

What are the factors that an opportunity sample of UK students insinuate as being associated with their wastage of food in the home setting?

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1 **What are the factors that an opportunity sample of UK students insinuate as being**
2 **associated with their wastage of food in the home setting?**

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11
12 **Abstract**

13 The aim of this research was to investigate the factors that influence student awareness and
14 behaviour associated with food waste. The study is exploratory in nature and the qualitative
15 research approach contextualises personal accounts of food waste awareness and behaviour.
16 Semi-structured interviews were undertaken with students (n=50) from 12 households, who
17 were enrolled at a UK university. Qualitative data was collected and thematically analysed
18 using Microsoft NVivo 11 and a thematic map developed to firstly postulate how students'
19 awareness and behaviour associated with food waste is influenced and secondly to support
20 further study in this area. In order to tackle the issue of students' food waste, measures to
21 increase awareness of food waste and improving design of kitchen environments should be
22 adopted. However the latter is often not possible in short-term rented accommodation. The
23 research contributes to the existing area of research and provides additional evidence for the
24 factors that influence students' food waste behaviour.

25 **Keywords: food, waste, consequences, awareness, student, resources, behaviour**

26 **Highlights**

- 27 • Fifty students interviewed in twelve households about their food waste practice.
28 • Multiple factors of influence including: habits, awareness, and social influences.
29 • Measures to increase awareness and improve kitchen design should be adopted.

30
31 **1. Introduction**

32 Global food waste is estimated to be 1.6 billion tonnes annually of which 1.3 billion
33 tonnes is edible with a value of \$750 billion (FAO, 2017). This scale of food waste impacts
34 society, the environment and the wider economy, in a world that is already struggling to feed
35

36 the population. Global food production will need to increase by 50-70% to feed the 9.3 billion
37 people living on the planet by 2050, whilst natural resources are becoming ever more scarce
38 (Bond *et al.* 2013). Consequently, food supply chains need to become more sustainable from
39 farm to fork, including by reducing existing levels of personal food waste. Food safety scares
40 too can also have a major impact on supply chain food waste: for example, a Salmonella
41 warning caused 32% of American tomatoes to be unharvested in 2008 (Gunders, 2012).

42 Total United Kingdom (UK) household food waste levels increased from 7 million
43 tonnes in 2012, to 7.3 million tonnes of food in 2015 at a monetary value of £13 billion per
44 annum. Avoidable UK household food waste reduced by 21% between 2007 and 2012
45 (Smithers, 2017) then increased by 5.1% to 4.4 million tonnes in 2015 (Quested and Parry,
46 2016). Individuals may not realise the impact that food waste has on the economy, the
47 environment, and society often thinking because food is natural, and it simply rots into the
48 ground (Doron, 2013). Domestic food waste largely ends up in landfill sites (Quested and
49 Parry, 2011), where space is becoming increasingly scarce, especially as communities do not
50 want new landfill sites a given area, due to environmental and aesthetic concerns (Barr,
51 2004). When food is placed into landfill the resources associated with the food are lost
52 (Doron, 2013), including in the UK, 5,400 million cubic metres of water annually (Quested
53 and Parry, 2011). In addition, methane, a potent greenhouse gas, that is 23 times stronger in
54 terms of the environmental impacts than CO₂, is produced when food starts to rot into the
55 ground (Thermelis and Villoa, 2007), whilst 19 million tonnes of CO₂ is produced when
56 manufacturing, distributing, storing and disposing of avoidable food waste (Doron, 2013).

57 Literature suggests two main motivators to encourage individuals to reduce food waste
58 namely **environmental concerns** (Doron, 2013) and the **monetary value** associated with
59 food waste (Lyndhurst, 2007; Graham-Rowe *et al.* 2014). These factors are important when
60 considering the policy campaigns that have been developed to influence personal behaviour.
61 Since 2009, a series of campaigns have been launched in the UK, by the government and
62 supermarkets, with the aim of trying to reduce food waste levels (Quested and Parry, 2016).

63 In 2005, the UK government launched the Courtauld Commitment, which is a voluntary
64 agreement between major suppliers, manufacturers and supermarkets to improve resource
65 efficiency and reduce waste. Subsequently, four stages of the agreement have been launched
66 with future targets for 2025 to reduce food and drink waste by 20% (WRAP, not dated). In
67 2007, the UK government ‘Love Food Hate Waste’ (LFHW) campaign aimed to reach two
68 audiences: firstly, the 15 million adults who are already aware, but need help in reducing the
69 amount they waste, and secondly the remaining population who were identified as not being
70 aware of food waste issues (Quested *et al.* 2012). It is difficult to determine the contribution
71 of such campaigns to reducing food waste, because other concurrent socio-economic issues,
72 can also play a part in food waste reduction. However recent research has suggested that
73 appropriately targeted campaigns are of value (Schmidt, 2016; Delley and Brunner, 2017).
74 The UK recession (2008 – 2012) caused food prices to rise by 14% whilst consumer income
75 stayed static (Quested and Parry, 2011). As households had less disposable income,
76 consumers started to pay more attention to perishable products like meat, as they could not
77 afford to waste food (Quested and Parry, 2011; Miller and Branscum, 2012). Arguably this
78 economic factor may have contributed to food waste reduction between 2007–2012, as
79 equally as the impact of the LFHW campaign.

80 Food loss occurs at all stages of food production (Figure 1), but the further down the
81 supply chain the food travels from the farm, the more costly it becomes to waste food as
82 greater value has been added, both in monetary and environmental terms. This makes
83 consumers and food retailers the most impactful food wasters in cost, society and
84 environmental terms (Eriksson *et al.* 2015). Figure 1 illustrates the potential factors that
85 contribute to the loss of food at different stages along the food supply chain.

86 **Take in Figure 1**

87

88 The literature demonstrates clearly that food waste is a global problem and a national problem
89 too in the UK and that unless action is taken to engage individuals and encourage them to

90 modify their behaviour then the social, environmental and economic impact will continue
91 unchecked.

92 **2. Food waste behaviour and its impact on the quantities of food wasted**

93 Consumer food waste can be categorised into three different groups: avoidable,
94 possible avoidable and unavoidable (Quested and Johnson, 2009). **Unavoidable food waste**
95 includes inedible material that would not be consumed under normal conditions, for example,
96 egg shells, fruit stones or animal and fish bones. **Possible avoidable food waste** is the food
97 and drink material that some people eat, whilst others do not (Quested and Johnson, 2009:14).
98 Alternatively **avoidable food waste** is classed as any food and drink product that was once
99 edible, but now due to its current nature is no longer fit for consumption, such mouldy fruit
100 (Quested *et al.* 2012; Eriksson *et al.* 2015). Table 1 outlines over the time period between
101 2007 and 2015 the quantity of the three aforementioned categories of household food waste in
102 the UK.

103 **Take in Table 1**

104

105 The data shows a drop in avoidable food waste, but conversely a rise in unavoidable food
106 waste over the time period. Factors influencing the quantity of food waste at the retail level
107 that are within the scope of the business to address include: visual appearance of food at point
108 of sale, over ordering, baking too much, handling fresh produce incorrectly and undertaking
109 promotions on products that cause customers to over-buy when they are unlikely to consume
110 the product (Stenmarck *et al.* 2011). Customers favour choice with fully stocked shelves,
111 forcing supermarkets to over order and over stock, increasing the chances of food going out of
112 date (Stuart, 2009; Stenmarck *et al.* 2011; Wyman, 2014) Furthermore, when supermarkets
113 run promotions such as ‘buy one get one free’, consumers switch away from regularly
114 purchases, to promotional offers, causing a variance in demand and increasing the chance of
115 over purchase and subsequent spoilage (Quested *et al.* 2012; Wyman, 2014). Consumer
116 buying patterns depend on additional factors too such as the weather, season, offers and

117 moods (Stenmarck *et al.* 2011; Eriksson *et al.* 2015) and retailers need to consider this as part
118 of their customer offer in order to minimise food waste at retail level.

119 The ‘**good provider**’ describes individuals, who purchase large amounts of fruit and
120 vegetable and tend to overcook, as they feel they have failed if the family goes hungry, or
121 snacks on unhealthy food (Graham-Rowe *et al.* 2014; Quested and Luzecka, 2014; Mallinson
122 *et al.*, 2016). ‘**Food recipients,**’ are those individuals who do not buy food for themselves and
123 live in the family home i.e. children and teenagers who, Graham – Rowe *et al.* (2014) argue,
124 are more likely to waste food, due to the lack of understanding of the monetary value of food.
125 Food waste in the family setting may also be in response to ‘**children being fussy**’. Parents
126 are more likely to follow use by dates¹, as they are concerned with the microbial safety issues
127 surrounding food products (Quested and Luzecka, 2014).

128 The older generation, i.e. in their seventies and over, can be typed as the ‘**waste**
129 **intolerators**’. They waste 25% less food compared to the rest of the population. They lived in
130 households with no tolerance of food waste, using up all the scraps and leftovers during the
131 food rationing in the Second World War (Quested *et al.* 2013) and greater levels of education
132 on food management and cooking (Godfray *et al.* 2010). This mindset has remained, even
133 though food is relatively cheaper than the past (Graham-Rowe *et al.* 2014). Conversely,
134 people lacking cooking skills and food storage knowledge are more concerned with the safety
135 risks involved with food, compared to those who do know how to cook and store food
136 correctly (Lyndhurst, 2007). The younger generation, i.e. aged 18-24, are said to be **less**
137 **educated** in terms of food, food storage and food waste, and scraps and leftovers are more
138 often thrown away due to them being perceived as being of little monetary value. Young
139 adults such as students, who have just moved out the family home, may not be able afford to

¹ The ‘best before’ date is associated with the quality (i.e. taste, texture, and aroma) and appearance of the product, which will slowly deteriorate after the date on the packaging, but it still safe to eat (Defra, 2011). Whereas the ‘use by’ date, is linked to the microbiological safety of the food product so after the ‘use by date’ has expired, the food could potentially cause illness (Defra, 2011).

140 waste food, so they should in theory have greater awareness of the monetary value of food
141 waste (Graham - Rowe *et al.* 2014). Conversely, other literature suggests that the younger
142 generation, aged 18-24, are the highest food wasters within society (Hamilton *et al.* 2005;
143 Lyndhurst, 2007; Principato *et al.* 2015; Mallinson *et al.* 2016). The literature highlighted a
144 duality in findings with regard to student behaviour and no previous literature has considered
145 UK students specifically. This presented as the research gap that this empirical work is
146 designed to address. This paper is structured as follows: firstly an introduction to the topic of
147 study. The methodology of the empirical study is then outlined followed by the results, and
148 analysis. Key themes are discussed and conclusions and recommendations provided for
149 further research.

150 **3. Food waste and behaviours associated specifically with students**

151 There have been a few studies on the topic of food waste and the younger generation
152 including Italian and Spanish students (Graham-Rowe *et al.* 2014; Queded and Luzecka,
153 2014; Principato *et al.* 2015; Mondéjar-Jiménez *et al.* 2016). Principato *et al.* (2015) in their
154 Italian study with students (n=230) found the greater knowledge students had of the issues
155 surrounding food waste, the greater the chance of changing behaviour. However, in the study
156 students struggled to identify the specific environmental, social and economic issues linked to
157 food waste. Conversely, Graham - Rowe *et al.* (2014) determined that with students the
158 monetary value of food waste was a motivator.

159 In a further study, 6% of students were confused between ‘best before,’ and ‘use by’
160 dates, and would throw the food away without a sensory evaluation (Principato *et al.* 2015).
161 Mondéjar-Jiménez *et al.* (2016) conducted an investigation to identify whether students in
162 Spain and Italy waste the same types of food. Table 2 shows the cultural difference in the
163 different types of food households waste on a weekly basis. For instance, on average Spanish
164 students wasted more white meat (14.75%) on a weekly basis than Italian students (7.36%).
165 Spanish students similarly wasted more convenience food (12.82%) per week on average
166 compared to Italian students in the study (2.94%). However, both countries, as with UK

167 households, waste more fruit, bread and vegetables than any other type of food (Caswell,
168 2008; Brown *et al.* 2014; Mondéjar-Jiménez *et al.* 2016).

169 **Take in Table 2**

170 The literature explored to provide context for this study has identified a number of
171 factors that may influence students' food waste behaviour including: being time poor,
172 confused over duration dates and lacking awareness of the global issues related to food waste
173 Figure 2 provides a summary of these and other factors that influence students' food waste
174 awareness, and behaviour.

175 **Take in Figure 2**

176 **There is a body of literature on food waste in the school food service, and canteen setting**
177 **(Ryley et al., 1979; Nicklas et al., 2013; Cohen et al., 2014; Hanks et al., 2014; Liu et al.,**
178 **2016) and whilst this is not the focus of the study such studies indicate the challenges**
179 **associated with food waste and young people.** Forty seven percent of 18-24 year olds in the
180 UK admit they lack knowledge when cooking and storing food in the kitchen (Sainsburys,
181 2016) and therefore are more likely to waste food when preparing, cooking and serving too
182 much. Universities in the UK are working with the LFHW campaign to help students when
183 they first move out of home, by giving advice on how to save money, gain greater skills in the
184 kitchen with simple recipes cards and advice on how to reduce food waste (Quested and
185 Luzecka, 2014), but students' awareness may not necessarily translate into actual behavioural
186 action. Awareness is defined for the means of this research as an individual's level of
187 knowledge, concern or interest in food waste and is a particular focus in this study.

188 **4. Methodology**

189 The aim of this research was to investigate the factors that frame student awareness and
190 behaviour associated with food waste. The study is exploratory in nature and the qualitative
191 data derived serves in terms of contextualising personal accounts of food waste awareness and
192 behaviour. The unit of analysis is therefore "the student", although the rationale for the
193 research recognises that the student does not exist in isolation, but is also influenced by the

194 household in which they live in terms of both its facilities, and also the other individuals in
195 the household. Thus, in analysing the results it is important to consider that the units of
196 analysis are not independent as social factors at the household level may have an influence.
197 This issue of interdependence means that qualitative rather than quantitative methods were
198 used in this research.

199 The methodology outlined here cannot be considered to be grounded theory in its
200 purest sense as a literature review has been conducted prior to the data collection phase in
201 order to contextualise the research within existing knowledge (Cresswell, 2012), what is
202 important in developing theory and to formulate a research question which is of interest
203 namely:

204 What are the factors that an opportunity sample of UK students insinuate as being associated
205 with their wastage of food?

206
207 However, the methodology has rather than a forcing approach followed an emerging,
208 exploratory approach (Glaser, 1992) with the literature being used to position the research
209 rather than inform its design in an alternative positivist approach. Constructivist grounded
210 theory means that the researcher is not neutral and the reflexive researcher's voice is thus
211 embedded within the methodology, through an active deliberation to prioritise primary data
212 analysis over and above the secondary data input via the literature (Ramalho *et al.*, 2015).

213 **4.1. Interview design**

214 Semi-structured interviews were undertaken with students (n=50) who were enrolled
215 at a UK university living in 12 rented households, of between three and six people (Table 3)
216 to build a picture of the relationship between place, student awareness, behaviour and food
217 waste.

218 **Take in Table 3**

219

220 A limitation of the study is the use of self-reporting by students and self-reporting might not
221 correlate to actual behaviour so face-to face interviews rather than an on-line survey was used
222 to seek to partially mitigate this factor. Dai et al. (2015) propose that interviews are well
223 established qualitative methods suited to explore the importance of factors of influence where
224 these have a complex interaction providing validity to the data but not indicating their relative
225 contribution nor distribution across the whole population rather than the reproducibility of a
226 quantitative data collection approach.

227
228
229

230 The interviews were conducted between February-March 2017, with one interviewer and one
231 interviewee at a time to maximise comfort and to avoid stress, anxiety and discomfort, whilst
232 taking into consideration the participants' body language as a means of improving the
233 researcher's judgment on the response (Bryman and Bell, 2011). This approach also avoided
234 response bias where participants might change their statements as might have occurred if a
235 group interview approach had been used as individuals do not liked to be seen in a negative
236 light or as exhibiting the "wrong" social behaviour by peers (Edmunds, 1999). A relaxed
237 conversational approach was used, but still with an underlying purpose, direction and with
238 prepared high level questions to use as a prompt if needed (see Appendix 1). The interviews
239 were structured around six themes of potential influence that arose from the literature review
240 element of the methodology: buying habits, kitchen, duration dates, monetary value, social
241 consequences and environmental consequences. (This work included: Graham-Rowe *et al.*
242 2014; Principato *et al.* 2015; Quested and Luzecka, 2014; and Mondéjar-Jiménez *et al.* 2016).

243 All the interviews were recorded with the participant's permission and lasted an
244 average of forty-five minutes. One pilot interview was conducted in order to refine and test
245 the semi-structured questions and to gain an understanding of the validity and reliability of the
246 data being collected (Saunders *et al.* 2012). No changes were made after the pilot interview so
247 it formed the first of the interviews undertaken. Before the interviews were conducted,

248 participants were required to read a brief containing details of the aim of the investigation, the
249 confidentiality of the results and a statement explaining that participants' had the right to
250 withdraw at any point and any result would be removed from further consideration. If
251 participants agreed to continue, the consent form was signed (Ritchie and Lewis, 2013). To
252 ensure participant privacy and confidentiality, anonymous interview coding was in recording
253 and transcripts. Participants were coded with the number of the interview.

254 **4.2. Interviewees and sampling procedure**

255 The interviewees were identified through a sampling strategy to include households firstly
256 with a range of mixed gender and single gender either all male or all female households and
257 secondly households of different sizes (see Table 3). Recruitment was via opportunity
258 sampling.

259 **4.3 Thematic analysis approach**

260 Qualitative data was collected and transcribed for each interview. The interview transcripts
261 were coded to identify thematic categories associated with students' awareness and behaviour
262 associated with food waste using NVivo version 11. Initial coding was undertaken and then
263 secondary, tertiary and fourth level 'axial' coding to identify connections between concepts
264 and organisation of these into higher order and lower order themes and to demonstrate
265 relationships between concepts at each coding stage (Bazely and Jackson, 2013). A thematic
266 map was developed to postulate how students' food waste awareness and behaviour is
267 influenced and to inform further study and theory development in this area.

268

269 **5. Results and Analysis**

270 This results are considered and analysed by primary theme. Fifty eight percent of the
271 participants were females, 42% were males, and 72% of the participants had never formally
272 studied food waste at university. The full household demographics can be seen in Table 3.

273 **4.1 Buying habits**

274 Whether students cook and shop by themselves or as a household, is a key influence as to
275 whether a **shopping list** is written, in advance. 43% of students in the study, who cook by
276 themselves, do not write a shopping list, and 20% of students will only write a shopping list in
277 accordance to the size of the shop. Two example student comments are as follows showing
278 the variance in planning amongst the interviewees (P = participant number):

279 *'I just buy what I fancy when I am walking around the shop, I do not tend to follow a*
280 *shopping list, as [I] will never stick to it' (P16).*

281
282 *'If I am planning on doing a large shop, I will record down the essentials on my phone, but if*
283 *I was doing a small shop then no, as I can usually just about remember what I need' (P31).*
284

285 Thirty percent of students interviewed did write a weekly food shopping list, but 60% of those
286 students shop and cook as a household and therefore are more organised. One response
287 demonstrated this approach:

288 *'We do all sit down, do an inventory of the cupboards, freezer and fridge and write down*
289 *what we need, as there are more mouths to feed and food desires to meet.'*(P24)
290

291 The literature demonstrates the value of **pre-planning** and then sticking to a list in order to
292 reduce food waste. Consumers are tempted by **promotions** and end up buying and wasting
293 more food than they actually need to (Quested *et al.* 2012). This was reinforced in this study
294 by 17% of students highlighting that they failed to follow a shopping list due to the temptation
295 of special offers. 22% of students interviewed stated they would buy foods on specials offer,
296 knowing that they might not ever use the product. This could explain why in previous studies
297 students spend 6% more on weekly shops than the older generation (Mondéjar-Jiménez *et al.*
298 2016), because they are more easily influenced by such offers. Indicative statements made
299 supporting this argument in this study included the following:

300 *'... I think its great value for my money, but when it sits in my cupboard for a long period of*
301 *time, I will throw them away, even if it's still in date' (P33).*

302
303 *'I should follow a shopping list and try and stick to it, but I always get tempted by promotions*
304 *and discounts. For example, XXXX is closing down, and everything is reduced and half price,*
305 *but XXXX prices are so expensive especially for the quality. Anyway, as soon as I saw*
306 *everything reduced, I went a bit crazy and brought nearly the whole shop, as I thought I was*

307 *saving money. But my housemate pointed out to me that I did not really save much money, as*
308 *YYYY is still cheaper than XXXX discounted prices. So I got tricked there' (P23).*

309

310 Thus buying habits are a key behaviour that can influence student' food waste.

311

312 **5.2 Types of food wasted and influence of kitchen facilities**

313

314 Analysis of the results of the interviews highlights that 38% of students stated that they cook

315 too much food; 32% did not use the food in time; 18% purchased too much food and 12%

316 were influenced by duration dates. When asked what types of food were thrown away 58% of

317 students stated they wasted vegetables. This was for three main reasons: 17% of students

318 stated they buy too many varieties of vegetables on a weekly basis; 25% of students cook too

319 much quantity; and 58% of the students do not use the vegetables up in time before they

320 deteriorated e.g. through mould growth. Fruit was the second most wasted food product for

321 28% of students for two main reasons: 28% of students stated they buy too much on a weekly

322 basis and 72% of students do not use the fruit in time. Milk was the third product stated to be

323 wasted most often by 20% of respondents followed by pasta and potatoes both identified by

324 12% of respondents. In this primary research, none of the students stated bread was a source

325 of waste and the pattern of food waste in terms of the type of food was different to the other

326 student studies in the literature where fruit, vegetables and bread were the top three sources of

327 food waste as food wasted once a week (Caswell, 2008; Brown *et al.* 2014; Mondéjar-

328 Jiménez *et al.* 2016 see Table 4).

329 **Insert Table 4**

330

331 Thirty-one percent of food waste is attributed to households cooking and preparing too much,

332 and throwing away the left overs, instead of freezing or making it do for another meal

333 (Quested *et al.* 2012). Consequently appropriate portion size is important (Graham-Rowe *et*

334 *al.* 2014). The students in this study identified **lack of freezer space** as a factor that had a

335 direct impact on the level of food waste. 20% of students stated they spent more on their

336 weekly food bill, due to limited freezer space and having to for example:

373 poisoning. At the same time these students do not follow the duration dates on fresh produce,
374 as they perceive there is a lower food safety risk.

375 *'I do not trust food after the duration dates on packaging, especially meat as I have had food*
376 *poisoning several times.'* (P14)

377
378 *'Depends on what it is. I do not follow dates of fruit and vegetables, as they will never give*
379 *you food poisoning, due to the risk of food poisoning. But on dairy products and meat I try*
380 *and make sure the food product is used in time, otherwise it goes in the bin as I do not want to*
381 *risk getting ill.'* (P32)

382
383 For 22% of students, this behaviour was identified as being down to parental influence as
384 shown in the next two indicative quotes:

385 *'I adopt all my cooking skills from my parents, and parents have always said do not eat meat*
386 *after the duration dates, due to the safety and increased risk of getting food poisoning'* (P20).

387
388 *'My parents have always told me to waste food when it comes to the use by date, especially*
389 *meat products, due to the risk of food poisoning. So I usually bin meat and dairy products on*
390 *the use by date, but things like vegetable I will just keep until they have started to turn*
391 *mouldy'* (P22).

392
393 This theme shows the link between an individual's awareness and their associated food
394 behaviour.

395 **5.4 Student awareness of monetary value of food waste**

397 Thirty two percent of students questioned stated they were more inclined to waste fruit and
398 vegetables than other food items, as they believed them in terms of monetary value as being
399 cheap and readily available. On the other hand, the same proportion of students were less
400 inclined to waste meat.

401 *'.....You can go to XXXX and buy a bag of carrots for 40p, which, if you end up wasting them,*
402 *you are only wasting 40p which is not going to break the bank'* (P25).

403
404 *'If I knew the exact total amount of the monetary value of the food I waste I waste was, then*
405 *probably yes. But as the same food is so cheap today, you can pick up a bag of vegetables for*
406 *under a £1, so I am probably not wasting huge amounts of money'* (P34).

407
408 The awareness factors identified by the respondents that they used when considering the
409 monetary value of food waste was firstly that ***food was cheap***;

410 *'if I was going to waste anything, I would waste the vegetables as they are the cheapest*
411 *component of a meal'* (P10).

412

413 12% of the respondents said *it was difficult to visualise the monetary value of food waste*
414 (concurring with Principato *et al.*, 2015);

415 ‘as the money has already gone out the bank account when the products are purchased in the
416 supermarkets.... it does not matter if the products are thrown in the bin...’ (P9).
417

418 28% of the students interviewed believed money was *only wasted when huge portions of*
419 *food were thrown away* in one sitting.

420 ‘I know you are wasting money every time you throw food away, but when I waste small
421 amounts, like a handful of peas, then no I don’t believe you are, or it never crosses my mind.
422 As it is only worth 10p or something’ (P46).
423

424 ‘Even though I am very conscious about the price of food when I go shopping, when I waste
425 food it never crosses my mind that wasting food is wasting money, as you only waste little bits
426 here and there, you are never wasting whole meals’ (P41).
427

428 Many interviewees **failed to comprehend the accumulative monetary value of food waste**
429 and were surprised how the value accrued over a monthly or on a yearly basis.

430 ‘Wow, I have never thoughts about how much it all adds up to, and £162 is a lot of money for
431 throwing away in a year, as I could do so much more with that money, rather than just
432 throwing it in the bin’ (P32).
433

434 ‘....I only waste small amounts of food. Maybe around £5 a week..... Wow £25 a month and
435 roughly £300 a year is a lot of money wasted of food waste. I have never thought about it like
436 that, as the £300 is not taken straight out of your account as a hump sum. Also you do not
437 even see the monetary value of food waste coming out of my account, as it is a part of your
438 grocery shop’ (P5).
439

440 ‘I honestly didn’t think £5 a week was a lot, as I only waste small portions of cheap food here
441 and there. But when you put it like that I am wasting huge amounts of money that could be
442 better spent. Also when I waste food, I never perceive it as wasting money, as the money has
443 already left your bank account’ (P20).
444

445 These indicative comments demonstrate a lack of awareness of the impact of food waste and a
446 disconnect between the monetary impact associated with their levels of personal food waste.

447 Some respondents stated that saving money in itself was not necessarily a motivator to waste
448 less food:

449 ‘Maybe if I run out of money.’ (P10)
450

451 ‘Yes I guess it would be if I had no money...’ (P22)
452

453 ‘If food becomes more expensive then yes.’ (P25)
454

455 The financial threshold that was a motivator to save money also varied between students and
456 for some saving two pounds a week was a motivator where for others it was not. The notion
457 of the influence of monetary value as a motivator for behavioural change with food waste is
458 worthy of further study as here the impact is unclear.

459 **5.5 Student awareness of the environmental impact of food waste**

460 The research indicates that students have a mixed degree of awareness of the environmental
461 consequences of food waste. Overall, 61% of students were conscious of the environmental
462 implications, especially those who had studied food topics as part of their university course.
463 Twenty-three percent of respondents in the study agreed with P1 that '*Food is natural so*
464 *surely it just rots down into the ground*' supporting the findings of Doron (2013). Similarly,
465 22% of students concurred that '*Food packaging ending up in landfills instead of being*
466 *recycled*' (P44) was the biggest environmental issue relating to food waste.

467 **5.6 Student awareness of the social impact of food waste**

468 The negative social impact of food waste are that if food is wasted this influences the balance
469 between supply and demand causing food prices to rise impacting those on a low income.
470 Conversely if surplus food is identified, collected and distributed to those who are food
471 insecure this can have a positive impact towards their lives both personally and at the
472 community level. An example of such social impact are the replacement of free school meals
473 during school holidays where parents cannot afford the cost of the lunch. As with
474 environmental impact, the social impact of food waste was not a strong motivator for the
475 students that were interviewed to influence behaviour. Fifty-four percent of respondents
476 lacked awareness and struggled to identify the social cost of food waste and only 14% firmly
477 associated the social implications of food waste behaviour with wasting food. Just under a
478 quarter of students mentioned people living in poverty or charities helping those in need, but
479 with a greater proportion believing that the world will not run out of food. Individual
480 indicative comments included:

481 *'The world population is expected to expand dramatically, but world food production will*
482 *have to increase by 40% to meet this demand. But also the fact there are thousands of families*
483 *and children in poverty who cannot afford food' (P36).*
484

485 *'Maybe in the very long term, vegetables may go back to seasonal, and with increased climate*
486 *change, there may be a shortage like we are seeing in Spain at the moment, but we will never*
487 *run out of food as there is always technology and 3D printing' (P10).*
488

489 *'I honestly do not know, they do say food production will have to increase to meet the*
490 *growing demand, but I personally do not think we will. I mean look how readily available it is*
491 *today and so much food is produced by technology. Maybe with the current climate change,*
492 *and food .. shortages, we may go back to seasonal produce, instead of all year round fruit and*
493 *vegetables. But the world will never run out of food' (P23).*
494

495 *'...technology forever increasing, like the development of 3D printers, and will save us if we*
496 *were going to run out of food' (P26).*
497

498 *'... there may be a shortages of fresh produce.....and fresh produce will become more*
499 *seasonal. But no, I don't think the world will ever run out of food, have you seen how much*
500 *food is on the supermarket shelves and how much we import' (P6).*
501

502 Respondents highlighted some degree of optimism that technology would prevent food
503 shortages, but as a consequence of climate change, one third of respondents (32%) stated that
504 fresh produce would become more seasonal.

505 **5.7 Primary motivators that influence food waste**

506 In this study, not one student highlighted the environment as a primary motivator to
507 change food waste behaviour concurring in part with the work of Principato *et al.* (2015). The
508 world running out of food was identified as a factor of influence by one in ten of the
509 respondents in this study. The lack of motivation associated with social or environmental
510 concerns meant that for 34% of respondents saving money was the primary, albeit limited
511 motivator, especially when as a result of the interview process, they became more aware of
512 the monetary impact of their behaviour. The students interviewed could roughly estimate the
513 monetary value of their level food waste within a given week. Respondents were more
514 inclined to waste fruit and vegetables, due to their perception that they were of little monetary
515 value, but were less inclined to waste meat, as it was seen to be the most expensive part of
516 any meal.

517 After saving money, being more educated on the monetary value of food waste and a
518 rise in food price were identified as motivators to change behaviour. 16% of respondents said
519 that being too busy was a barrier to changing behaviour and reducing food waste. Sources
520 such as Qusted and Luzecka (2014) suggest that the younger generation implied being too
521 busy and having more important priorities to worry about than changing food waste
522 behaviour. Additional factors were suggested in the interviews as potential ways to motivate
523 students to waste less food including: reduced pack size, single duration dates rather than the
524 current system of multiple duration codes, and improved food safety. Some of the
525 respondents' indicative comments that underpin this summary of findings are collated (Table
526 5).

527 **Take in Table 5**

528

529 There was a full second, third and fourth level axial coding undertaken (Table 6) that
530 informed the development of a thematic map (Figure 3). The thematic map takes the six
531 themes of buying habits, kitchen facilities, student awareness of duration dates, monetary
532 value, environmental impacts and social impacts and adds a seventh theme of knowledge of
533 food in its wider sense.

534 **Take in Table 6 and Figure 3**

535

536 The thematic map that emerges from the synthesis and analysis of the primary data
537 explores the interconnection between factors of influence and student awareness and
538 behaviour associated with food waste found in the research. Figure 3 reflects the seven
539 superordinate factors of influence towards students' food waste behaviour, and sub-ordinate
540 factors that influence student awareness such as parental or household influence, and
541 awareness of monetary, environmental or social impact. The implications of the findings of
542 this study are now discussed.

543 **5. Discussion**

544
545 Previous literature has considered both plate waste in the food service setting (Cohen et al.,
546 2014; Falasconi et al., 2015) and also individual households in the household level setting, the
547 unit of analysis for this study. Students were identified are most likely to waste food when
548 preparing, cooking and serving too much food leading food waste campaigns to focus solely
549 on tools such as recipe cards when trying to educate students (Quested and Luzecka, 2014).
550 However, the thematic map developed through this study demonstrates multiple, complex and
551 nuanced influences behind students' food waste behaviour when purchasing, preparing,
552 cooking and serving their own food. At one level a lack of freezer space, students eating what
553 they fancy rather than making use of leftovers, not creating or following a shopping list, the
554 temptation of special offers in store and then not using food up in time, all influence
555 behaviour. The level of awareness of multiple duration dating systems and what they mean in
556 terms of food safety also are factors of influence. The students who have been raised by food
557 safety conscious parents have adopted the same food waste behaviour habits. Therefore the
558 influence of parents' food waste behaviour on their children's food waste behaviour later in
559 life is worthy of further study.

560 There are some limitations to this study in terms of the sample group being students
561 and thus this limits wider generalisation to the whole population. The sampling strategy was
562 based on a convenience approach, but this has provided a thematic map worthy of further
563 research using a quantitative methodology that has greater validity in terms of the inference
564 that can be drawn.

565 Four barriers were noted in this work and others that influence awareness or behaviour
566 associated with food waste: being too busy or having more important priorities (see too
567 Quested and Luzecka, 2014); believing money is only wasted when huge portions of foods
568 are thrown away in one sitting; not being able to visualise the monetary value of food waste
569 as part of the overall grocery bill and finally that cheap food is so readily available. For
570 students in this study, there was limited cognitive connection between reducing personal food

571 waste today in order to reduce the degree of food crisis in the future or indeed the impact of
572 food waste on the climate. In fact this study would suggest that for the respondents sampled
573 there is little worry or concern for the environmental and social consequences of food waste
574 now or for future generations. This may in part be due to a lack of awareness, but also it could
575 be as a result of other priorities being seen as more important or more pressing, returning to
576 notions of being too “busy”. This suggests that there is a cognitive filtering occurring where
577 food waste as being seen as less important or more distant compared with other more
578 immediate concerns and this is worthy again of further study to identify how to make food
579 waste less cognitively distant as a concern for young people.

580 Steg and Vlek (2009) considered the factors that promote or inhibit environmental
581 behaviour namely perceived cost and benefit, moral and normative concerns and effect. They
582 note too that availability of facilities and intra-personal factors play a role such as habits also
583 a feature of this work. This research shows that individual levels of awareness actually
584 mediate the influence of these factors and as a result the environmental behaviour that is
585 exhibited. Steg and Vlek (2009) suggest that environmental behavioural change can be driven
586 by informational strategies, and structural strategies that reward good behaviour and punish
587 bad behaviour. This was not a research objective for this study but in future research the use
588 of incentives could be considered as well as developing the methodology to overcome the
589 limitations described above.

590 **6. Conclusions**

591 This research has clearly demonstrated there are multiple influencers of students’ food
592 waste behaviour making the issue a complex one to effectively tackle. Lack of awareness of
593 the economic, environmental and social costs of food waste and an attitude of being ‘too busy
594 to care’ also play a part. As a result, it is vital to address student food waste from multiple
595 angles, including when students first come to university creating wider awareness of the
596 personal, environmental and social impact of food waste. Communication and policy tools
597 aimed at the young need to reflect these factors and also recognise that in short-term rented

598 accommodation the facilities that the students have in terms of kitchen space, especially
599 freezer space can limit behavioural options. Future research should look to expand this study
600 to encompass a larger sample size of students.

601

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803

804

805

806

807 **Appendix 1**

808 Participant's Code Number:

809 Household Code:

810 Date and Time visited:

811 **Background Information**

812 - Gender – Female/ Male

813

814 - What course are you studying?

815

816 - Have you studied the topic of food waste as a part of your university course? –

817 Yes/No

818 **Household Questions**

819 (Questions will vary depending on whether the student eat and shop as a household,
820 individual or both)

821 - How many students do you live with, including yourself?

822

823 - Do you shop as a household, individually or both?

824

825 - Do you eat as a household, individually or both?

826

827 - How does the sharing of the kitchen food cupboards work? Do you communally
828 share? Or do have limited space each?

829

830 - How does sharing of the freezer work? Do you communally share or have a
831 limited space each?

832

833 - How does sharing of the fridge work? Do you communally share or have a limited
834 space each?

835

836 - Does your kitchen space or the equipment you have to cook limit you in terms of
837 how you buy food?

838 **Buying Habits**

839 (Questions will vary depending on whether the student eat and shop as a household,
840 individual or both)

841 - If you shop as a household, individual or both how do you decide what food to
842 buy?

843

844 - When shopping as a household, individual or both, do you tend to do an
845 inventory of your food cupboards/ fridge/ freezer?

846

847 - When you shop as a household, individual or both, do you shop with a shopping
848 list?

849

850 - When shopping as a household, individual or both, do you buy certain food on
851 special offer knowing that you might never use it?

852 **Kitchen**

853 - When eating as household, individual or both, how do you decide what you are
854 going to eat?

855

856 - Why do you personally throw away food?

857

- 858 - When you cook too much, as a household, individual or both, what do you do with
859 the leftover food?
860
861 - What types of food do you usually find yourself throwing away?

862 **Duration Dates**

- 863 - What does the best before date on a food indicate?
864
865 - What does the use by date on a food indicate?
866
867 - What do you do when a food product goes past the best before date on the label?
868
869 - What do you do if a food product goes past the use before date on the label?

870 **Monetary Value of Food Waste**

- 871 - Are you aware of the monetary value of food you buy? e.g. an average price for a
872 250g block of cheese.
873
874 - Do you believe you are wasting money when throwing food away?
875
876 - Could you calculate the monetary value of the food you throw away?
877
878 - If so, on a weekly basis, what is the monetary value of the food you throw away?
879
880 - Is saving money a motivation that encourages you to waste less food?

881 **Environmental and Social Impacts of Food Waste**

- 882 - Are you aware of the environmental impacts of food waste?
883
884 - What do you consider to be the most important aspects?
885
886 - Are you aware of the social impacts of food waste?
887
888 - What do you consider to be the most important aspects?
889

890 **Conclusion Questions**

- 891 - As a student what is the primary factor that would encourage you to waste less of
892 the food that you buy?
893
894 - What other factors would encourage you to waste less food?
895
896 - As a result of this interview what steps, if any, are you prepared to take to reduce:
897
898 - Personal food waste
899
900 - Household food waste
901

902 Thank you very much for taking the time to speak with me today.
903
904

905 **Table 1: 2012-2015 UK household food waste. (Figures rounded to the nearest thousand**
 906 **tonnes).**

	2007	2010	2012	2014	2015
Avoidable	5,342	4,299	4,221	4,480	4,436
Possibly avoidable	1,433	1,226	1,203	1,277	1,264
Unavoidable	1,521	1,575	1,598	1,620	1,633
Total	8,296	7,100	7,022	7,377	7,333

(Source: Quested and Parry, 2016)

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910 **Table 2: Types of foods wasted once a week by Italian and Spanish students as**
 911 **percentage values. (Adapted from Mondéjar-Jiménez et al., 2016)**

Types of Food	Italian students	Spanish students
Fruit	41.90	37.82
Bread	36.03	38.46
Vegetables	33.82	25.00
Pasta	21.32	10.90
Eggs	16.18	10.25
Salted Snacks	9.56	15.38
White Meat (Turkey, Chicken)	7.36	14.75
Yogurt	5.15	7.69
Milk	4.42	3.84
Dairy Products	3.68	3.20
Convenience Food	2.94	12.82
Precooked Foods	2.94	12.18
Processed Meat	2.21	7.69
Red Meat	2.21	5.77
Cheese	2.21	4.49
Sweet Snacks	2.21	3.20
Frozen Foods	1.48	3.85
Fish	0.74	5.77
Butter and other Fats	0.74	3.84

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915 **Table 3. Participant Profile**
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Household No.	Participant No.	Gender	Household Size	Studied Food Waste (Y/N)
H1	P2	F	4	Y
H1	P6	M	4	N
H1	P8	M	4	N
H1	P31	F	4	Y
H2	P4	F	5	N
H2	P5	M	5	N
H2	P32	F	5	N
H2	P33	M	5	N
H2	P34	M	5	N
H3	P7	F	6	Y
H3	P10	F	6	N
H3	P11	F	6	N
H3	P12	F	6	N
H3	P35	F	6	N
H3	P36	F	6	Y
H4	P9	F	4	N
H4	P43	F	4	Y
H4	P44	F	4	N
H4	P45	F	4	N
H5	P13	M	4	N
H5	P14	F	4	N
H5	P15	F	4	Y
H5	P16	M	4	N
H6	P17	M	3	N
H6	P18	M	3	N
H6	P19	M	3	N
H7	P20	F	5	Y
H7	P21	F	5	N
H7	P22	F	5	N
H7	P23	F	5	N
H7	P46	F	5	Y
H8	P24	M	3	N
H8	P25	M	3	N
H8	P26	M	3	N
H9	P27	F	4	Y
H9	P28	F	4	Y
H9	P29	F	4	N
H9	P30	F	4	Y
H10	P47	F	4	Y
H10	P48	F	4	Y
H10	P49	M	4	N
H10	P50	M	4	N
H11	P39	F	5	N
H11	P40	M	5	N
H11	P41	M	5	N
H11	P42	F	5	Y
H11	P1	M	5	N
H12	P3	M	3	N
H12	P37	M	3	N
H12	P38	M	3	N

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918 **Table 4: Types of foods wasted once a week in percentage values - comparison between**
 919 **study group and the literature**

Types of Food	Italian youths (Mondéjar-Jiménez et al., 2016)	Spanish youths (Mondéjar-Jiménez et al., 2016)	British Students in research
Fruit	41.90	37.82	28
Bread	36.03	38.46	Not identified
Vegetables	33.82	25.00	58
Pasta	21.32	10.90	12
Eggs	16.18	10.25	4
Yogurt	5.15	7.69	4
Milk	4.42	3.84	20

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921 **Table 5: Indicative comments from respondents highlighting influencing factors**

'Today's individuals do not mind wasting food, as it is so readily available and cheap, as I am the same. But if food was to become more expensive, then everyone would be encourage to waste less food, as they will not be able to afford to waste food' (P47).

'If food become more expensive, I would definitely start wasting less food' (P32).

'Why can't manufactures get rid of the 'best before' date and only have a reasonable 'Use By' date or if a product never goes off like pasta or rice, then have no date at all. It is almost like food manufacturers are trying to get consumers to waste huge amounts of food, as we are not all educated in food' (P40).

'If there was not the safety risk related to food product, I would definitely waste less food, but I am far too scared to risk it, so it is just easier to throw food away, rather than having food poisoning' (P14).

'.....sometimes it is just easier to throw food away, than to keep it for another a meal, without worrying whether you have used it in time' (P27).

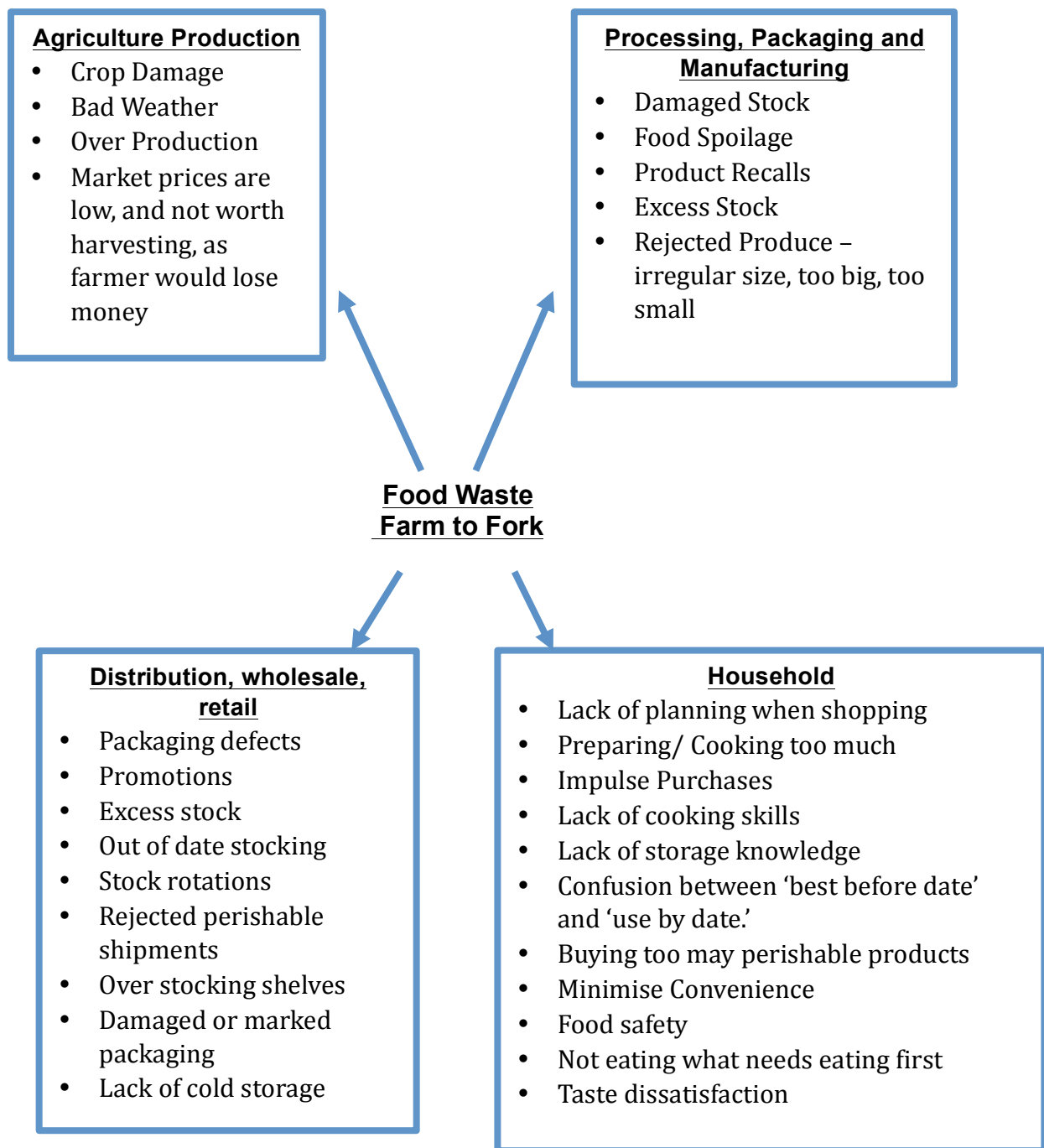
'I would consider using the Olio app , but it does seem a bit time consuming and people today are time short, why would they want to waste time using the app. It is easier and more convenient to buy all your food from the supermarket, and what you do not want to just throw in the bin...' (47)

'If I knew the exact total amount of the monetary value of the food I waste I waste was, then probably yes' (P34).

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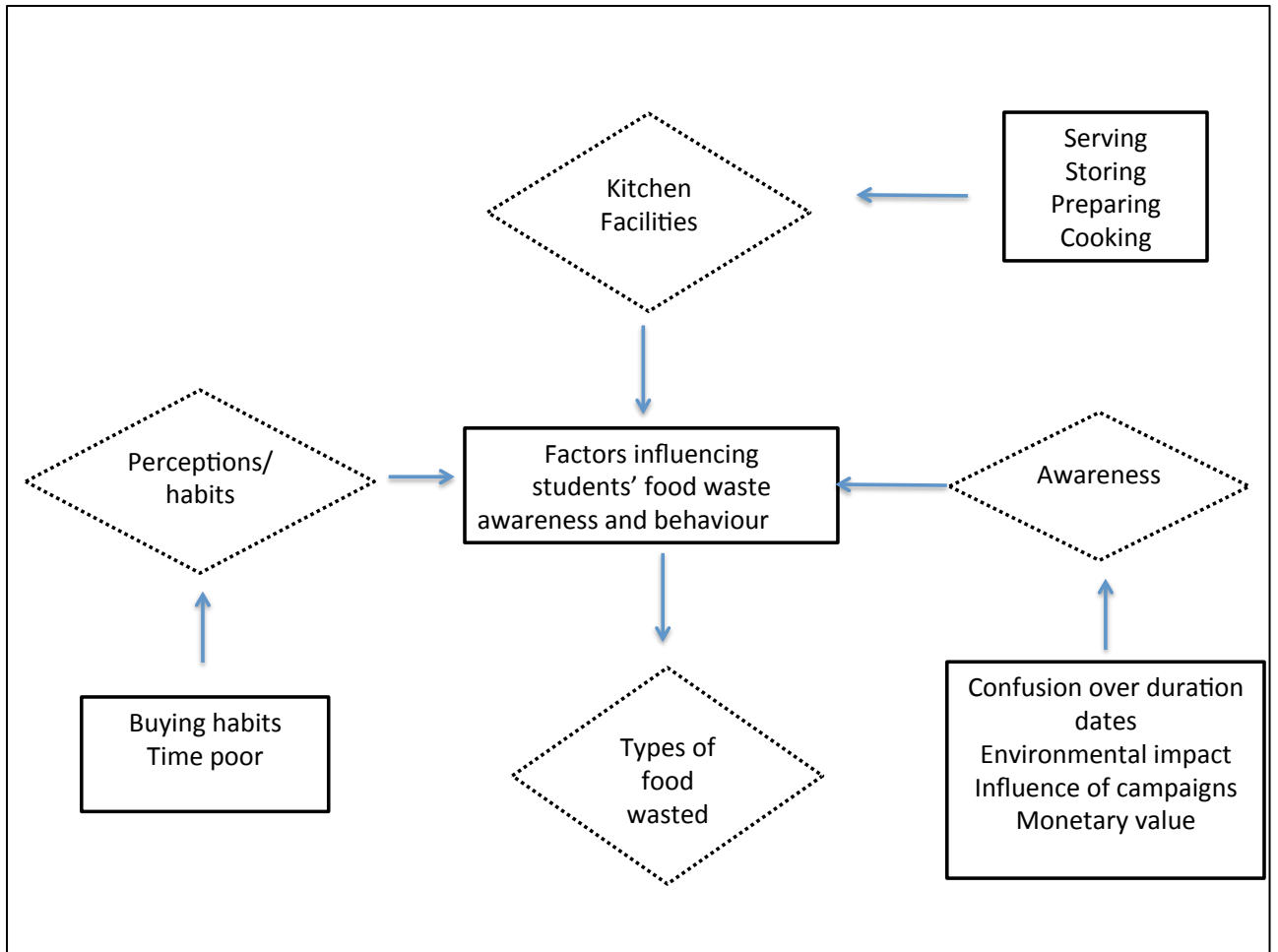
First Initial Coding	Secondary Coding	Third Coding	Fourth Coding
Buying Habits	<ul style="list-style-type: none"> • Shopping Lists. • Limited storage space. • Special offers 	<ul style="list-style-type: none"> • Do follow shopping list. • Do not follow shopping list. • Write a shopping list in accordance to size of shop. • Special offers. 	<ul style="list-style-type: none"> • Cooking and shopping as a household. • Cooking and shopping individually. • Fail to follow a shopping list. • Buy foods on special offers knowing they will not be consumed.
Kitchen Facilities	<ul style="list-style-type: none"> • Why waste food. • Types of food wasted. • Food packaging • Storage • Leftovers 	<ul style="list-style-type: none"> • Prepare, cook, and serve too much. • Fruit, Vegetables, Milk. • Food packaging does not extend shelf life of a product. • Fancy vs leftovers. • Limited freezer space. 	<ul style="list-style-type: none"> • Fancy Vs leftovers. • Limited storage – waste food. • Buy smaller packs of freezer food. • Spend more on weekly grocery shops.
Student awareness of duration dates	<ul style="list-style-type: none"> • Confusion. • No confusion. • Educated. • Food safety. 	<ul style="list-style-type: none"> • Know what the ‘use by’ stands for but not what the ‘best before’ stands for. • Follow duration dates • Do not follow duration dates. • Food safety concerns regarding meat but not vegetables. 	<ul style="list-style-type: none"> • Waste food on use by date. • Waste food on best before date. • Sensory evaluations. • Food poisoning. • Parental influence.
Student awareness of monetary value of food waste	<ul style="list-style-type: none"> • Yes, wasting food waste money. • No, wasting food does not waste money. 	<ul style="list-style-type: none"> • Food cheap. • Money only wasted when huge portions of foods are wasted. • Cannot visually see the monetary value of food waste. • Estimate weekly monetary value of food waste. 	<ul style="list-style-type: none"> • Vegetables wasted, as perceived cheap, but not meat, as seen as the most expensive part of a meal. • Fail to comprehend the monetary value of food waste adds up.
Student awareness of the environmental Impacts	<ul style="list-style-type: none"> • Aware. • Not aware. • Educated. 	<ul style="list-style-type: none"> • Food packaging. • Methane. • Natural. • Waste of Resources. • No idea. 	<ul style="list-style-type: none"> •
Student awareness of the social impacts	<ul style="list-style-type: none"> • Aware. • Not aware. 	<ul style="list-style-type: none"> • Starving children. • Educated. • Future of food. 	<ul style="list-style-type: none"> • Populations growing but not enough food to feed everyone. • Over eating and under eating. • Seasonal. • Technology.
Primary motivating factors	<ul style="list-style-type: none"> • Saving money. • Saving the environment. 	<ul style="list-style-type: none"> • Saving money. • Too busy. • One duration dates. • Food become expensive. • Educated on monetary value of food waste. • Improve safety of foods. 	<ul style="list-style-type: none"> • Saving money primary motivator.



(Source: Adapted from Gunders, 2012)

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Figure 1: Factors causing food waste from farm to fork



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940 **Figure 2: Factors identified in the literature said to influence students' food waste**
 941 **awareness, and behaviour. (Adapted from Lyndhurst, 2007; Doron, 2013; Graham-**
 942 **Rowe *et al.*, 2014; Quested and Luzecka, 2014; Mondéjar-Jiménez *et al.*, 2016;**
 943 **Principato *et al.*, 2015)**

