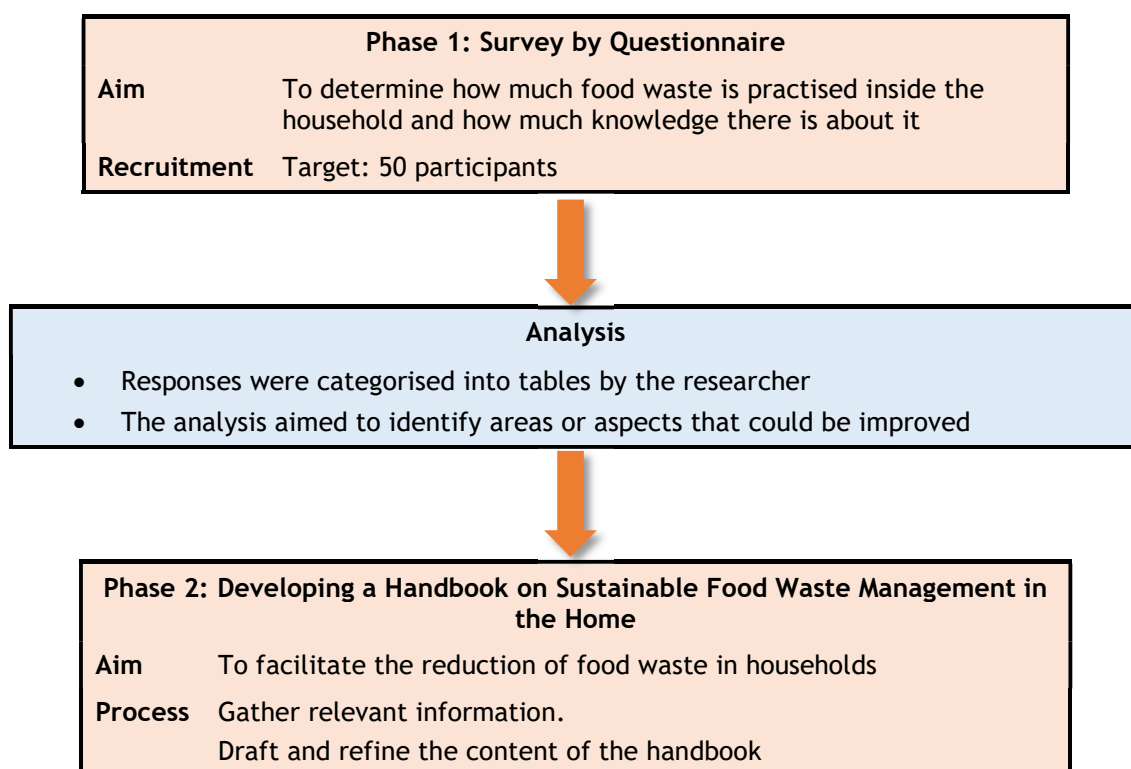


Figure 1 The research design

In phase 2, key findings were then used to craft an educational handbook designed for those who oversee food provision in households. The handbook provided awareness-raising information and practical tips on food acquisition, storage, and preservation, along with traditional and innovative recipes to inspire users to experiment with fresh or leftover ingredients. It also offered insights on making recipes healthier and enhancing food presentation. To build on existing knowledge, a constructivist approach was used, basing the

food waste prevention education activities on consumers' existing patterns of behaviour and promoting more desirable patterns of behaviour.

Phase 1: Baseline Investigation

Research Paradigm and Theoretical Framework

For the exploratory phase this study adopted a post-positivist worldview, where the scientific method is used to accumulate data to either confirm or refute research questions. This aligns with Kuczynski's (2012) take on empiricism where he proposes that we learn things by directly or almost directly observing them. The "empiricism" theory is further empowered by Kant's statement "that all knowledge not only begins with experience but also is derived from or arises out of experience" (Leiden, 2012, p.123). This study used the empiricism theory to create the research method and tools, ensuring that the right questions were asked to obtain the required data from Maltese household managers about their food waste experiences and knowledge.

Sample Recruitment

To obtain insights into people's food waste-related perceptions and behaviour at home, the researcher opted for an online survey as the data collection method, using a questionnaire as the tool. While qualitative data could provide in-depth information, quantitative data was deemed more practical for reaching busy and hard-to-reach individuals (Leavy, 2017). Snowball sampling was employed to gather information from participants and their acquaintances, by posting an invitation to participate and a link to the survey on informal social media groups and pages involving adults. The online questionnaire allowed respondents to complete it at their convenience, enabling the collection of a substantial amount of data (Davies & Hughes, 2014). Furthermore, using online questionnaires is more environmentally friendly than distributing physical forms. The primary person in charge of the household's grocery shopping, food provision, food storage and menu planning was the inclusion criterion for sample selection.

The Data Collection Tool

The questionnaire mainly comprised fixed-choice questions, such as multiple choice and checklists, providing respondents with a range of potential responses. According to Bergin (2018), this type of question structure makes it simple for the researcher to obtain a variety of straightforward data points that are also very generalisable when using large samples. However, a few open-ended questions were also included for a more detailed response. The objectives of each section of the questionnaire are presented in Table 1.

Table 1 Questionnaire objectives

Section	Specific Objectives	
1	Buying groceries and essential knowledge regarding food	<ul style="list-style-type: none"> To investigate respondents' food purchasing patterns and choices.
2	Meal planning	<ul style="list-style-type: none"> To examine respondents' behavioural attitudes and practices in respect of meal planning.
3	Preservation Methods	<ul style="list-style-type: none"> To identify respondents' awareness of the value of food preservation. To determine respondents' awareness of various preservation techniques. To investigate respondents' attitude toward food waste. To identify any strategies implemented to reduce food waste.

The questionnaire was piloted with two users similar in profile to the intended audience. Pilot participants' verbal suggestions led to adjustments. The length of the questionnaire was a common critique. Minor adjustments, such as grammatical errors and required questions, were also considered to improve the final version.

Implementing and Analysing the Survey

A web-based questionnaire was made available to participants from August 8, 2022, through November 8, 2022, via an online platform. To improve validity through providing clarity, individuals could complete the questionnaire in either English or Maltese. Eventually, 52 valid surveys were collected. Microsoft Excel was used for the analysis of the questionnaire data after gathering the results. Basic descriptive statistics were generated automatically by the platform for the quantitative data and qualitative responses were analysed manually by the researcher, consolidating and tallying as necessary.

Limitations

Several limitations can be outlined, mainly with respect to the data collection tool. Since the questionnaire was shared on social media, people who did not have access to the internet or were not computer literate, such as some elderly, could not fill it out or needed help from family members. Using a questionnaire that primarily consists of multiple-choice questions ignores any thoughts and opinions that respondents may have about the subject being investigated, as pointed out by Leavy (2017). In addition, although participants were allowed to respond at their convenience, the questionnaire was quite time-consuming, so individuals may have chosen to fill it out without much thought or attention to understanding the questions well; or merely started responding without so much precision due to respondent fatigue. Notably, this study was based on a small sample specifically to gain an insight into needs. Its results cannot be generalised and any reliability test may not be accurate (Leavy, 2017).

Phase 2: Resource Design, Production and Evaluation

Reasons for Choosing a Handbook

To effectively communicate practical information, an educational handbook is an ideal format. Handbooks are convenient and accessible, as they can be either a soft or hard copy and can be referred to multiple times (Smith, 2021). They also provide a structured and organised approach to presenting information, which is particularly helpful for those new to a topic, in this case sustainable food waste management (Smith, 2021).

Theoretical Background

For this resource to be more effective, the researcher sought to adopt a framework to help in altering behaviour, as this is a crucial component of sustainable food waste management (Redman & Redman, 2014). Acknowledging that a well-developed framework facilitates education delivery by addressing a variety of learning styles (Meyer, 2017), the handbook comprises various 'educational' messaging formats and tasks. As stated in the literature review, andragogy emphasises the significance of building upon adults' prior experiences and knowledge (Matthies, 2012). Adults learn best when the material is relevant to their everyday interests and objectives (Graham, 2017). In addition, they must be able to connect their learning to real-world experiences and be provided with opportunities to put their knowledge into practice. In this regard, any handbook needs to clearly articulate why the topic is beneficial and how the users—learners—will benefit. This could involve incorporating practical tips and real examples that are relevant to them, encouraging them to try new skills.

Application of the Baseline Investigation Results

The baseline survey proved invaluable in developing an educational handbook on sustainable food waste management. Table 2 shows how the data was used to categorise and determine which information should be included in the handbook.

Table 2 Application of the baseline investigation results

Outcomes from the baseline study	Information/Tasks to include in the handbook
40% regularly check what they have at home.	Check what they have in pantry, cupboards, fridge, and freezer and avoid unnecessary purchases.
25% of the target audience tends to purchase fresh produce in bulk during its seasonal availability.	Emphasise the value of using seasonal items in meal preparation and food preservation practices, giving examples and outlining processes.
50% of the participants checked for expiration dates.	Emphasise the importance of date labelling as it contributes to lessen food waste generation
29% of the target audience always practises meal planning, due to a lack of time, which was the primary reason cited by 39% of the participants.	Provide tips on the proper storage of food items in the fridge or freezer, which can help save time and reduce food waste.
67% of the target audience uses leftovers the next day.	Supply practical tips on proper food storage to maximise the shelf life of leftovers.
92% of the target audience throws away food scraps.	Educate users on the concept of food scraping and how food scraps can be repurposed into completely new food items.
60% of the target audience does not practise food preservation at home.	To highlight different food preservation methods that can be easily implemented
Some users are not aware of the importance of reheating food items to eliminate bacteria	Emphasise the importance of proper reheating practises. This can help alleviate concerns and aid those who may be afraid of this issue.
From the baseline study: vegetables (29%), fruit (23%), and cereal products (22%), emerged as the most commonly thrown-away food items.	Outline a seasonal meal plan to minimise food waste.

Andragogy principles were applied to the study's results and analysis. The study collected information from participants who handled grocery shopping, food provision, food storage, and meal planning. These are all activities that require adult skills, knowledge, and experience. Hence, the study provided insights into how adults can be empowered to reduce food waste in their households considering the importance of self-directed learning and taking personal responsibility—key principles of andragogy.

Aims and Objectives of the Handbook

Based on the key findings of the baseline study (Table 2), and the ultimate goal of nurturing sustainable and healthy food behaviours, the aims and objectives of the educational handbook are listed in Table 3.

Table 3 Aim and objectives of the handbook

Aim
<ul style="list-style-type: none"> • To increase awareness among individuals and families about the impacts of household food waste on the environment, society, and economy. • To engage and empower household users to act towards reducing food waste.
Objectives
<ul style="list-style-type: none"> • To define household food waste and its environmental, social, and economic impacts. • To provide information on the causes of household food waste, including factors such as food storage, meal planning, and food shopping habits. • To offer practical guidance on how to reduce household food waste, including tips on food preservation.

Planning the Educational Handbook

Considering the multiple implications for learning appearing from the baseline study (Table 4), while also keeping andragogy in mind, the researcher constructed a mind map (Figure 2 next page) to facilitate the creation of an original and effective product. This specifically enabled the researcher to pinpoint the key subjects that would be the primary chapters of the handbook.

Designing the Handbook

The design of the educational handbook on household food waste involved careful consideration of various factors. The content was tailored to engage and be easily understood by the target audience. The information was organised logically, and visual aids, like images, were included for accessibility.

After planning the chapters and content, each chapter was drafted, and a Table of Contents was added for reader convenience. The chapters comprised the following topics:

Introduction

The introduction emphasised adult learning principles and presents the handbook's five chapters. It highlighted the urgency of addressing food waste and included statistics and references to Sustainable Development Goal 12 for credibility. Reflective questions and a quote from Pope Francis added depth and emotional appeal.

Chapter 1: Grocery Shopping Tips

This chapter covered meal planning, creating shopping lists, buying local and seasonal produce, and understanding food labels. The researcher used text boxes, templates, and visuals to aid comprehension. Reflective questions were included to encourage critical thinking about food waste habits.

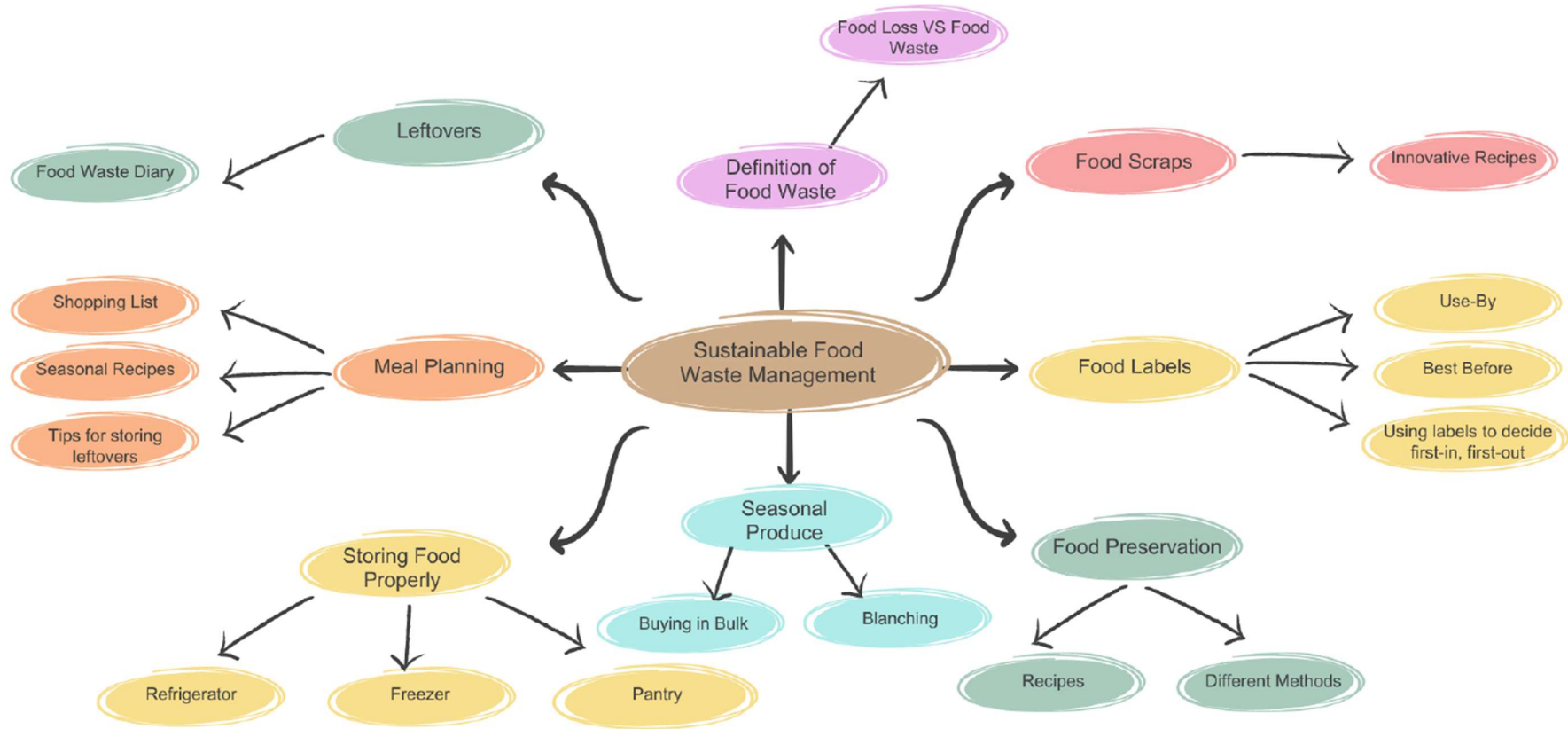


Figure 2 Planning the educational handbook

Chapter 2: Food Waste at Home

This chapter explained the difference between food loss and waste and included a food waste diary template with examples. It discussed leftover foods, proper reheating, and the advantages of using leftovers.

Chapter 3: Food Scraps... or Not

This chapter focused on using food scraps to create innovative recipes. It aimed to reduce the 92% of participants who reported discarding scraps. Easy-to-follow recipes were provided, emphasising bread and vegetable utilisation.

Chapter 4: Food Preservation

This chapter explored food preservation methods and included recipes. Instructions on jar sterilisation were given to prevent contamination. Various preservation techniques were introduced to engage the audience, along with a crossword puzzle to reinforce learning.

Chapter 5: Seasonal and Reworked Meal Plans

The final chapter proposes meal plans for each season, emphasising seasonal produce. Shopping list templates and colour-coded leftover and reworked meals were provided. Detailed recipes and storage information were included to encourage trying healthy, budget-friendly recipes and batch cooking to reduce food waste.

In designing each chapter, a focus on engaging content and critical thinking questions aimed to raise awareness and promote action in reducing household food waste.

Format and Style

To ensure the accessibility of the handbook to all users, various factors in the format and style were considered. Andika size 13 was chosen for the font to ensure readability and legibility for all users (Borg, 2017). The background colour was also chosen to be suitable and distinguishable for users with dyslexia. Furthermore, the researcher also considered other factors, such as adequate line spacing, that makes the content more legible, particularly for users who struggle with tracking the text across lines. Additionally, bullet points and numbered lists were used to break up dense text and make the content more readable (Peters, 2022).

The language used in an educational handbook plays a crucial role in ensuring that readers comprehend the content. In this case, the language used was easy to understand and jargon was avoided. This is important because using complex language and jargon can make the content difficult to understand and readers may lose interest or become frustrated (Peters, 2022). In addition, a Glossary of terms was included at the end of the handbook. This is a useful tool for readers who may encounter unfamiliar terms throughout the text. By providing definitions of these terms, readers can better understand the content and the context in which these terms are used. This approach can also help improve the reading experience and promote comprehension.

The use of images and diagrams helped illustrate concepts and made the content more engaging and memorable. The chosen colour scheme featured green and pastel colours, which were selected for their calming effects on learners. Green is known to promote positive emotions, which can enhance both cognitive and emotional performance (Juviler, 2022). Meanwhile, pastel colours are less saturated and often associated with peaceful and calming vibes. The

soft look of pastels helps reduce eye strain and creates a more relaxing learning environment, which will help retain information. Moreover, the use of colour highlighted important information, broke up content, and made it visually appealing. However, it was crucial to ensure that colour was not the only means of conveying information, as some users may have colour blindness or other visual impairments (Rubio, 2020).

The Cover of an educational handbook is a key element that can make a lasting impression on readers. It serves as the first point of contact and can significantly influence their decision to engage with the content (Payne, 2021). The cover page's design can establish the document's credibility and professionalism, which is particularly important in educational settings. In designing the Cover, efforts were made to ensure it visually represented the content, theme and purpose of the handbook to attract the target audience. Furthermore, the images selected for the cover page served to give the reader an idea of what to expect.

Discussion

This study initially explored the issue of food waste practices in Maltese households, aiming to identify the main factors that contribute to food waste generation and management. The research methodology involved conducting an online survey to collect data on food habits and waste, which proved effective in providing valuable insights. The findings revealed important aspects of food waste behaviour. The results indicated both positive and negative behaviours. Notably, only 40% of participants consistently checked their existing inventory before shopping, which contributes to buying unnecessary items and, subsequently, food waste. Additionally, a mere 50% of respondents checked expiration dates which could lead to the disposal of perfectly edible food. On a positive note, 67% of respondents habitually used leftovers, showing potential for reinforcement and change. These findings underscored the necessity for practical advice and strategies to enhance shopping practices, raise awareness about expiration dates, and promote leftover utilisation to reduce food waste effectively.

Whereas the online survey allowed for efficient data collection from a diverse group of respondents, giving a comprehensive understanding of food waste practices in the Maltese households involved, it is worth noting that the sample was primarily composed of women, potentially introducing gender bias into the findings, as food provision and waste management responsibilities are often shared among household members. Therefore, future research should aim for a more balanced representation of gender in the sample.

Data collected from the survey was sufficient to offer a solid foundation for the creation of an educational handbook on food waste management. The educational handbook aligns with andragogy principles, emphasising self-directed learning, active engagement and the relevance of content to adult learners' lives. It empowers readers with knowledge and practical tools to reduce food waste, including practical advice, engaging activities, and a focus on personal responsibility, which aligns with the andragogical approach to adult education.

The study effectively addresses growing concerns on food waste and sustainable practices, producing an educational resource to help combat food waste through individual and household actions. The feedback from a small group of individuals similar in profile to the target audience emphasises the need for continuous improvement and adaptation of educational resources to suit the Maltese context. Additionally, the positive response to the handbook's sections on food

leftovers and seasonal dishes suggests that practical advice and engaging content can drive behavioural change.

Conclusion

This study has delved into the myriad aspects of food waste practices in Maltese households, shedding light on their dynamics before, during, and after meal preparation. The study uncovered a multitude of factors influencing food waste creation and management. Unfortunately, many individuals seem to discard food without much thought, potentially driven by financial security or concerns about food safety. This behaviour not only hinders responsible budgeting and resource management, but also inflicts harm upon the environment. The lack of awareness about the gravity of food waste is especially disheartening, considering the global food insecurity crisis that plagues millions.

Building upon the insights obtained from the investigative baseline survey with adults, the researcher developed an educational handbook on food waste management aimed at adults responsible for food provision, preparation and storage in their households. This handbook, designed to reduce negative environmental impact and financial impact resulting from food waste, sought to empower readers with knowledge and practical tools. Utilising learner-centred, engaging, and culturally appropriate messaging and tasks, the handbook provided practical advice, to induce behavioural change and promote sustainable food practices.

Suggestions for Future Research

To further our understanding and efforts in reducing food waste in Malta, future research should consider working with larger, nationally representative samples to explore consumer attitudes, beliefs, and practices. Additionally, community-based, in-person, and online workshops for household food providers could help evaluate the effectiveness of educational materials and foster a sustained community of practice. These steps will advance our collective goal of mitigating the detrimental impacts of food waste on both personal budgets and the environment.

Implications for Home Economics Educators

The original food waste educational handbook holds promise as a valuable resource for Home Economics educators, offering various benefits to support their teaching objectives. This guidebook can be seamlessly integrated into the secondary level curriculum, addressing topics such as seasonal vegetables fruits and vegetables, culinary skills, food preservation and sustainable living practices at home. Educators can use the handbook as a structured teaching tool with both secondary and adult learners, enabling them to reflect on their food waste behaviours and apply their current and new knowledge and skills in real-world contexts, thereby deepening their understanding of the subject matter. One of the handbook's core principles is to instil a sense of responsibility in its users, emphasising that small steps towards sustainability contribute to the achievement of sustainable development goals and the wellbeing of future generations.

Biographies

Claire Agius was born in Malta on March 24th, 1998. Her passion for cooking began at a young age, as she frequently assisted her mother in the kitchen. Claire pursued her interest in Home Economics starting in Form 3, successfully obtaining her O-Level and later her A-Level qualifications at G.F. Abela Junior College. She then continued her studies at the University of Malta, where she earned a Bachelor of Science (BSc Hons.) in Home Economics.

Claire furthered her education by completing a two-year postgraduate course, obtaining a Master's degree in Teaching and Learning in Home Economics with a focus on Health and Social Care. Currently, Claire is teaching Home Economics at a government school in Malta, and she also works part-time in addition to her teaching responsibilities.

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