A Socio-ecological Perspective on the Food Dudes Healthy Eating Programme

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Abstract

In response to poor levels of fruit and vegetable consumption in children across the UK, numerous interventions have been developed in schools in an attempt to encourage children to meet the recommended five a day. This programme of research examined the potential of a school-based healthy eating intervention, the Food Dudes programme, to increase children's fruit and vegetable consumption in the long-term, at both school and at home, in 15 schools across the West Midlands. In contrast to previous studies that focused on the internal validity of the intervention, the programme of research utilised a socio-ecological approach to explore the wider contextual factors involved in behaviour change, beyond discussion of efficacy. Evidence from the six outputs indicated that the Programme was: effective in increasing fruit and vegetable consumption in the short-term only; more effective for children who consumed school-provided lunches than those provided from home (output 3); did not result in any decreases in high fat and/or sugar foods (output 4), not able to transfer to the home environment (output 5); and difficult to implement as part of the school day (output 6). Sustaining healthy eating behaviours beyond the intervention was a key challenge. Whilst interventions such as Food Dudes may work at the intrapersonal level of an ecological system, issues of sustainability arise from the intervention's inability to extend or function beyond individual level behaviour change. The ecological approach on children's' eating behaviour offers an alternative theoretical approach to explain the effectiveness of interventions such as Food Dudes, and as a basis for proposing alternative intervention strategies.

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Introduction

There is strong evidence to suggest that eating a diet rich in fruit and vegetables has multiple health benefits, and may reduce the risk of cardiovascular disease, stroke and cancer (Boeing, Bechthold, Bub, Elinger, Halle, Kroke et al., 2012; O'Flaherty, Flores-Mateo, Nnoaham, Lloyd-Williams, & Capewell, 2012). In 2000, The Department of Health recommended that adults and children over two years of age should eat at least five portions of fruit and vegetables per day. However, the average consumption level of fruit and vegetables in the UK, as in many other Western countries is much lower than this and most children, and adults fail to meet recommended levels of consumption. A recent Health Survey for England report (NHS Digital, 2016) identified that fruit and vegetable consumption among children aged between five and 15 years has increased over the past few years, with 23% of both boys and girls consuming at least five portions per day in 2014 compared with only 20% in 2010. The mean number of portions consumed also increased in this period, from 3.3 to 3.5 portions of fruit and vegetables. In contrast, fruit and vegetable consumption among adults aged 16 and over remained the same in 2014 as 2010, with 26% of adults consuming the recommended daily intake of at least five portions. Whilst children's fruit and vegetable intake has increased in recent years, these figures are still remarkably low and suggest the need for well-designed interventions that will produce longer term improvements in children's fruit and vegetable consumption.

Background to the Food Dudes Wolverhampton Study

Since the formation of the Ottawa Charter in 1986, an agreement signed at the First International Conference on Health Promotion by the World Health Organisation

identifying priorities for health promotion by the year 2000 (World health Organisation, 1986), schools have been recognised as an important setting for health promotion. One such school-based intervention is the Food Dudes healthy eating programme, a behaviour change programme designed for use in primary schools to increase children's consumption of fruit and vegetables at school and at home.

The Food Dudes programme is a multi-component behaviour change intervention developed following research into the psychological components influencing children's food choice (Horne, Lowe, Fleming & Dowey, 1995) and has evolved following extensive research and development (Lowe & Horne, 2009). The Food Dudes programme is divided into two phases: an initial 16 day intervention (phase 1) and a maintenance phase (phase 2). In phase 1 of the programme, children are introduced to the 'Food Dudes', four super-heroes who gain special powers by eating their favourite fruit and vegetables. Each day, children are read a letter and/or watch a DVD of the Food Dudes' adventures and are given a portion of fruit and vegetables. If the children succeed in eating both portions they are presented with a small reward. Phase 2 continues to support successful eating of fruit and vegetables, but with less intensity than during Phase 1. Classroom Wall Charts are used to record consumption levels of these foods, and as the children achieve more advanced goals they earn further rewards and Food Dudes certificates (see appendix A for a full description of the intervention).

During the period 2010-2011, Food Dudes was implemented in 8 schools in Wolverhampton, following trials in Bangor, London and Ireland (Horne et al., 2004;

2009; Lowe, Horne, Tapper, Bowdery & Egerton, 2004). A large scale independent evaluation was commissioned by Wolverhampton City Primary Care Trust and the Department of Health West Midlands to evaluate the effectiveness of the Programme as it was introduced into schools across Wolverhampton. This aim of the current programme of research was to examine the potential of the Food Dudes programme to increase children's fruit and vegetable consumption in the long-term, at both school and at home, in schools across the West Midlands. In contrast to previous studies which focused on the internal validity of the intervention, the programme of research asked, 'what works, for whom, and why?' and so represented a broader discussion beyond establishing efficacy (Glasgow, Vogt & Boles, 1999).

Research objectives

The research objectives were as follows:

1. Evaluate the extent to which the Food Dudes programme leads to long-term changes in children's fruit and vegetable consumption at school and home;

2. Explore whether increases in consumption of fruit and vegetables can displace consumption of foods that are high in fat and/or sugars;

3. Critically explore factors which may influence the maintenance or extinction of children's eating behaviours over time;

4. Critically explore how McLeroy's ecological model of health behaviour can be used as a conceptual framework to explain associations between different ecological levels and children's fruit and vegetable consumption.

Structure of the critical overview

An overview of the publications included in this critical overview is presented in Table 1. Chapters 1-4 incorporate the main critical synthesis. Chapter 1 reviews the existing evidence for school-based healthy eating interventions. The limitations of current strategies are discussed and an alternative framework for situating school-based healthy eating interventions is proposed.

Chapter 2 describes the methodology used in the studies which reflects the limitations of previous evaluation studies outlined in chapter 1. This chapter provides additional contextual information, in relation to the philosophical assumptions underpinning the research, and specific data collection methods that did not appear in the published outputs due to journal space constraints.

Chapter 3 discusses the findings of the research presented in the six outputs and explores the notion of coherence, or 'the logic of connectivity' (Grant, 2011) – the golden thread which joins each of the separate outputs to form a coherent whole (research objectives 1-4). Connectivity is articulated through a secondary analysis of the study findings, a meta-inference (Tashakkori & Teddlie, 2003).

Chapter 4 applies the learning from the programme of research to guide recommendations for the future development of the Food Dudes programme and school-based healthy eating interventions.

Chapters 5-8 discuss the development and impact of the outputs in addition to a reflection on my development as a researcher. Chapter 5 outlines the chronological

development of the published outputs, describing how each output adds to the collective contribution to knowledge and my role within the publication cycle.

Chapters 6 and 7 consider the concepts of originality and the contribution to knowledge made by the published work. The originality of each of the published outputs is identified, using the statements listed by Philips and Pugh (2010), in addition to feedback from peer reviewers. The contribution of the work to the discipline is discussed in terms of both its academic and wider environmental impact, including the development of the programme following the evaluation period and decisions pertaining to roll-out of the programme across schools in the West Midlands. Finally, Chapter 8 provides a critical reflection on my development as a researcher utilising Vitae's Researcher Development Framework.

Table 1.

Writing Strategy and overview of publications

Output	Deadline (initial draft)	1st target journal	IF	2nd target journal	IF	Author order	Year of publication	% Contribution
1	September 2011	Journal of Human Nutrition and Dietetics	2.583	NA	NA	DU, PU, CT	2012	CT:70%, PU:15%, DU:15%
2	January 2012	British Journal of Health Psychology	2.895	Health Education	0.683	CT, PU, DU	2015	CT: 70%, PU: 20%, DU: 10%
3	January 2012	Public Health Nutrition	2.433	Journal of Human Nutrition and Dietetics	2.583	DU, PU, CT	2013	CT: 60%,PU: 25%, DU: 15%
6.	March 2012	Education and Health	NA	NA	NA	PU, CT, DU	2012	CT: 80%, PU: 10%, DU:10%
5	June 2013	Perspectives in Public Health	0.987	NA	NA	CT, HD, PU, DU	2013	CT: 70%, HD: 20%, PU: 5%, DU: 5%
4	July 2013	Perspectives in Public Health	0.987	NA	NA	PU, CT, DU	2015	CT: 70%, PU: 20%, DU: 10%

Note. Publications are listed in the order in which they were drafted.

CRITICAL OVERVIEW

Chapter 1

School-based healthy eating interventions to increase fruit and vegetable consumption: an ecological approach

In response to the low levels of fruit and vegetable consumption in the UK, interventions designed to increase children's consumption of these foods have been implemented in a variety of settings, including schools (Evans, Christian, Cleghorn, Greenwood & Cade, 2012). This chapter presents a brief review of school-based interventions to change children's fruit and vegetable consumption before discussing an alternative perspective on school-based health promotion using a socio-ecological approach.

Substantial evidence indicates that basing interventions on psychological theories of behaviour change will improve their effectiveness, and many approaches have been developed using these models (Baban & Craciun, 2007; Gratton, Povey & Clark-Carter, 2007; Reinaerts, de Nooijer, Candel & de Vries, 2007). School based programmes have the potential to be an effective intervention method, enabling large numbers of children to be targeted simultaneously (Lowe et al., 2004). However, research has indicated that these have minimal impact in increasing fruit and vegetable consumption, often falling short of even a single daily additional portion per child (Reynolds et al, 2000). Furthermore, even where changes have proved statistically significant, the clinical (real-world, practical) significance of these is unclear (Cliska et al, 2000).

Evidence examining the effectiveness of multi-component interventions, i.e. interventions comprising more than one element is largely inconclusive. Whilst it has

been suggested that multi-component interventions are effective (Reinaerts, Nooijer, Candel & de Vries, 2007), evidence also suggests that the individual elements that comprise these interventions have not been demonstrated to influence eating behaviour reliably (Perry et al., 1998). Despite this, a recent systematic review and meta-analysis of interventions to promote fruit and vegetable consumption reported that multicomponent interventions were not effective and improvements in methodology are required (Delgado, Tort, Martinez-Zapata & Bonfill, 2011). Furthermore, it is well documented that both school based and multi-component interventions may only be effective in the short term; evaluations of such interventions do not provide evidence for long term outcomes nor have they, in the main, employed robust methodologies (Knai, Pomerleau, Lock & McKee, 2006; Pomerleau, Lock, Knai & McKee, 2005; Reinaerts et al., 2007).

The Food Dudes Healthy Eating Behaviour Change Programme

The Food Dudes programme is a multi-component behaviour change intervention developed following early research into the psychological components influencing children's food choice (Horne et al., 1995). The programme has evolved over a number of years following extensive research and development (Lowe & Horne, 2009). Early empirical work investigated the effectiveness of a video based peer modelling and rewards intervention on consumption of foods previously refused by the child (Horne et al., 1995). The studies were conducted in the home environment and involved observing the eating behaviour of four children during family meal times. Whilst large increases in fruit and vegetable consumption were evident, these studies were conducted with small numbers of children and further research was required to assess the impact of the

intervention with larger groups of children in the school setting (Horne, Lowe, Fleming & Dowey, 1998). A standalone programme targeted at primary school children aged 4-11 was subsequently developed and trialled in a number of schools in regions of England and Wales (Horne et al., 2004; Lowe et al., 2004) and a modified version of the programme piloted in Ireland (Horne et al., 2009) prompting national rollout in the country (Lowe & Horne, 2009). The programme has also been trialled in Italy (Laureati, Bergamaschi & Pagliarini, 2014; Presti, Cau, Oppo & Moderato, 2015) and the USA (Morill, Madden, Wengreen, Fargo & Aguilar, 2016; Wengreen, Madden, Aguilar, Smits & Jones, 2013).

The Food Dudes programme aims to increase consumption of fruit and vegetables both at school and at home, develop a liking for fruit and vegetables, reduce unhealthy snack consumption and establish a whole-school healthy eating culture. The programme is based upon repeated tasting, role modelling and rewards, psychological principles shown to reliably impact upon consumption (Horne et al., 1995). Repeated taste exposure, one of the intervention components, is widely accepted as an important determinant of children's food preferences (Cooke, 2007). Increased exposure through repeated tasting of fruit and vegetables has been linked to increases in liking (Appleton, 2013) and consumption of both fruits and vegetables (Brug, Tak, te Velde, Bere & de Bourdeauhij, 2008; Lakkakula et al., 2011; Wardle, Herrera, Cooke & Gibson, 2003). The second component of the intervention, peer modelling (Bandura, 1977), or 'exposure by proxy' (Wardle et al, 2003) has also been linked to increased fruit and vegetable intake, and suggested as an important influence on decisions to eat healthy foods (Povey, Cowap & Gratton, 2016). Research has suggested that children are more likely to imitate

behaviours if the model is rewarded, is the same age or slightly older than the child, and where multiple models are used (Brody & Stoneman, 1981; Fehrenbach, Miller & Thelen, 1979; Flanders, 1968). Consequently, the Food Dudes programme provides opportunities to observe others consuming fruit and vegetables (Savage, Fisher & Birch, 2007) in addition to early, positive repeated exposure. The final intervention component, the use of rewards to increase fruit and vegetable consumption in children is more controversial. Whilst providing an individual with extrinsic rewards may impact upon their intrinsic motivation for the task, and may in fact reduce long term consumption (Newman & Taylor, 1992), more recent evidence suggests that reward contingencies do not have pervasive negative effects on intrinsic motivation and may in fact be useful in promoting healthy eating due to increased liking of fruits and vegetables (Cameron, Banko & Pierce, 2001; Cook, Chambers, Añez & Wardle, 2011; Corsini, Slater, Harrison, Cooke & Cox, 2013).

Research has suggested that the Food Dudes programme is effective in producing increases in children's fruit and vegetable consumption across settings – home and school (Horne et al., 2004, 2009, 2011; Lowe et al., 2004), increases in liking of fruit and vegetables (Laureati et al., 2014; Lowe et al., 2004) and displacement of unhealthy snacks (BFARU, 2010). However, despite evidence indicating the success of the Food Dudes programme in leading to changes in children's consumption of fruit and vegetables in the short term, evidence for the long-term effectiveness of the programme, in both the school and home environment is limited (Taylor, Upton & Upton, 2015). Consequently, an investigation into the effectiveness of the programme

was required to assess if the intervention to leads to long-term changes in children's eating behaviours that transfer across settings.

School-based interventions such as the Food Dudes programme, although underpinned by psychological theories and claims of multi-level impact often target individual level behaviour change. However, it has been increasingly recognised that behaviour change, particularly relating to healthy eating, is influenced by a broader range of factors, including aspects of the environment, social context, policy and culture (Brug et al., 2008). This has led to an increasing focus on the application of socio-ecological approaches to health promotion (Moore, de Silva-Sanigorski & Moore, 2013; Townsend & Foster, 2013; Trickett & Rowe, 2012) to address the lack of external validity of many community based behaviour change interventions (Dzewaltowski, Estabrooks, Klesges, Bull & Glasgow, 2004). As Trickett and Rowe (2012) suggest, a move towards ecological thinking represents more than simple modification of existing practices, rather an alternative worldview that individual behaviour is affected by multiple influences, and recognition that individual level behaviour change may be difficult to sustain in the absence of environmental change supportive of individual efforts (Campbell, 2003).

An alternative perspective on school-based health promotion: a socio-ecological approach

Early ecological models stemmed from ecological systems theory (EST) which suggests that human development is shaped by a number of interrelated systems (Bronfenbrenner, 1979). These are: the micro-system, the immediate settings in which an individual participates (e.g. home, school), meso-system, the interactions between

these settings, exo-system, the relationship between the settings in which an individual does not participate, but may affect the micro-system (e.g. the education system), macro-system, cultural environment and chronosystem, the passage of time which reflects the dynamic relationships between context and individuals. The fundamental principle underpinning ecological models is that behaviour has multiple levels of influence which includes: intrapersonal (biological, psychological), interpersonal (social), organisational, community and political (Sallis, Owen & Fisher, 2015). These models also suggest that influences on behaviour interact across these levels, should be behaviour specific, and multi-level interventions should be the most effective in facilitating behaviour change, although it is also recognised that decisions in which level to intervene are likely to be a function of programme resources (McLeroy, Bibeau, Steckler & Glanz, 1988).

Socio-ecology as a theoretical framework: McLeroy's model.

Early ecological models were mainly designed to explain behaviour, e.g. Urie Bronfenbrenner's (1979) ecological systems theory, however later models, have been designed to support the development of behavioural interventions, e.g. McLeroy et al's (1988) model, with emphasis on environmental, social and psychological influences on behaviour. McLeroy and colleagues' ecological model is based upon EST and suggests that health behaviours are determined by the following:

1. **Intrapersonal factors** - Interventions at this level focus on change at the individual level, e.g. knowledge and attitudes.

2. **Interpersonal factors** - Interpersonal relationships with family members, friends etc. are important sources of influence. The focus at this level is on changing social norms.
3. **Organisational factors** - Organisational characteristics and their role in behaviour change, e.g. development of a culture that supports healthy behaviour.
4. **Community factors** - Physical, i.e. face to face groups to which individuals belong (i.e. school) and psychological sense of community, i.e. belonging/shared identity.
5. **Public policy** - Local or national laws/policies.

Socio-ecological thinking has also been extended to the evaluation of health promotion programmes, in the form of the RE-AIM evaluation framework (Glasgow et al., 1999). The RE-AIM framework identifies the need to not only evaluate interventions in terms of efficacy in a controlled research setting, but to consider other factors such as: reach (the proportion of the target group which the intervention reached); effectiveness (impact on behavioural outcomes); adoption (uptake by settings which adopt the intervention); implementation (whether the intervention is implemented as intended) and maintenance in promoting 'real world' impact. Glasgow and colleagues propose that focusing on efficacy alone does not address how well an intervention works, e.g. in a busy school environment. In order for wide scale dissemination of health promotion programmes, consideration of the broader dimensions of reach, adoption, implementation and maintenance is crucial (Glasgow et al., 1999).

Socio-ecology: application to the programme of research.

Socio-ecological approaches were applied at the level of theory (McLeroy's model), and practice (RE-AIM evaluation framework). McLeroy's (1988) ecological model of health behaviour was explicitly used to explain associations between the different ecological levels and children's fruit and vegetable consumption and to highlight the connectedness of the outputs contained within this critical overview, explored in more detail in chapter 3. The RE-AIM framework was adopted to evaluate the Food Dudes programme, assessing its potential to lead to real-world impact (Glasgow et al., 1999). The RE-AIM model is consistent with socio-ecological thinking in that impact can be measured at various ecological levels: at the level of the individual (reach and efficacy) and that of the organisation (adoption and implementation). Maintenance can be both individual and organisational level of impact. For example, a school-based healthy eating intervention may lead to long-term changes in individual level behaviour change, but these changes may not be maintained in settings (school) over time.

The programme of research presented within this critical overview document utilises McLeroy's (1988) socio-ecological model and Glasgow et al's (1999) RE-AIM framework to address not only 'what works?', i.e. questions of efficacy, rather 'what works, and why? This highlights the importance of not only understanding factors which influence behaviour change but translating research into action and reflects the primary purpose of this research as a problem-solving, action-focused process of inquiry (Johnson & Onwuegbuzie, 2004). Although McLeroy's socioecological model has been applied to school-based healthy eating behaviour change interventions, the use of this

model and the RE-AIM evaluation framework only began to gain precedence at the time when this work was completed (Golden & Earp, 2012; Moore et al., 2013; Townsend & Foster, 2013). Therefore, the application of such in this critical overview represents a significant but modest contribution to the field of school-based health promotion.

Chapter 2

Methodology and Methods

Approach to the research: underpinning philosophical assumptions

The approach to the research was positioned within the paradigm of pragmatism (Tashakkori & Teddlie, 2003), a philosophical worldview which is orientated towards a real-world practice focused epistemology. Pragmatism has a logic of inquiry which focuses on problem-solving thus allowing the use of multiple methods for practical purposes, and views knowledge as a function of organism-environment transactions (Johnson & Onwuegbuzie, 2004). Consequently, pragmatism is consistent with socio-ecological thinking which posits that behaviour is shaped by multiple levels of influence. In pragmatist terms, knowledge should be evaluated according to its consequences in action, for example, Instead of asking 'Does this knowledge accurately reflect the underlying reality?' the question becomes 'Does this knowledge serve our purposes?' (Rorty, 1999; Cornish & Gillespie, 2009). Likewise, methods should not be evaluated according to a hierarchy of evidence but how well they serve a specific purpose. Pragmatism has been used to address some of the challenges of multiple forms of knowledge in health psychology research (Bishop, 2015; Cornish & Gillespie, 2009) and specifically in the evaluation of school-based health promotion interventions (Fairclough et al., 2013) to aid the translation of research evidence into health promotion practice (Whitelaw, Baxendale, Bryce, MacHardy, Young & Witney, 2001).

Research Design

The research design consisted of predominantly quantitative methods, but with a small scale qualitative component. The multiple methods approach (Greene, Caracelli & Graham, 1989) focuses on inclusion of at least one quantitative method, and one qualitative method and is governed by a parallel logic (Mason, 2006), i.e. the qualitative study was not subsumed with the overall quantitative study but had its own logic of data generation, analysis and explanation, in parallel to the main quantitative study (see Figure 1). The focus was therefore on the co-presence of multiple methods as opposed to integration of methods (Mason, 2006) and is consistent with the pragmatist view of the use of multiple methods for practical purposes.

Rationale for the research design.

The research was divided into three phases: baseline, 3-month follow-up and 12-month follow-up, during which quantitative measures of children's fruit and vegetable consumption, in addition to consumption of unhealthy snack foods were recorded (see Figure 1).

In line with pragmatist thought, methods were selected to best address the research objectives and purpose (Bishop, 2015). Whilst the primary focus on the quantitative elements addressed research objectives 1 and 2, a qualitative study was conducted to address the third research objective. The qualitative study was conducted in parallel to the quantitative studies in the third phase (12 month-follow-up) exploring teachers' experiences of implementing the Food Dudes programme (see Figure 1). This study provided important feedback on the Food Dudes programme including suggestions for

improvement, and helped develop an understanding of the role of teachers in supporting school based health promotion initiatives, a common approach in health science research (Creswell, Fetters, Plano Clark & Morales, 2009). The focus on different questions, i.e. intervention effectiveness in different settings and participants' (teachers) experiences, also allowed the findings to be disseminated more widely (see outputs 1, 3-6). Finally, exploring teachers' perceptions of the programme further reflected the socio-ecological approach of the research. Socio-ecology was used to inform the recruitment strategy, identifying participants at different ecological levels, including teachers (organisational level) (Moore, Murphy & Moore, 2011).

Study sample

Two cohorts of children participated in the research; one who participated in the Food Dudes intervention and the other, the control group, received no intervention. The intervention schools were selected by the Department of Health West Midlands and Wolverhampton Primary Care Trust, and the control schools by the University of Worcester research team.

The Food Dudes programme was evaluated in 15 schools (8 intervention and 7 control schools). Two special needs schools were also included, one in each group. All intervention schools were located in one West Midlands city, Wolverhampton; control schools were recruited from a number of other West Midland towns and cities including Dudley, Birmingham and Worcester. Schools were matched, as far as possible, in terms of school size, proportion of children entitled to free school meals and proportion of children from ethnic minorities. The demographic characteristics of the sample are

shown in Table 2. Specific details about each study sample are reported in the respective outputs.

Table 2.

Demographic characteristics of the study sample

Group	N	Boys (n)	Girls (n)	Index of Multiple Deprivation	Deprivation Rank (%)	Free School Meals (%)	Ethnic Minorities (%)
Intervention							
1	154	85	69	1,768	**5.44***	40.7	22
2	67	36	31	1,217	**3.75***	39.0	27
3	177	95	82	7,242	22.3	13.2	10
4	165	92	73	3,639	11.2	30.5	82
5	48	33	15	1,768	**5.44***	57.9	14
6	295	155	140	2,822	**8.69***	25.9	18
7	265	162	103	20,609	63.45	7.8	74
8	281	134	147	20,609	63.45	8.7	71
Control							
9	149	69	80	2,528	**7.78***	36.6	25
10	168	88	80	3,432	10.57	28.0	15
11	143	65	78	8,199	25.24	35.8	10
12	320	171	149	26,581	81.83	2.8	10
13	217	125	92	9,748	30.01	35.5	80
14	170	86	84	6,195	19.07	7.8	51
15	105	56	49	14,977	46.11	14.5	10

Note. IMD: 1 = Most deprived, 32,482 = least deprived
*Schools within 10% most deprived areas in England.

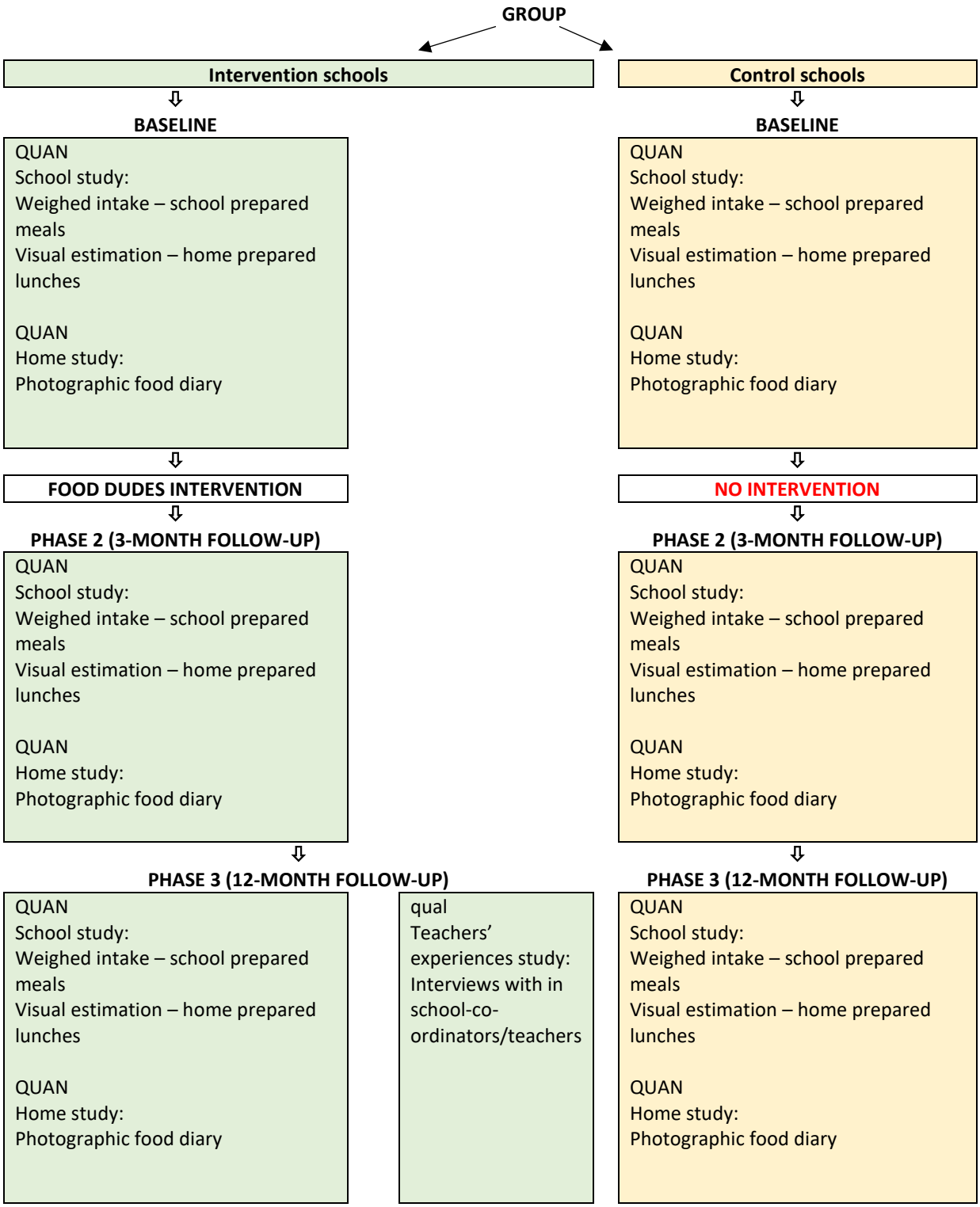

Figure 1. Overview of research design

Recruitment of schools

In the intervention schools, the head teacher for each school was contacted and an initial consultation meeting arranged prior to the baseline phase of the study. In order to select matched control schools, a database of all schools in the Dudley, Birmingham and Worcestershire local authorities was compiled and a list of potential schools identified using the criteria specified (school size, free school meal entitlement, proportion of ethnic minorities). The head teacher from each control school was contacted by letter and a follow-up phone call (one week after the initial contact) was made to arrange an initial consultation meeting. All of the schools initially contacted agreed to participate in the research.

School study (QUAN)

Data collection took place between May 2010 and October 2011. The same design, measures and data collection procedure was followed at each phase (baseline, 3 month and 12-month follow-up) of the research in both intervention and control schools for each of the school studies (see outputs 1, 3 and 4).

Design.

A between-group design of two cohorts of children participating in the study; one receiving the Food Dudes intervention and a matched control group who did not receive the intervention.

Measures.

Measures were collected of both fruit and vegetable consumption, and consumption of foods considered to be high in fat and/or sugar, e.g. chocolate, cakes, sweets etc. In

accordance with the Medical Research Council's best practice guidelines intake at lunchtime for children having school meals was assessed using the weighed intake method, the gold standard method for measuring dietary intake (Wrieden, Peace, Armstrong, & Barton, 2003). Salter digital scales were used accurate to 1 gram. For children bringing in a home prepared lunch, consumption was visually estimated using digital photographs (Swanson, 2008).

Procedure: measuring consumption for children eating school meals.

Prior to lunchtime, each child was given a label listing their ID number, name and class. Due to the time frame of lunchtime service and the number of participants in the study, mean portion size was obtained to provide an accurate measure of dietary intake. Average portions of all food choices on the school menu were taken and five weights of each food recorded to obtain a mean weight. At the beginning of the lunchtime period, children's food choices were recorded on a spreadsheet and, once the children had finished their lunch, the weight of any food waste for each child was recorded. The amount of each food item consumed was calculated by subtracting the leftover weight from the average portion weight recorded. These measures were recorded across five consecutive days in each school.

Procedure: measuring consumption for children eating home prepared lunches.

At the start of the day, lunchboxes were labelled with the child's ID number, name and class and a digital photograph taken of lunchbox contents. Following lunchtime, lunchboxes were collected and a photograph taken of any leftovers. Children were encouraged to leave any uneaten food, wrappers and so on in their lunchboxes. The

number of portions of fruit, vegetables and snack foods consumed were visually estimated using portion guidelines developed by Dresler-Hawke, Whitehead and Coad (2009). Inter rater agreement was calculated for 25% (n=80) of the study sample at baseline by two independent researchers. This established excellent agreement between raters ($r(78) = .98$, $p<0.01$). These measures were recorded across five consecutive days in each school.

Home study (QUAN)

Data collection took place between May 2010 and October 2011. The same design, measures and data collection procedure was followed at each phase of the research in both intervention and control schools for the home studies (output 5).

Design.

A between-group design of two cohorts of children participating in the study; one receiving the Food Dudes intervention and a matched control group who did not receive the intervention.

Measures.

Consumption at home was measured using a 7-day whole diet photographic diet diary (see Appendix B). This method combines two techniques of dietary intake measurement: direct observation and prospective dietary intake recording. Prospective food diaries are typically associated with high participant burden and concerns that the process of completing the food diary may change eating behaviours (Rockett, Berkey & Colditz, 2003). However, this method has been suggested not only to enhance the quality of data collected but to make the process fun and interesting to participants,

particularly when researching with children (Small et al., 2009). Furthermore, for those who are unfamiliar with standard portion sizes or weights/volume of foods this method can decrease the error associated with self-reported intake (Higgins et al., 2009).

Procedure: measuring consumption at home.

Parents were asked to complete their child's food diary for a 7-day period, recording the type of food consumed and an estimation of the amount eaten. Portion sizes could be estimated using household measures or natural unit sizes (e.g. slices of bread). Information on brand names, cooking and preparation methods were also recorded.

Parents were required to identify all foods and drinks consumed rather than just fruit and vegetables/sugary and fatty snacks and photograph each of their child's meals both pre and post consumption. Written and pictorial instructions regarding portion sizes and depicting a standardised approach to taking photographs pre and post consumption were provided (Appendix C). Researchers used the photographs to visually estimate the number of portions of fruit, vegetables and snack foods consumed using portion guidelines developed by Dresler-Hawke et al., (2009), the same guidelines used to assess consumption for children eating lunches prepared at home. Inter rater agreement was calculated for 25% (n=306) of the study sample at baseline by two independent researchers. This established excellent agreement between raters ($r(304) = .95$, $p<0.01$). To maximise engagement with the study, an incentive was offered to families who returned completed food diaries in the form of entry into a £50 prize draw. At the end of 12 month follow-up phase, all participating families in the home arm of the study received a £10 gift voucher in appreciation of their participation. Children were given a

certificate as a thank you for their involvement and each school was also presented with a certificate as a thank you for their assistance with the study.

All materials were made available in Urdu, Punjabi and Hindi, in order to reflect the languages spoken within the geographical areas to ensure that families where parents did not speak English as a first language could participate.

Qualitative study: Assessing teachers' experience of implementing the programme

Teachers (also referred to as in-school co-ordinators) were also included in the study sample (see output 6). An in-school co-ordinator for each intervention school (n=8) was identified by the Food Dudes programme team, and interviews conducted with in-school co-ordinators. In-school co-ordinators were either: class teachers (n=6), or staff members with specific responsibilities for Personal Social and Health Education (PSHE) (n=2). The in-school co-ordinators were trained by the Bangor University research team and were responsible for delivering all aspects of the Food Dudes programme during the initial 16-day intervention phase (Phase 1) and the maintenance phase (Phase 2).

An interview schedule was developed to guide the structured interviews with in-school co-ordinators (see appendix D). This aimed to capture not only co-ordinators general views about the Food Dudes programme but also to explore more specific issues. Three main areas were identified to be explored throughout the course of the discussion:

a) their understanding of Food Dudes before the intervention took place,

b) aspects of the intervention that worked/didn't work well and

c) how the intervention impacted upon the children in their school.

Initial prompts were drafted and subsequently refined to ensure neutrality, avoid assumptions and increase an open discussion by the use of open rather than closed questions. At the end of the 12-month follow-up (phase 3), structured interviews were conducted with the in school co-ordinator from six of the intervention schools to gain an understanding of their experiences of the Food Dudes programme. Interviews were arranged at a mutually convenient time for both the school co-ordinators and researchers. Each interview lasted for approximately 15-20 minutes, was digitally recorded and transcribed in full.

Ethics

Details of ethical considerations were not discussed in depth in the published outputs, and so are outlined here. In accordance with principles laid down in the Code of Ethics and Conduct (British Psychological Society, 2009) and the British Psychological Society's Code of Human Research Ethics, section 10.1 (2010), specific safeguards were put in place for working with vulnerable populations, in this case children aged 4-11. Children were given ample opportunity to understand the nature, purpose and anticipated outcomes of participation. The research student visited the school prior to the start of the study to explain what the study was about and what would happen. An enhanced Disclosure and Barring Service (DBS) clearance was obtained prior to commencement of the study and a copy given to each participating school on request.

Informed consent was sought from head teachers who acted as a gatekeeper. Consent was also obtained on behalf of children from their parent/legal guardian and

given the option to withdraw their child(ren) from the study without explanation. Written consent was obtained from school staff participating in the structured interviews. An information sheet was provided to parents and school staff to provide participants with sufficient information about the research in an understandable form (translated on request).Where written consent was required, two copies of the consent form were signed by the researcher and the consenting participant or parent/guardian. One copy was retained by the participant and one by the researcher.

Participants were made aware that they could withdraw their data at any point during the study. To facilitate this, a database of participants and corresponding ID numbers was created by the research team in order to identify those that wish to withdraw data.

Teachers participating in structured interviews were made aware that the discussion would be recorded and all recordings would be deleted once transcribed with only the anonymised transcripts kept by the research team. All data were kept on a password protected computer with a hard copy locked in a filing cabinet. Participants were given pseudonyms on interview transcripts to ensure anonymity.

A number of methods were employed to ensure recruitment of schools to the study, and engagement throughout the research study including: Identifying an individual who would be the single point of contact for the duration of the study (gatekeeper); providing clear information about the purpose of the study and why that setting has been chosen; being open about what was required of the school, e.g. the

number of visits, amount of time required and who the research would involve; ensuring the offer from the University was aligned with the needs of the school, e.g. evidence in support of existing healthy schools status; and explaining how the findings would be used, in terms of reporting and dissemination. All of the control schools identified agreed to take part in the research and were retained over the course of the research. One intervention school dropped out of the school study after the baseline phase due to a fire which devastated the school building; however, continued to participate in the home study.

Data analysis

Information relating to data analysis procedures of each of the studies is contained within each output.

Chapter 3

A description, synthesis and evaluation of links between the outputs

This chapter explores the notion of coherence, or 'the logic of connectivity (Grant, 2011), the golden thread which joins each of the separate outputs to form a coherent whole using Teddlie and Tashakkori's (2003) concept of inference. This chapter will focus on the links between theory (McLeroy's ecological model of health behaviour), and the evidence generated in the outputs. In doing so, this synthesis will not only illuminate the contribution to knowledge made by this programme of research, but also explain the discrepancy between the findings of previous evaluations of the programme and the research in this critical overview, and highlight future directions for the development of the Food Dudes programme.

Description of inferences

Teddlie and Tashakkori (2003) define inferences as:

"an umbrella term to refer to a final outcome of a study. The outcome may consist of a conclusion about, an understanding of, or an explanation for an event, (a) behaviour, (a) relationship, or a case" (p.35).

In this sense, inference is taken to mean the conclusions which can be made on the basis of the obtained data which not only address the research questions but also enable new understandings or explanations (Teddlie & Tashakkori, 2008). To aid with the process of making inferences, a summary of the studies was first compiled (see Table 3) which included details of the design, sample, setting, methods of data collection and outcome

measures. This enabled a direct comparison of the studies and illustrates similarity of methodology. Output 2 (Taylor, Upton & Upton, 2015) was excluded as this output reported a review of the Food Dudes programme evidence and did not include primary data.

Table 3.

Summary of studies

Output	Design	Sample	Setting	Data collection method	Outcomes measured
1 Upton, Upton & Taylor (2012)	Cohort study	1,296 children aged 4-11	School	Weighed intake method	Fruit and vegetable consumption (FV) Unhealthy snack consumption
3 Upton, Upton & Taylor (2013)	Between groups cohort study	2,433 children aged 4-11	School	Weighed intake method (school prepared meals) Digital Photographic method (home prepared meals)	Fruit and vegetable consumption (FV)
4 Upton, Taylor & Upton (2015)	Between groups cohort study	2,433 children aged 4-11	School	Weighed intake method (school prepared meals) Digital Photographic method (home prepared meals)	Fruit and vegetable consumption (FV) Displacement of unhealthy snacks
5 Taylor, Darby, Upton & Upton (2013)	Between groups cohort study	34 children aged 4-11	Home	7 day whole-diet photographic diet diary	Fruit and vegetable consumption (FV)
6 Upton, Taylor & Upton (2012)	Qualitative study	6 teachers from 6 primary schools	NA	Structured interviews	NA

In order to generate inferences, key research aims/objectives and headline results were extracted for each output (see Table 4).

Table 4.

Summary of inferences from each of the published outputs

Output	Research aim/question	Results	Inference
1 Upton, Upton & Taylor (2012)	To examine levels of children's lunchtime fruit and vegetable consumption in 15 primary schools across the West Midlands region.	66% of the children did not consume any fruit at lunchtime and only 3% of children consumed at least one portion as part of their school meal. Although the proportion of children consuming vegetables was higher (77%), only 6% (n = 72) consumed at least one portion at lunchtime. 80% of children consumed a nonfruit-based dessert (e.g. sponge cake, flapjack, etc.)	In the West Midlands region, children's intake of fruit and vegetables at lunchtime remains poor. Despite the introduction of food-based standards and an increased emphasis on the consumption of fruit through the School Fruit and Vegetable Scheme, children were not consuming, or perhaps even selecting, healthy choices and children continued to consume more nonfruit-based desserts such as chocolate cake than healthy options such as fruit. This suggests that the introduction of these standards alone is not sufficient to change children's eating behaviours, and intervention in this region may be needed

3 Upton, Upton & Taylor (2013)	To investigate the effectiveness of the Food Dudes programme in increasing primary-school children's fruit and vegetable consumption for both home- and school supplied meals; To establish the extent to which the programme is able to influence long-term maintenance (12 months post-intervention) of any observed behaviour change.	Significant increases in fruit and vegetable consumption were found at 3-month follow-up in the intervention but not in the control group for school-provided lunches. Increases were not maintained at 12 months post intervention. No short-term increases were found in the intervention schools for children who consumed home-provided lunches although significant increases at 3-month follow-up were observed in the control schools.	The Food Dudes programme is effective in achieving short term behaviour change (3 months post intervention), but does not lead to sustained changes in behaviour. Furthermore, this was limited to children who consumed school provided meals. The intervention was not effective in changing fruit and vegetable consumption for children who consumed meals provided from home (packed lunches). The significant increases in children's fruit and vegetable consumption found in the control schools may be a result of the schools existing commitment o healthy eating, e.g. all schools in the study had been awarded healthy schools status and needed to implement strategies to maintain this, e.g. healthy eating weeks. It is also possible that involvement in a study focusing on healthy eating may have changed behaviour in the short-term.
4 Upton, Taylor & Upton (2015)	To examine whether increases in fruit and vegetable consumption lead to changes in children's consumption of high fat/sugar foods.	Significant increases in fruit and vegetable consumption were found at 3-month follow-up in the intervention but not in the control group for school-provided lunches but not for those provided from the home. For children consuming school meals, consumption of high-fat and high-sugar foods for children in the intervention and control schools increased over time. Consumption of high-fat and high-sugar foods for children consuming home-provided lunches also increased over time in both groups, although was higher for the control schools. No relationship was found between increases in fruit and vegetable consumption and decrease in consumption of high-	This study suggested that the Food Dudes Programme had a limited impact on children's consumption of foods high in fat and sugar. Whilst some increases in fruit and vegetable consumption were observed, this did not lead to the displacement of high fat and sugar foods. Targeting unhealthy food consumption in addition to strategies to increase fruit and vegetables may facilitate this behaviour change.

		fat and high-sugar foods following the Food Dudes intervention.	
5 Taylor, Darby, Upton & Upton (2013)	To establish whether the intervention could influence home consumption of fruit and vegetables. To establish the extent to which any changes in eating behaviour following the intervention were maintained in the long term.	Short-term increases were evident in weekday fruit consumption in the intervention but these were not maintained in the long term. Weekday vegetable consumption decreased over time in both groups. Short term increases in weekend fruit consumption were found in the intervention and control schools, but only maintained in the long-term in the control schools.	The Food Dudes programme had a limited effect on changing children's fruit and vegetable consumption in the home environment. While the intervention has been shown to be effective in the school setting (in the short term), there is arguably greater potential for variation in the provision of fruit and vegetables for meals provided from home; therefore, the potential of the programme to change eating behaviours in the home setting may be more difficult.
6 Upton, Taylor & Upton (2012)	This study aimed to gain an understanding of the experiences of primary school teachers responsible for implementing the Food Dudes programme. To explore what teachers perceived to be the successes of the programme, barriers to implementation and areas for further development.	Teachers perceived the programme to have a beneficial impact upon children's awareness of healthy eating and the opportunities provided to taste new foods. The materials associated with the programme, particularly the rewards given to children, were also potent. A number of barriers to implementing the programme were identified including: the time required to implement the programme, and the need to implement the programme on a rolling basis.	Understanding stakeholder perspectives when designing interventions is crucial. Sustaining behaviour change is an important issue within health promotion programmes, and may require more than just a one-off intervention found to be efficacious in a controlled research environment. The study highlights the importance of continual education to children regarding healthy eating and the integration of nutrition education into the primary curriculum to reinforce these messages once the programme has come to an end.

Integration of inferences using McLeroy's (1988) ecological model of health behaviour

McLeroy's (1988) ecological model of health behaviour provides a conceptual framework to integrate the inferences outlined in Table 4, and provide an overall explanation, a meta-inference (Tashakkori & Teddlie, 2010). This model has particular relevance to the outputs contained within this critical overview, indeed each can be framed by this ecological model. Whilst the Food Dudes programme was found to be effective in changing children's eating behaviours in the short-term (Upton, Upton & Taylor, 2013), evidence for long-term behaviour change was limited (Taylor, Darby, Upton & Upton, 2013; Taylor, Upton & Upton, 2015; Upton, Upton & Taylor, 2013) and supports the claim that individual behaviour change is difficult to sustain in the absence of changes to the environment which are supportive of individual efforts (Trickett & Rowe, 2012).

In recent years, ecological perspectives on behaviour have become increasingly applied to enhance understanding of health behaviours, particularly within school-based health promotion (Golden & Earp, 2012; Moore et al., 2013). McLeroy et al's (1988) model (see Figure 2), outlined in the introduction to this critical overview is one such model which emphasises the environmental, social and psychological influences on behaviour. McLeroy's model proposes that behaviour is shaped by Intrapersonal factors, Interventions at this level focus on change at the individual level; Interpersonal factors, Interpersonal relationships with family members, friends; Organisational factors, characteristics of the organisation and their role in behaviour change, e.g. development of a culture that supports healthy behaviour; Community factors, Physical, i.e. face to

face groups to which individuals belong and psychological sense of community; Public policy, Local or national laws/policies.

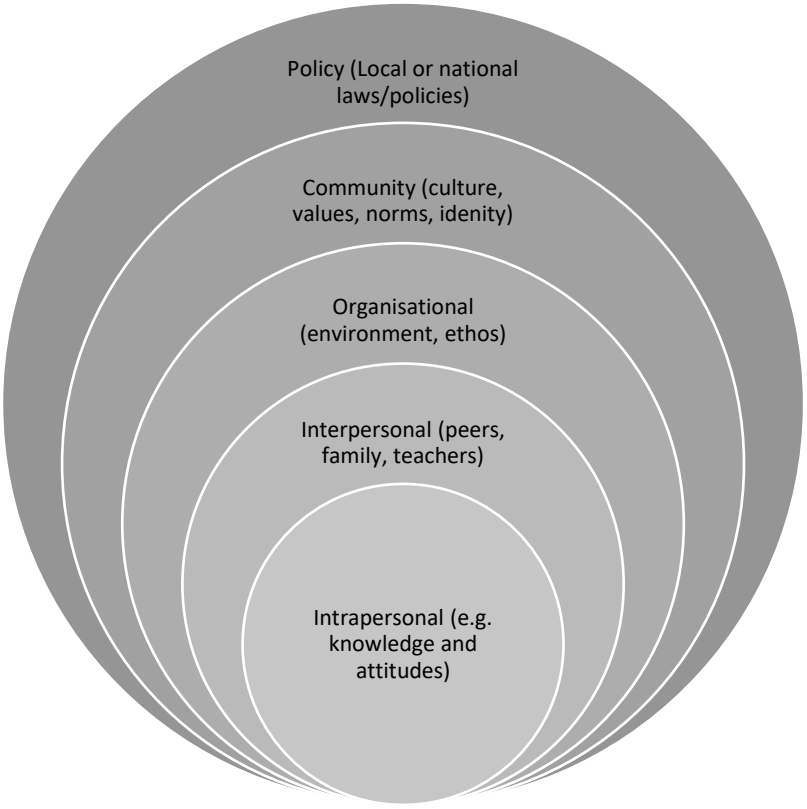

Figure 2. McLeroy et al's (1988) Ecological Model of Health Behaviour

This model provides the conceptual tools in which to understand, describe and explain the importance of broader environmental influences and their interactions in promoting sustained dietary behaviour change in children. The emphasis is on the interactions between the different intervention components operating at different ecological levels. In this sense, behaviour change is systemic and not additive; the effectiveness of one aspect of the intervention to outcomes will depend on the contributions of other aspects. Many school-based behaviour change interventions, including the Food Dudes programme operate at the intrapersonal level, yet the ability of the programme to

facilitate nutritional behaviour change, particularly in the long-term is contingent upon other ecological levels. This chapter will discuss the five levels of McLeroy's framework, specifically how the findings and inferences drawn from each of the outputs can be situated within this theoretical framework.

Intrapersonal and Interpersonal Factors.

The first level of McLeroy's model focuses on characteristics of the individual such as knowledge, attitudes, and skills. Many school-based healthy eating interventions operate at this level, including the Food Dudes programme. The intervention is underpinned by principles of operant conditioning and social learning theory, e.g. the use of incentives to reward eating behaviours and peers (the Food Dudes) as role models in encouraging children to eat fruit and vegetables. However, even though the programme incorporates social influence, the purpose is to change individual level behaviour rather than the social environment (McLeroy et al., 1988) therefore may reflect an assumption that the mechanism for behaviour change is the responsibility of the individual alone.

Whilst the Food Dudes programme had developed following the end of this research to more effectively engage the whole school community, at the time of publication, it was solely focused on promoting individual level behaviour change. Adopting a whole school community approach to healthy eating, e.g. engaging parents, teachers and school catering staff has been recognised as instrumental in supporting behaviour change (Langford, Bonell, Jones & Campbell, 2015; Todd, Christian, Davies, Rance, Startton, Rapport & Brophy, 2015). The focus on individual level behaviour change may, in part explain the limited success of the programme in promoting

sustained behaviour change (Maintenance) particularly in the home environment, i.e. changes in eating behaviour at school were not found at home (Taylor et al., 2013) and changing parental behaviours, i.e. the provision of fruit and vegetables in lunches provided from the home (Upton, Taylor & Upton, 2014). This suggests that the effectiveness of the intervention is context dependent and strategies are required to ensure that behaviour change occurs across contexts (school and home). As Todd et al., (2015) conclude, translating evidence based interventions into the real-world is a complex task and the success of the intervention is dependent upon its acceptability by the school and parents. Strengthening partnerships between home and school is therefore important in maximising the impact of school-based behaviour change interventions and highlights the important role of interpersonal processes.

Organisational Factors.

The third level of McLeroy's ecological framework addresses organisational factors including how organisational characteristics can be used to support behaviour change and the importance of organisational change as a target for health promotion strategies. McLeroy et al., (1988) argue that organisational change is fundamental to creating a culture which is supportive of health promotion and a necessary prerequisite for the adoption, effective implementation and institutionalisation of behaviour change interventions. This is consistent with Bronfenbrenner's (1979) view who also emphasised the importance of the relationship between the intervention team and the host organisation (school), and the notion of buy-in and ownership. If schools do not feel a sense of ownership of the programme, they may not be motivated to support the implementation of the intervention in the long-term. Output 6 (Upton, Taylor & Upton,

2012) provides evidence for a number of barriers to implementing the Food Dudes programme, particularly the difficulties associated in incorporating the programme into the busy school day and competing priorities with regard to academic aspects of the curriculum:

"We had some issues with the running of it, it is, on occasions something that is in the way of teaching literacy … when I'm putting something else in the curriculum they see it as taking away, as stripping away." Teacher, School 2

"The problem is that we have a very busy timetable and all primary schools have a curriculum that barely fits into the time that we're given to deliver it and so it was very difficult trying to fit it in to the day." Teacher, School 6

Teachers were the key instigators of change, they were responsible for implementing all aspects of the Food Dudes programme: showing the daily videos, completing classroom wall charts, serving fruit and vegetables at break-time. However, it is clear that teachers viewed the programme as negatively impacting on the core business of the school – education and did not fully subscribe to the intervention. The concept of shared ownership is central to the Health Promoting Schools initiative (Macnab, Gagnon & Stewart, 2014) which argues that staff are more likely to 'buy-in' to an intervention if they believe it is rooted in the ethos of the school. Whilst output 6 did not capture intervention fidelity, this may explain why the programme did not lead to longer term behaviour change. Indeed, Todd et al., (2015) found that whilst teachers acknowledge the importance of their role, many believed the responsibility placed upon schools for health promotion activities was too great and that interventions needed to better integrate school, parental and societal components. In this sense, an intervention

is not simply an 'add on' but needs to permeate school life and achieve a sense of common purpose (Macnab, Gagnon & Stewart, 2014).

Community Factors.

The fourth level, community may be viewed as face-to-face primary groups or organisations to which individuals belong. This includes the school itself, but also embraces the wider community, e.g. families, friendships and the physical neighborhood in which the school is situated (McLeroy et al., 1988). Four out of the eight intervention schools were located in 10% of the most deprived areas in England. Whilst data were not available to suggest a relationship between deprivation and the effectiveness of the Food Dudes intervention in these schools, it is possible that many parents may not have had the financial resource to buy fruits and vegetables once the programme had come to an end.

Community may also be thought of as the relationship between organisations and groups in a geographical area, e.g. other schools, local charities and health providers. This definition of 'communities as relationships' is important. As McLeroy et al., (1988) suggest, neglecting relationships may reduce the acceptability of an intervention within specific subgroups by neglecting geographical variations in values, norms, attitudes and behaviours. The physical communities in which the intervention and control schools were situated were markedly different in terms of culture. For example, 82% of children in one intervention school were from ethnic minority backgrounds, compared to 10% in another intervention school less than 4 miles away. It is possible that these communities may have different values, norms or attitudes

towards healthy eating and how interventions to change children's eating behaviours should be implemented. If the intervention conflicted with these subcultural norms and values then this may result in resistance from the community to support the approach. This indicates a need for partnership and networking between the school and the community in which it is situated, e.g. collaboration with community members in planning interventions or engaging community members in school activities (Rowling & Samdal, 2011). Consequently, despite interventions such as Food Dudes being implemented in schools, it may be suggested that the responsibility for child health is not solely the responsibility of the school, but of the wider community.

Policy Factors.

In response to poor levels of fruit and vegetable consumption, and the rising prevalence of childhood obesity in the UK, increasing attention has been given to the nutritional standards of school meals. In 2006, the School Food Trust introduced thirteen food-based standards for school meals and a set of nutrient-based standards in 2008. The food-based standards were implemented to increase the availability of healthier options such as fruit and vegetables and to reduce the availability of foods that are high in fat or sugar, such as confectionary and fizzy drinks. The standards were reviewed in 2015 (School Food Plan, 2015) to offer guidance to schools on a range of foods including: starchy foods, fruit and vegetables, sources of protein, milk and dairy, food and drinks high in fat, sugar and salt, healthier drinks and school food other than lunches, e.g. break-time snacks, breakfast and after school clubs and tuck shops. Whilst the standards govern what should be provided to children who consume school lunches, at the time

of publication guidance on providing nutritional packed lunches for children was not available.

Evidence from one output (Upton, Upton & Taylor, 2013) found that the programme was more effective for children who consumed school provided lunches than those which are provided in the home (packed lunches). This may, in large, be due to the Children's Food Trust guidelines which are in place to regulate what is provided to children as part of their school lunch, e.g. One or more portions of vegetables must be provided as an accompaniment every day and one or more portions of fruit must also be provided (School Food Plan, 2015). This highlights the importance and role of guidelines which regulate the type and quantity of food which should be provided to children who consume meals provided by the school. However, whilst school policies should reflect those of national policies, e.g. the School Food Plan, these are also influenced by other factors including children's food preferences, parental views and those of school catering staff. The role of school catering staff in supporting children to make healthy choices is crucial, and whilst staff agreed that they encouraged children to make healthy choices (South, Taylor, Darby, Upton & Upton, 2012), the often overcrowded nature of the dining halls and time pressures observed during data collection likely had an impact upon the ability of lunchtime staff to encourage children to eat healthily. Furthermore, the menus on offer on a particular day or week did not always follow those prescribed by the local authority, and reflected decisions by the school cook, e.g. absence of fruit as a dessert option but a variety of cakes. Although little is known about whether interventions targeting fruit and vegetable consumption also produce changes in consumption of unhealthy foods, research has shown that

restricting the availability of high-fat and high-sugar foods is a useful strategy for increasing fruit and vegetable consumption (Gonzalez, Jones & Frongillo, 2009; Moore & Tapper, 2008). Eliminating or restricting choices is one example of 'nudge theory' and may be a tool which schools and parents could use to promote healthy eating is a less paternalistic way (Thaler & Sunstein, 2009). A nudge can be used to alter behaviour in a predictable way, without forbidding food options through the provision of information, social cues, changes to the environment or default choice (Local Government Association, 2013; Thaler & Sunstein, 2009). For example, catering staff may change the default side option to salad rather than chips. Discouraging consumption of unhealthy foods is therefore equally as important as consuming healthy foods. Output 4 (Upton, Taylor & Upton, 2015) found that the Food Dudes Programme had a limited impact on children's consumption of foods high in fat and sugar. Whilst some increases in fruit and vegetable consumption were observed, this did not lead to the displacement of high fat and sugar foods.

Therefore, despite local and national policies which guide the provision of healthy foods, practical decisions made by catering staff in terms of the food provided to children are likely to have a significant impact in encouraging children to make healthier choices (Moore, Tapper & Murphy, 2010). To ensure intervention fidelity, greater attention should be paid to the interaction between local and national policy and key stakeholders (school cooks, lunchtime assistants etc) if school-based interventions are to be effective in promoting long-term behaviour change.

This chapter has provided a bottom-up synthesis (i.e. from the intrapersonal level to the policy level) to understand, describe and explain the importance of broader environmental influences and their interactions in promoting sustained dietary behaviour change in children. This has also identified challenges and opportunities for school-based healthy eating behaviour change interventions such as the Food Dudes programme in how such processes could be better harnessed to support sustained behaviour change. The implications for this and further directions are discussed in chapter 4.

Chapter 4

Directions for future work

The central aim of this research was to examine the potential of the Food Dudes programme to increase children's fruit and vegetable consumption in the long-term, at school and at home, in schools across the West Midlands. In contrast to previous studies which focused on the internal validity of the intervention, the programme of research asked, 'what works, for whom, and why?' and so represented a broader discussion beyond establishing efficacy (Glasgow et al., 1999) to take account of the wider contextual factors involved in behaviour change. In summary, evidence from the six outputs indicated that the Programme was: effective in increasing fruit and vegetable consumption in the short-term only; more effective for children who consumed school-provided lunches than those provided from home (packed lunches); not able to transfer to the home environment – changes in school consumption were not found in the home; did not result in any decreases in foods which were high in fat and/or sugar, and difficult to implement as part of the school day. This chapter acknowledges these key findings and proposes directions for future work in the field in the form of a whole school approach to school-based health promotion

In contrast to previous research evaluating the Food Dudes programme (Horne et al., 2004; 2009; Lowe et al., 2004; Lowe & Horne, 2009), this programme of research found limited evidence for the effectiveness of the programme at school or at home in the short or long-term. Whilst interventions such as Food Dudes may work at the intrapersonal level of the ecological system, issues of sustainability may arise from an

intervention's inability to extend or function beyond this individual level behaviour change. The behaviourist principles which underpin the Food Dudes Programme arguably work in the short-term (see output 3), however do not take account of the wider contextual factors required for long-term behaviour change. Schools are dynamic environments, they are in a state of flux and many factors in the school environment may affect the maintenance of behaviour change, e.g. teacher turnover, lack of resources and lack of parental engagement with initiatives among others (Altman, 2009). Indeed, it is likely that the potential of the intervention to change consumption of fruit and vegetables for children who consume packed lunches (output 3) was limited by parental provision of fruit and vegetables (Upton, Taylor & Upton, 2014). Characteristics of the home environment including parental provision have been found to significantly mediate both short-term and sustained increases in child fruit and vegetable consumption (Wyse, Wolfenden & Bisquer, 2015). Consequently, this variable may prove to be a useful target for intervention if immediate and longer term changes in children's fruit and vegetable consumption are to be realised. However, a recent review of school-based nutritional interventions targeting fruit and vegetable consumption found no evidence to suggest that factors such as parental involvement were associated with positive outcomes, although interventions which focused on working with school catering staff did lead to increases in fruit and vegetable consumption (Aloia, Shockey, Nahar & Knight, 2016).

Future directions: Behaviour change and socio-ecological models: a need for synergy? The Health Promoting Schools approach

Over a decade ago, Russell Glasgow and colleagues (Glasgow, Klesges, Dzewltowski, Bull & Estabrooks, 2004) issued a call to reconsider the potential of health behaviour change research and its role in health promotion practice. A major limitation of efficacy research according to Glasgow et al., (2004) was that it decontextualised an intervention effect by studying narrowly selected participants and narrowly specified intervention strategies that cannot always be implemented. As a result, many interventions, such as the Food Dudes programme may be effective in highly controlled efficacy studies but prove to be impractical in large scale applied settings, as demonstrated in this critical overview, that have limited time, resources or competing demands, e.g. the school curriculum. This factor was highlighted specifically in output 6, as one teacher identified:

"Timetables are really tight in school and you're giving up some time. You've got to allocate that time and it becomes every day and it can impact on other things even though it's 10 or 15 minutes whatever but that is still a significant time." Teacher, School 4

In recent years, there has been increasing recognition that a stronger alliance between health and education is crucial to intervention success and a call for researchers to work with schools in both the development and implementation of interventions (Langford et al., 2015). This emphasis on co-design has been found in other areas of public health (Andersson, 2017), however it may be suggested that its potential is not yet fully realised in the field of school-based health promotion. If key stakeholders, including children, teachers, parents and catering staff are involved in planning and

decision making, there is greater potential for shared ownership and 'buy-in' of the programme (Macnab et al.,2014).

There is also growing evidence to suggest that education-only (Aloia et al., 2016; Evans, et al., 2013) and those based on experimental interventions, such as Food Dudes, alone are not sufficient in improving children's consumption of fruit and vegetables and approaches which emphasise multiple levels of analysis, such as the socio-ecological approach, offer significant promise as a model to understand health behaviour (Trickett & Rowe, 2012). However, this does not mean the goal of school-based health promotion should be to select interventions at multiple levels in an additive fashion, rather what is required is a move beyond the levels of analysis approach to embrace a systemic and collaborative approach to health promotion. As Trickett and Rowe (2012) propose, the school is not simply the site in which the intervention occurs but is the system to be improved by the intervention. The school is therefore an active and not passive agent in the health promotion efforts, the goal of which should be to change the school environment in ways that facilitate positive health behaviour change. Poor levels of fruit and vegetable consumption is one part of a multifaceted problem, including rising levels of obesity and low levels of physical activity, and as such requires a multifaceted solution within the constraints of time, and resources, physical and financial.

The importance of engaging the whole school community in health promotion activities was first recognised in the late 1980s (WHO, 1986), yet has only made a resurgence in the academic literature in recent years (Langford et al., 2015; Moore et al., 2013; Wang & Stewart, 2013). The 'Health Promoting School' (HPS) approach is

rooted in socio-ecological thinking and aims to promote health throughout the whole school through providing an environment that supports and encourages healthy lifestyles and enables students and staff to take action for a healthier community (Health Education Boards, 1996). It acknowledges that both children and teachers are not isolated from large social structures in which they live and work, and that the creation of a supportive health environment is pivotal to achieving the desired health outcomes, e.g. increased fruit and vegetable consumption. The HPS incorporates three key elements: the curriculum, school ethos and environment, and involvement of parents and the wider community. It represents a coordinated effort to ensure that learning within the classroom is supported by learning and experiences outside of the school environment. The emphasis therefore is not solely on education or food provision but the whole school environment. It is recommended that the Food Dudes programme be developed in line with a whole-school or holistic approach advocated through the HPS through the following:

Integrating interventions within the curriculum.

Schools play an important role in the education of healthy eating among children and teachers are a key social agent in promoting good health yet little evidence exists to suggest which strategies may be most effective in terms of facilitating healthy eating behaviours in primary aged children. Allegrante, Barry, Auld, Lamarre and Taub (2009) suggest, school-based health promotion programmes should become integrated into teaching curricula alongside established theories and evidence based intervention techniques. Indeed, a recent systematic review and meta-analysis (Dudley, Cotton & Peralta, 2015) found that the most effective teaching strategies for encouraging healthy

eating behaviours in primary school children are curriculum, cross-curricula and experiential learning approaches such as gardening interventions. Given that it is teachers which are often the key agent of change within schools (Todd et al., 2015), the findings of this review may have great promise for the field of school-based health promotion. The outcome of health promoting schools cannot and should not be limited to defined health outcomes achieved through single health promotion interventions, e.g. increasing fruit and vegetable consumption. Health promotion activities in schools need to be linked to the core business of schools – education if the goal is long-term behaviour change (Simovska, 2012). This may indicate a shift in what is measured to an alternative outcome that is more aligned with education, e.g. health literacy (the cognitive and social skills which determine the motivation and ability of individuals to gain access to, understand and use information to promote good health (Nutbeam, 2008; Ratzan & Parker, 2000) in addition to strengthening partnerships between home and school (Todd et al., 2015). There is greater scope for the Food Dudes intervention to be embedded within the curriculum as part of wider personal, social health and economic education (PSHE) which may help alleviate timetabling pressures and competing demands of the national curriculum. Healthy lifestyles is now a core topic of the PSHE programme for key stages 1 and 2 including what constitutes a healthy lifestyle, how to recognise what they like and dislike, how to make informed choices that improve their physical health and to recognise that choices can have good and not so good health consequences (PSHE Association, 2017). This approach, combined with the experiential aspect of the Food Dudes programme, i.e. tasting of fruits and vegetables may lead to better health outcomes (Dudley et al., 2015).

Supporting a whole-school healthy eating ethos through policy.

A key finding from the programme of research was that the Food Dudes intervention was more effective for children who consumed school provided meals than those who consumed meals provided from home, due in part to the low levels of fruit and vegetable provision by their parents (Upton, Taylor & Upton, 2014). This may suggest the need for greater regulation of what is provided to children from the home, although is arguably much harder to implement in practice and risks focusing on parents' shortcomings (Middleton, Evans, Keegan, Bishop & Evans, 2014). Since this programme of research was completed, there has been a marked shift in the government approach to school-based health promotion including a focus on creating a culture and ethos of healthy eating which is not limited to improving fruit and vegetable consumption alone as was the goal of previous initiatives, e.g. the school fruit and vegetable scheme (Department of Health, 2000; Teeman et al., 2010). One way in which a whole school culture can be developed is highlighted in the School Food Plan. The School Food Plan published in 2013 (Dimbleby & Vincent, 2013) proposed a series of recommendations on how to improve school food across schools in England. This was combined with a review of the school food standards in January 2015 which provide guidance on the provision of a range of food groups including starchy foods, fruits and vegetables, milk and dairy and foods high in fat and/or sugar (School Food Plan, 2015). All maintained schools in England in addition to free schools and academies are required to meet the standards to ensure that school food is healthy and balanced and provides children with the energy and nutrients they need to do well at school and develop healthy eating habits. However, this policy only applies to children who consume school meals, and not

those brought from home (packed lunches). In light of differences observed in the nutritional content of packed lunches versus school provided meals (School Food Plan, 2015), the Plan calls for greater uptake of school meals in order to provide a nutritionally balanced lunch.

However, actions taken at one level of the socioecological model (policy level) may not produce intended health outcomes (increased fruit and vegetable consumption) due to factors at another level which mediate the relationship between the intervention and outcome. For example, as discussed in chapter 3, despite these national policies which guide the provision of healthy foods, practical decisions made by catering staff in terms of the food provided to children are likely to have a significant impact in encouraging children to make healthier choices (Moore et al., 2010). To ensure intervention fidelity, greater attention should be paid to the interaction between local and national policy and key stakeholders (school cooks, lunchtime assistants etc) if school-based interventions are to be effective in promoting long-term behaviour change.

Engaging stakeholders: involving parents and teachers.

The HPS advocates that in order to promote the long term health of children it is imperative that schools work closely with parents and teachers in the planning, implementing and evaluation of school-based healthy eating interventions (Pettigrew, Pescud & Donovan, 2012). Moreover, both parents and teachers should play an active and not passive role in collaborative efforts. This may require understanding the health beliefs of both groups, implementation of the intervention is likely to depend on

changing the behaviour of those delivering it (Atkins & Michie, 2015). For example, implementing a school-based healthy eating intervention such as Food Dudes is reliant on teachers and parents perceiving healthy eating as an important issue (Todd et al., 2015). Whilst the school environment is a key setting for intervention, the home environment is also a key setting for behaviour change. Parents play an important role as caregivers and food providers and so are instrumental in developing and promoting nutritional health. Despite this, it is recognised that developing partnerships with parents is often the most challenging aspect of collaborative working with schools (Clelland, Cushman & Hawkins, 2013). There is little consensus about the role of parents in HPS interventions (Aloia et al., 2016), which may in part be due to the inadequacy of current approaches e.g. newsletters and information sheets. The Food Dudes programme currently uses both of these approaches in its liaison with parents, however such an approach does not constitute active engagement called for by some (Middleton et al., 2014). Alternatively, it may be that interventions such as Food Dudes remain within the school with resources focused on in-school activities such as tasting sessions and curricula activities such as PSHE. Further qualitative work is required to explore more innovative methods of engaging parents to address these questions.

More evidence is needed which systematically explores key stakeholders' experiences and perceptions of implementing the Food Dudes intervention. Output 6 offers a preliminary insight into the difficulties associated with running the programme within the school day, however further qualitative work could explore barriers and facilitators in greater depth. The translation of the Food Dudes programme into a whole school programme in line with a HPS approach is dependent upon both support from

parents and teachers therefore it is important that this partnership is strengthened to support the development of healthy eating behaviours in school aged children.

Further implications for intervention development and evaluation.

In addition to strategies discussed above, a number of challenges of and implications for designing and evaluating school-based interventions to change eating behaviours can be identified. Firstly, greater attention ought to be paid to Intervention fidelity. Intervention fidelity refers to the extent to which an intervention was delivered as intended. A limitation of the research discussed in this critical overview is that intervention fidelity was not measured. Future evaluation of the Food Dudes programme should ensure that fidelity of delivery is monitored to aid with the interpretation of outcomes and the identification of training needs of those delivering the intervention (Atkins & Michie, 2015). Secondly, school-based interventions should involve a longer intervention phase. The initial phase of the Food Dudes programme lasts for 16 days and the second phase, the maintenance phase for up to one year (Lowe & Horne, 2009). However, the formation of healthy eating habits is likely to take much longer than this and requires more than a one off intervention (see output 6). Indeed, Rana and Alvaro (2010) suggest that school-based healthy eating programmes should be implemented over at least a one year period in order to facilitate longer term behaviour change. Whilst it may be difficult to maintain momentum over a one year period, it is possible that actively involving key stakeholders, i.e. children, teachers and parents, in intervention design and delivery may overcome this. Furthermore, schools are more likely to engage with an intervention if it fits with the priorities of the school (Langford et al., 2015). In addition to longer intervention periods, further evidence for

the long-term effectiveness of the programme is required. Similarly to other school-based interventions (Wang & Stewart, 2012), the Food Dudes programme was not found to be effective at 1 year post intervention. Whilst short-term changes were found for some subgroups, i.e. children who consumed school meals, no longer term effects in children's fruit and vegetable consumption were found. Long term follow-up is essential if programme such as Food Dudes are to facilitate sustained behaviour change.

Conclusion

The programme of research aimed to examine the potential of the Food Dudes programme to increase children's fruit and vegetable consumption in the long-term, at both school and at home, in schools across the West Midlands. Utilising a socio-ecological approach, this was the first systematic and independent study which not only investigated the efficacy of the programme in changing children's fruit and vegetable consumption but also to investigate whether increases in consumption of fruit and vegetables can displace consumption of foods that are high in fat and/or sugars. Whilst the research focused on one geographical area, the West Midlands is typical of an area in which fruit and vegetable consumption among children is low. Consequently, the broader implications of the work are not limited to the West midlands context, but can be adopted by similar settings. Experimental interventions such as the Food Dudes programme should be viewed as synergistic with a socio-ecological approach to healthy eating. Whilst the programme recognises the importance of intrapersonal level factors, further development of the Food Dudes programme should adopt a whole school approach to healthy eating drawing on the key aspects of the health promoting schools framework.

DEVELOPMENT AND IMPACT OF THE OUTPUTS

Portfolio of evidence

Output 1: Upton, D., Upton, P., & Taylor, C. (2012). Fruit and vegetable intake of primary school children: a study of school meals. *Journal of Human Nutrition and Dietetics, 25*(6), 557-562 doi: 10.1111/j.1365-277X.2012.01270.x

Output 2: Taylor, C., Upton, P., & Upton, D. (2015). Increasing primary school children's fruit and vegetable consumption: a review of the Food Dudes programme. *Health Education. 115*(2), 178-196. doi 10.1108/HE-02-2014-0005.

Output 3: Upton, D., Upton, D, & Taylor, C. (2013). Increasing children's lunchtime consumption of fruit and vegetables: an evaluation of the Food Dudes programme. *Public Health Nutrition, 6*(6), 1066-1072. doi:10.1017/S1368980012004612.

Output 4: Upton, P., Taylor, C.E., & Upton, D. (2015). The effects of the Food Dudes programme on children's intake of unhealthy foods at lunchtime. *Perspectives in Public Health, 135*(3), 152-159. doi:10.1177/1757913914526163. 336.

Output 5: Taylor, C., Darby, H., Upton, P., & Upton, D. (2013). Can a school-based intervention increase children's fruit and vegetable consumption in the home setting? *Perspectives in Public Health, 133*(6), 330-

Output 6: Upton, P., Taylor, C., & Upton, D. (2012). Exploring primary school teachers' experiences of implementing a healthy eating intervention. *Education and Health, 30*(2), 27-31.

Statement of contribution: Output 1

Upton, D., Upton, P., & **Taylor, C.** (2012). Fruit and vegetable intake of primary school children: a study of school meals. *Journal of Human Nutrition and Dietetics, 25*(6), 557-562 DOI: 10.1111/j.1365-277X.2012.01270.x

Statement of contribution: Output 2

Taylor, C., Upton, P., & Upton, D. (2015). Increasing primary school children's fruit and vegetable consumption: a review of the Food Dudes programme. *Health Education. 115*(2), 178-196. DOI 10.1108/HE-02-2014-0005.

Statement of contribution: Output 3

Upton, D., Upton, P., & **Taylor, C.** (2013). Increasing children's lunchtime consumption of fruit and vegetables: an evaluation of the Food Dudes programme. *Public Health Nutrition, 6*(6), 1066-1072. DOI:10.1017/S1368980012004612.

Public Health Nutrition: 16(6), 1066–1072 doi:10.1017/S1368980012004612

Increasing children's lunchtime consumption of fruit and vegetables: an evaluation of the Food Dudes programme

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Abstract

Objectives: Although previous research has shown that the Food Dudes programme increases children's fruit and vegetable consumption at school, there has been limited evaluation of the extent to which changes are maintained in the long term. Furthermore, despite knowledge that the nutritional content of home-supplied meals is lower than that of school-supplied meals, little consideration has been given to the programme's impact on meals provided from home. The present study therefore assessed the long-term effectiveness of the Food Dudes programme for both school- and home-supplied lunches.

Design: Two cohorts of children participated, one receiving the Food Dudes intervention and a matched control group who did not receive any intervention. Consumption of fruit and vegetables was assessed pre-intervention, then at 3 and 12 months post-intervention. Consumption was measured across five consecutive days in each school using weighed intake (school-provided meals) and digital photography (home-provided meals).

Setting: Fifteen primary schools, six intervention (n 1282) and seven control schools (n 1151).

Subjects: Participants were children aged 4–11 years.

Results: A significant increase in the consumption of fruit and vegetables was found at 3 months for children in the intervention schools, but only for those eating school-supplied lunches. However, increases were not maintained at 12 months.

Conclusions: The Food Dudes programme has a limited effect in producing even short-term changes in children's fruit and vegetable consumption at lunchtime. Further development work is required to ensure the short- and long-term effectiveness of interventions promoting fruit and vegetable consumption in children such as the Food Dudes programme.

Keywords
Child
Fruit
Health behaviour
Vegetables

The health-related benefits of eating a diet rich in fruit and vegetables are well documented. Evidence suggests that increased fruit and vegetable consumption significantly reduces the risk of CVD and stroke[1–4] and offers protective effects against some forms of adult cancer[5,6]. Despite the positive health outcomes associated with consuming fruit and vegetables and recommendations that children over 2 years of age should consume five portions of fruit and vegetables daily, most children in the UK fail to meet recommended levels of intake[7]. Since evidence from longitudinal studies suggests that food preferences established in childhood and adolescence are likely to persist into adulthood[8–10], it is clear that interventions to increase children's consumption of fruit and vegetables would be beneficial.

As children spend a large proportion of their time in school, the school environment is a logical setting for targeting nutrition behaviours. Interventions to promote fruit and vegetable consumption in the school environment are varied in their approach and effectiveness. However, three strategies that have been shown to have a reliable effect on children's fruit and vegetable consumption are taste exposure, peer modelling and rewards[11]. One evidence-based intervention which incorporates these three core principles is the Food Dudes[12]. This programme is aimed at primary-school children and is designed to increase consumption of fruit and vegetables both at school and at home. The programme also aims to help children develop a liking for fruit and vegetables, reduce their snack consumption, think of themselves as healthy eaters and establish a whole-school healthy eating culture[13].

Research has suggested that the Food Dudes programme is effective in producing increases in children's fruit and vegetable consumption at school[14–19] and at home[14,15]. Evidence also suggests that the programme encourages an increased liking for fruit and vegetables[14]. However, only one evaluation study[16] has investigated the impact of the intervention beyond a 6-month follow-up; thus the

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effectiveness of the programme in facilitating long-term behaviour change is unclear. Furthermore, UK studies of lunchtime consumption have focused mainly upon school-supplied meals, neglecting those supplied from home. It is known that the nutritional content of packed lunches is far lower than that of school-supplied meals[20], containing only half the recommended amount of fruit and vegetables[21]. It is therefore important that the effectiveness of the Food Dudes programme in increasing fruit and vegetable consumption for all children, including those eating home-supplied lunches, is established.

The aims of the present study were therefore twofold: first, to investigate the effectiveness of the Food Dudes programme in increasing primary-school children's fruit and vegetable consumption for both home- and school-supplied meals; and second, to establish the extent to which the programme is able to influence long-term maintenance (12 months post-intervention) of any behaviour changes which were observed.

Experimental methods

Design

A between-group analysis was conducted of two cohorts of children participating in the study; one receiving the Food Dudes intervention and a matched control group who did not receive the intervention. The impact of the Food Dudes programme on fruit and vegetable consumption was assessed at baseline (prior to the intervention), at 3-month follow-up (post-intervention) and at 12-month follow-up.

Participants

The programme was evaluated in fifteen primary schools in the West Midlands, predominantly in areas of high deprivation. Participants were 2433 children aged 4–11 years, 1282 in the intervention schools (690 boys and 592 girls) and 1151 in the control schools (596 boys and 555 girls). Power calculations, using G Power, were computed to determine necessary sample size. Intervention schools were selected by the local health authority and control schools matched as far as possible in terms of school size, proportion of children entitled to free school meals and proportion of children from ethnic minorities. Characteristics of the study sample are shown in Table 1.

Food Dudes intervention

The Food Dudes programme consists of an initial 16 d intervention phase during which children watch a series of DVD episodes of the Food Dudes' adventures. The Food Dudes are four super-heroes who gain special powers by eating their favourite fruit and vegetables that help them maintain the life force in their quest to defeat General Junk and the Junk Punks. The Dudes encourage children to 'keep the life force strong' by eating fruit and vegetables every day. Class teachers also read letters to the children from the Food Dudes to reinforce the DVD messages. During the first four days of the intervention, children are given rewards for tasting both the target fruit and vegetables and then for consuming both foods for the remaining 12 d. Following the intervention, a maintenance phase is implemented during which fruit and vegetable consumption is encouraged, but with less intensity than the intervention phase (a full description of the rationale behind the intervention and details of the Food Dudes programme is given elsewhere[14]).

Procedure

The same procedure was employed in both the intervention and control schools at each study phase and measures were recorded across five consecutive days in each school. As the study employed an ecological design, no changes were implemented to school practices which could impact upon the everyday experience and choices

Table 1 Demographic characteristics of the study sample: primary-school children aged 4–11 years from fifteen schools, West Midlands, UK

Group	*n*	Boys (*n*)	Girls (*n*)	IMD	Rank (%)	FSM (%)	Ethnic minorities (%)
Intervention							
1	125	64	61	1768	5·44*	40·7	22
2	61	34	27	1217	3·75*	39·0	27
3	149	82	67	7242	22·30	13·2	10
4	167	98	69	3639	11·20	30·5	82
5	49	34	15	1768	5·44*	57·9	14
6	296	148	148	2822	8·69*	25·9	18
7	265	162	103	20 609	63·45	7·8	74
8	209	88	121	20 609	63·45	8·7	71
Control							
9	125	57	68	2528	7·78*	36·6	25
10	188	94	94	3432	10·57	28·0	15
11	104	48	56	8199	25·24	35·8	10
12	284	158	126	26 581	81·83	2·8	10
13	222	128	94	9748	30·01	35·5	80
14	135	67	68	6195	19·07	7·8	51
15	95	46	49	14 977	46·11	14·5	10

IMD, Index of Multiple Deprivation (1 – most deprived, 32 482 – least deprived); FSM, free school meals.
*Schools within 10% of most deprived areas.

of children, i.e. school lunchtime menus remained as prescribed by the local education authority. However, food standards developed by the School Food Trust[22] require that at least one portion of fruit and one portion of vegetables or salad must be provided per pupil per day, thus ensuring consistency in fruit and vegetable provision both between menus and schools across the UK.

In line with guidelines developed by the Health Promotion Agency[23], a child's portion of fruit or vegetables was defined as 40 g. Control schools remained under baseline conditions during the 16 d intervention phase.

Lunchtime consumption

School-provided lunches

Consumption at lunchtime for children having school-provided meals was assessed using the weighed intake method, the 'gold standard' method for measuring dietary intake[24]. Prior to lunchtime, each child was given a label with his/her identification number, name and class. Due to the time frame of lunchtime service and the number of participants in the study, mean portion size was obtained to provide an accurate measure of dietary intake. Average portions of all fruit and vegetables on the school menu were taken and five weights of each food recorded to obtain a mean weight. At the beginning of the lunchtime period, children's food choices were recorded on a spreadsheet and, once the children had finished their lunch, the weight of any food waste for each child was recorded. The weighing area was located next to the rubbish bin and the return of trays monitored by the research team to ensure that children did not throw away any uneaten food. Salter digital scales were used, accurate to 1 g. The amount of fruit and vegetables consumed was calculated by subtracting the leftover weight from the average portion weight recorded. In cases where a negative value was obtained, it was assumed that the child did not consume that particular food item and a value of zero was reported.

Home-provided lunches

At the start of the day, lunchboxes were labelled with the child's identification number, name and class and a digital photograph taken of lunchbox contents after morning break. Following lunchtime, lunchboxes were collected and a photograph taken of any leftovers. Lunchtime staff instructed children to leave any uneaten food or packaging in their lunchboxes at the end of lunchtime. All rubbish bins were located away from tables to ensure that the children did not throw any food items away and also enabling close monitoring of food disposal by the research team.

The number of portions of fruit, and vegetables consumed was visually estimated on a five-point Likert scale (0, ¼, ½, ¾, 1) using previously validated guidelines[25]. Inter-rater reliability analysis was performed using correlation to determine consistency among raters. Agreement was calculated for 25 % (n 80) of the study sample at baseline and was found to be excellent ($r(78) = 0{\cdot}98$, $P < 0{\cdot}01$).

Ethical approval

The study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving human subjects were approved by the University of Worcester Institute of Health and Society Ethics Committee. Informed consent was obtained from the head teacher at each school. Consent was sought from head teachers acting *in loco parentis*, supplemented by parental 'opt-out' consent whereby children are included in the study unless their parents withdraw them[26].

Data analysis

Mean values were computed for each child to provide an indication of average daily consumption of fruit and vegetables for children who (i) consumed school-supplied lunches and (ii) consumed home-supplied lunches. In cases where children consumed both school- and home-supplied lunches during the same study phase or across study phases, children were classified according to the predominant mode of supply (school or home), with the criterion that children consumed exclusively school- or home-supplied lunches on a minimum of 3 d during each phase. Data were analysed using the statistical software package IBM SPSS Statistics 19·0 and differences in consumption tested using repeated-measures ANOVA. Paired t tests determined the source of any variance and effect sizes, using Cohen's d, were calculated to measure the practical significance of any changes in fruit and vegetable consumption. An α level of 0·05 was used in all statistical analyses.

Results

Description of the study sample

A total of 2433 children participated at baseline, 1696 at 3-month follow-up (30 % attrition from baseline) and 1470 at 12-month follow-up (13 % attrition from the second time point). Two intervention schools only completed the baseline phase for reasons unconnected with the study. The analyses presented are for children from whom data were available on at least three consecutive days and at each time point in the study. A multivariate ANCOVA was undertaken to establish the potential impact of age, sex, ethnicity and Index of Multiple Deprivation on children's fruit and vegetable consumption. Analysis determined that differences were not significant for age ($F(2, 33) = 1{\cdot}05$, $P > 0{\cdot}05$), sex ($F(2, 33) = 5{\cdot}99$, $P > 0{\cdot}05$), ethnicity ($F(2, 33), = 2{\cdot}17$, $P > 0{\cdot}05$) or Index of Multiple Deprivation ($F(2, 33), = 1{\cdot}75$, $P > 0{\cdot}05$).

Lunchtime consumption

School-provided meals

Figure 1 displays lunchtime consumption of fruit and vegetables in the intervention and control schools. Analysis of fruit and vegetable consumption identified a

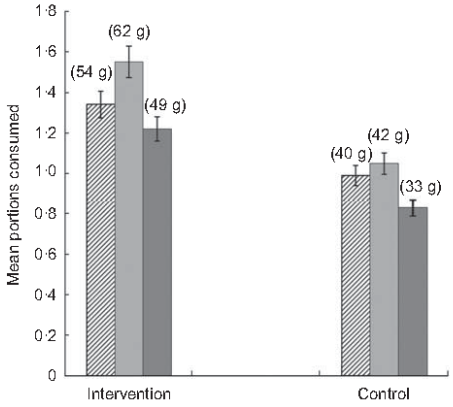

Fig. 1 Portions of fruit and vegetables consumed at lunchtime (amount in grams in parentheses) in the intervention and control schools (school-provided meals) at baseline (▨), 3-month follow-up (□) and 12-month follow-up (■); primary-school children aged 4–11 years, Food Dudes programme, West Midlands, UK. Values are means with 95% confidence intervals represented by vertical bars

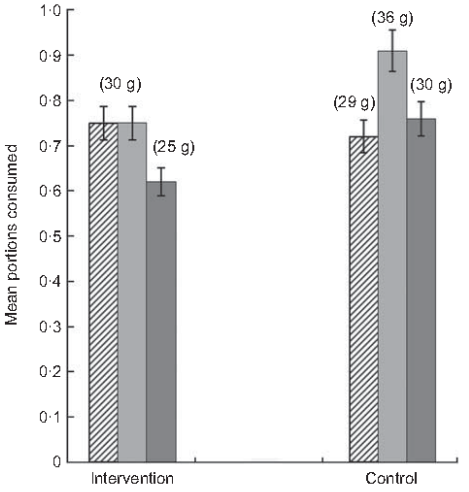

Fig. 2 Portions of fruit and vegetables consumed at lunchtime (amount in grams in parentheses) in the intervention and control schools (home-provided meals) at baseline (▨), 3-month follow-up (□) and 12-month follow-up (■); primary-school children aged 4–11 years, Food Dudes programme, West Midlands, UK. Values are means with 95% confidence intervals represented by vertical bars

significant main effect of study phase ($F(2, 519) = 14{\cdot}26$, $P < 0{\cdot}01$, $\eta_p^2 = 0{\cdot}02$) and school setting ($F(1, 519) = 45{\cdot}83$, $P < 0{\cdot}001$, $\eta_p^2 = 0{\cdot}09$). However, there was no significant interaction between study phase and school setting ($F(2, 519) = 1{\cdot}20$, $P > 0{\cdot}05$, $\eta_p^2 = 0{\cdot}005$). Paired-samples t tests demonstrated that fruit and vegetable consumption in the intervention schools was statistically higher at 3-month follow-up than baseline and of small practical significance ($t = -2{\cdot}54$, $P < 0{\cdot}05$, $d = 0{\cdot}26$, 95% CI $-5{\cdot}39$, $6{\cdot}10$) but not in the control schools ($t = -0{\cdot}97$, $P > 0{\cdot}05$, $d = 0{\cdot}07$, 95% CI $-4{\cdot}46$, $4{\cdot}01$). A statistically significant decrease was evident in the intervention and control schools at 12-month follow-up but was of greater practical significance for the control group ($t = 1{\cdot}40$, $P < 0{\cdot}05$, $d = -0{\cdot}14$, 95% CI $-5{\cdot}46$, $5{\cdot}71$ and $t = 2{\cdot}63$, $P < 0{\cdot}05$, $d = -0{\cdot}21$, 95% CI $-3{\cdot}57$, $3{\cdot}73$, respectively).

Home-provided lunches

Mean portions of fruit and vegetables consumed are shown in Fig. 2. Results of lunchtime fruit and vegetable consumption showed a significant main effect of study phase ($F(2, 343) = 3{\cdot}52$, $P < 0{\cdot}05$, $\eta_p^2 = 0{\cdot}01$) but not school setting ($F(1, 343) = 1{\cdot}52$, $P > 0{\cdot}05$, $\eta_p^2 = 0{\cdot}004$). The interaction between study phase and school setting was also non-significant ($F(2, 343) = 1{\cdot}65$, $P > 0{\cdot}05$, $\eta_p^2 = 0{\cdot}005$), suggesting that changes in consumption over time were not due to school setting (intervention or control). No short-term changes in fruit and vegetable consumption were found in the intervention schools; however, decreases evident at 12-month follow-up were not statistically or practically significant ($t = 1{\cdot}37$, $P > 0{\cdot}05$, $d = -0{\cdot}16$, 95% CI $-0{\cdot}30$, $0{\cdot}01$). In the control schools, fruit and vegetable consumption was statistically higher at 3-month follow-up compared with baseline, however of small practical significance ($t = -2{\cdot}55$, $P < 0{\cdot}05$, $d = 0{\cdot}26$, 95% CI $-0{\cdot}12$, $0{\cdot}38$), but not at 12-month follow-up ($t = -0{\cdot}48$, $P > 0{\cdot}05$, $d = 0{\cdot}05$, 95% CI $-0{\cdot}08$, $0{\cdot}16$; see Table 2).

Discussion

The present study demonstrated that the Food Dudes programme has a limited effect in producing even short-term increases in children's consumption of fruit and vegetables at lunchtime. Although significant increases were found at 3-month follow-up in the intervention but not in the control group for school-provided lunches, the non-significant interaction effect suggests any changes were not the result of the intervention. Likewise, no short-term increases were found in the intervention schools for children who consumed home-provided lunches although significant increases at 3-month follow-up were observed in the control schools. This indicates that children who did not receive the intervention still increased their fruit and vegetable consumption in the short term. Once again this may be explained by the non-significant interaction effect observed for children consuming home-supplied lunches, which suggests that changes in consumption between study phases did not reflect a programme effect. Previous research has

Table 2 Short- and long-term changes in mean portions of fruit and vegetables consumed (grams in parentheses); primary-school children aged 4–11 years, Food Dudes programme, West Midlands, UK

	School provided		Home provided	
	FU_1	FU_2	FU_1	FU_2
Intervention	0·21 (8 g)*	−0·12 (5 g)*	− (±0)	−0·13 (5 g)
Control	0·06 (2 g)	−0·16 (7 g)*	0·19 (7 g)*	0·04 (1 g)

FU_1 – 3-month follow-up – baseline; FU_2 – 12-month follow-up – baseline.
*Significant at $P < 0·05$.

found the programme to be effective in increasing children's lunchtime consumption of fruit and vegetables[14,15,17]; however, this has focused almost exclusively upon school-supplied meals and not those supplied from home. While one study[16] found the intervention to be effective in increasing the consumption of home-supplied fruit and vegetables, the sample size was small (forty-nine children in the intervention and fifty-three in the control group[27]) and thus may have limited power to detect a significant effect. The findings of that study have yet to be replicated and there remains a lack of evidence for the effectiveness of the programme in increasing fruit and vegetable consumption particularly for home-provided meals. In contrast to school-provided meals which are required to conform to food- and nutrition-based standards[22], there is arguably greater potential for variation in the provision of fruit and vegetables for meals provided from home[28]. Consequently, the potential of the programme to change eating behaviours for children consuming home-supplied lunches may be more difficult.

The present findings offer limited support for the role of repeated tasting, peer modelling and rewards alone in producing short- or long-term increases in fruit and vegetable consumption. The development and manifestation of eating behaviours is embedded within a system of influences including intrapersonal (food preferences[29,30]), social (family eating habits[31]) and cultural factors[32], along with aspects of the physical environment such as availability and accessibility[28,33]. Consequently, children's fruit and vegetable consumption is likely to be the result of an interaction between various levels of these ecological systems[34]. Availability is an important factor in determining consumption of fruit and vegetables[35] at school, for both those meals prepared in school and those brought from home. If children are not provided with fruit and vegetables then this will inevitably impact upon their levels of consumption. Indeed, research[28] has found that home availability of fruit and vegetables was associated with increased levels of consumption and suggested that this could be easily manipulated in order to increase children's fruit and vegetable intake. Furthermore, it is important that schools work with parents and children to increase awareness of what constitutes a healthy lunch[21] and educating parents about the nutritional content of home-provided lunches is therefore essential[36]. Collectively, this may enhance the effectiveness of the programme in increasing consumption of fruit and vegetables for children who consume home-provided lunches. Availability of fruit and vegetables is also likely to impact upon consumption of school-provided meals. In each of the schools that participated in the study, it was observed that older children (aged 7–11 years) typically enter the dining hall towards the end of lunchtime service when fruit and vegetables may not always still be available. Caterers should take this factor into account when planning menus and ensure that sufficient portions of fruit and vegetables are available for each child. School policies around healthy eating are also likely to mediate consumption. Recent research[37] identified that schools can effectively impact upon children's eating behaviour by increasing availability of fruit and vegetables; however, the availability of unhealthy foods offered in competition with healthier options undermines this effect. Habit has also been highlighted as a strong predictor of fruit and vegetable consumption in children[33]. In order to facilitate long-term behaviour change, it may be argued that healthy eating behaviours, such as fruit and vegetable consumption, need to become habitual, i.e. behaviour determined by automaticity and executed without awareness[38,39]. Further development of the Food Dudes programme could focus on encouraging habitual intake and take account of the ecological factors that mediate fruit and vegetable consumption. Indeed, the programme is currently being developed further to support the long-term maintenance of consumption.

Comparison between the present findings and those from previous Food Dudes evaluation studies is difficult due to differences in the definition of portion size, particularly regarding lunchtime consumption. For example, a child's portion of fruit and vegetables has been defined as 80 g and 60 g, respectively, which are likely to be larger than appropriate for children of primary school age[14]. Variations in study design also present difficulties. First, previous evaluation studies typically assess the impact of the programme during the 16 d intervention phase[14,16,17]; therefore it is likely that increases in consumption will be more pronounced while the intervention procedures are still in place. Second, existing studies provide an evaluation based upon experimental design rather than an ecological approach as reported here. To maximise the effectiveness of interventions, assessment of intake should be conducted in a way that is ecologically valid, an important consideration within the context of public health. The stringent control evident in the literature[14,15], while necessary to guide intervention development, is not conducive to the eating context of the school setting. The social context of the eating environment can have a large impact on children's behaviour and, given limited attention capacities of children, tightly controlled exposure may result in increased attention on the target stimuli and increased

consumption[40]. This may account for the differences in the findings between the present study and previous evaluations of the programme.

A particular strength of the present study is the use of validated measures of dietary intake. As noted by Klepp *et al.*[41], evaluations of such interventions should be based upon robust measures of dietary intake. Many evaluations of interventions designed to increase children's fruit and vegetable consumption rely on self-report measures, which are clearly limited by the ability of respondents (in this case children) to accurately recall and record consumption. In contrast, the present study used weighed intake of foods, the 'gold standard' assessment tool, to measure consumption of school-provided meals. It was not practical to employ this method for home-supplied lunches, so these were assessed using digital photography, which offers a pragmatic and reliable tool for assessing consumption in the school setting[42]. This method is particularly effective for studies that require rapid acquisition of data and minimal disruption to the eating environment such as the study reported here[43].

Conclusions

The present results offer limited support for the effectiveness of the Food Dudes intervention in increasing the fruit and vegetable consumption of primary-school children. Clearly, further development work is required to ensure both the short- and long-term effectiveness of interventions promoting fruit and vegetable consumption in children such as the Food Dudes programme[44]. The Food Dudes Forever phase of the programme currently underway is one approach that may enhance the short- and long-term effects of the programme on children's eating habits.

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Statement of contribution: Output 4

Upton, P., **Taylor, C.E., &** Upton, D. (2015). The effects of the Food Dudes programme on children's intake of unhealthy foods at lunchtime. *Perspectives in Public Health, 135*(3), 152-159. doi:10.1177/1757913914526163.

Statement of contribution: Output 5

Taylor, C., Darby, H., Upton, P., & Upton, D. (2013). Can a school-based intervention increase children's fruit and vegetable consumption in the home setting? *Perspectives in Public Health, 133*(6), 330-336.

Statement of contribution: Output 6

Upton, P., **Taylor, C.,** & Upton, D. (2012). Exploring primary school teachers' experiences of implementing a healthy eating intervention. *Education and Health, 30*(2), 27-31.

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Exploring primary school teachers' experiences of implementing a healthy eating intervention.

In response to rising levels of childhood obesity, schools have become an influential environment in the promotion of health behaviours and in particular programmes aimed at increasing children's consumption of fruit and vegetables. A range of UK school-based interventions have been developed to target children's fruit and vegetable consumption (Ransley et al, 2007; Wardle, Herrera, Cooke & Gibson). One intervention that has been suggested to be particularly effective is the *Food Dudes* programme.

The programme is based upon psychological principles of behaviour change and aims to increase children's fruit and vegetable consumption through repeated tasting, peer modelling and rewards (Lowe, Dowey & Horne, 1995). The *Food Dudes* are four super-heroes who gain special powers by eating their favourite fruit and vegetables that help them maintain the life force in their quest to defeat General Junk and the Junk Punks. The *Food Dudes* encourage children to 'keep the life force strong' through letters and DVD episodes of their adventures. Evidence suggests that the programme is effective in producing substantial increases in fruit and vegetable consumption (Lowe et al., 2004; Horne et al., 2004, 2009, 2011). However, the effectiveness of interventions such as the *Food Dudes* programme is arguably dependent upon a number of other factors including the perceptions of those responsible for implementing programmes (Baranowski & Stables, 2000). Indeed, health behaviour change programmes are embedded within a system of structures including participating agencies (e.g. schools) and programme implementers (e.g. teachers). Furthermore, following the introduction of the National Healthy Schools Programme and the Enhancement Model (Department of Children, Schools and Families, 2009), all schools in England are required to adopt the ethos of a health promoting school. Teachers are therefore influential agents in the promotion of healthy eating within schools (Speller, et al, 2010) and perceptions of this group are likely to be integral to beliefs about programme effectiveness.

This study aimed to gain an understanding of the experiences of primary school teachers responsible for implementing the *Food Dudes* programme. More specifically, to explore what teachers perceived to be the successes of the programme, barriers to implementation and areas for further development.

Method

Semi structured interviews were conducted with six teachers of the *Food Dudes* programme from six primary schools in one West Midlands city.

Procedure

Following completion of the intervention, all teachers responsible for co-ordinating the programme within their school were contacted via telephone and asked to participate in an interview regarding their experiences of the programme. Interviews were arranged at a mutually convenient time for both the researcher and teachers. Two out of the eight teachers contacted by the researcher were unavailable for interview. An interview schedule was developed to guide the semi-structured interviews with teachers. A funnelling approach was adopted to elicit not only teachers' general views about the *Food Dudes* Programme but also to explore more specific issues. Four main areas were identified to be explored throughout the course of the

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discussion:

a) Their understanding of *Food Dudes* before the intervention took place
b) Aspects of the intervention that worked well
c) Any aspect(s) of the intervention that they felt to be challenging
d) How the intervention affected the children in their school

Initial prompts were drafted and subsequently refined to ensure neutrality, avoid assumptions and increase an open discussion by the use of open rather than closed questions. Interviews were conducted, digitally recorded and transcribed in full.

Ethical approval was gained from the Institute of Health and Society's Ethics Committee and verbal consent given from teachers prior to interview.

Analytic framework

Transcripts from each focus group discussion were analysed using Ritchie and Spencer's (1994) Thematic Framework method. This enabled a detailed exploration of how teachers made sense of their experiences, their understandings, perceptions and views while providing a systematic and rigorous framework enabling the researcher to carefully rework ideas as the analysis developed. Initial themes were identified and an index was constructed by identifying links between categories, grouping them thematically and developing a hierarchy of main and subthemes.

Analytic procedure

The analysis was guided by Ritchie and Spencer's (1994) Framework which depicts five key stages of the analytic process: familiarisation, the identification of initial themes or concepts, indexing, charting and mapping and interpretation.

In order to become familiar with the teachers' accounts, each transcript was examined individually and read multiple times by the researcher. Digital recordings of each of the interviews were also revisited to facilitate this process. The next stage involved identifying initial themes present in the data and interesting and significant issues were noted in the margins. To ensure conceptual clarity, an index was constructed by identifying links between categories, grouping them thematically and developing a hierarchy of main and subthemes. Following this, each main theme and associated subthemes were plotted on a separate thematic chart. Finally, the charted data were examined in order to identify patterns and develop explanations for the data and discuss their application to health promotion within schools.

Results

Analysis of the data revealed three main themes: successful aspects of the intervention, challenges to implementation and maintenance of healthy eating in the long term.

Successful aspects of the intervention

Teachers suggested that the intervention had raised children's awareness of healthy eating, increasing their exposure to fruit and vegetables and providing increased opportunities to try different fruits and vegetables.

> "*It has raised awareness of fruit and veg to children, a lot of children are having fruit as a snack.*" Teacher, School 3

> "*Where it's changed and where I think it's had the most impact is that those, the minority of pupils that don't like fruit and veg, it has changed them, opened their minds a little bit.*" Teacher, School 2

> "*I thought 'I'll just ask them (children) 'are there any fruits or vegetables that you would eat now that you wouldn't before?' and a number of children mentioned peppers which I think is a really good example, people have a perception around the word 'pepper' that it's not going to be edible. They were saying that they were genuinely eating peppers and they didn't before, they wouldn't have eaten them or wouldn't have tasted them.*" Teacher, School 4

However, there was also some recognition that increased exposure to fruit and vegetables did not necessarily produce behaviour change. Children are aware of the importance of healthy eating but their knowledge of what is healthy may not always result in quantifiable changes in consumption suggesting a gap between children's intentions and actual behaviour.

> "*I mean these children they really know what's healthy, what's good for them, so they've got the*

knowledge even if they don't necessarily choose to follow it, they know, they've got the understanding." Teacher, School 1

"*The fact that it was about widening children's eating experiences I think is one of the real strengths. Now, whether it's successful or not I'm not sure but it's clearly got to make sense to try that because I genuinely think it's an issue, children make value judgements based on little or nothing or hearsay and if you can get out of that, or at least try to that's got to be positive.*" Teacher, School 3

The prizes given to children as rewards for tasting the fruit and vegetables were regarded as a particularly positive aspect of the intervention. The prizes were perceived to be well-developed and age-appropriate. Teachers suggested that the prizes encouraged children to try fruit and vegetables.

"*The children were highly motivated by the prizes. The prizes, I thought, were very well planned in terms of; they were very well pitched in terms of the age appropriateness of them and in addition, in terms of the materials that we used were actually also very well pitched. Quite often when organisations come into schools, primary schools, they will have programmes that are run and due to their not having full knowledge of, the range of if you like, emotional and intellectual abilities of children, sometimes these programmes don't always match their abilities and age ranges.*" Teacher, School 2

"*Simple things like the prizes were really good, little things. I think the prizes, and it's hard to think of lots of different prizes worked well and kids loved them and so that was good.*" Teacher, School 4

Teachers also commented on the effectiveness of the DVD episodes shown to the children during the intervention phase. These were enjoyed by the younger children in particular, perhaps reflecting the developmental stage of this age group. It was suggested that these were not as appropriate for older children.

"*They loved the little film clips on the DVD. They loved the fact that they were other children telling them about fruit and vegetables and they put it into the villain and the superhero situation and they, they got it spot actually because that's what children like, the baddies and the goodies. The younger ones, responded to we've got a letter from the Food Dudes like wah! I think the older ones perhaps thought...you're having us on here.*" Teacher, School 6

"*The children really liked it, I mean that's important. They buy into the whole experience. The characters may be a little bit twee but they work really well, particularly with the younger children. I'd say the upper juniors start saw it as a little bit patronising. I know it's not age related but I think probably more powerful with the younger children than the older ones possibly.*" Teacher, School 4

Challenges to implementation and maintenance of healthy heating

The time required to implement the programme was a significant challenge for teachers, particularly the difficulties associated in incorporating the programme into the busy school day. There was also recognition of competing priorities with regard to academic aspects of the curriculum.

"*We had some issues with the running of it, it is, on occasions something that is in the way of teaching literacy … when I'm putting something else in the curriculum they see it as taking away, as stripping away.*" Teacher, School 2

"*The problem is that we have a very busy timetable and all primary schools have a curriculum that barely fits into the time that we're given to deliver it and so it was very difficult trying to fit it in to the day.*" Teacher, School 6

"*Timetables are really tight in school and you're giving up some time. You've got to allocate that time and it becomes every day and it can impact on other things even though it's 10 or 15 minutes whatever but that is still a significant time.*" Teacher, School 4

The *Food Dudes* intervention was viewed positively by the majority of school teachers, however it was suggested that the programme should be rolled out on a cyclical basis rather than as a one off intervention thus encouraging

children to revisit the importance of eating fruit and vegetables as part of a healthy diet.

> "*What might concern me is that really children should be educated like this on a regular basis so every subsequent year group should be educated in years to come so really it probably needs building into the curriculum, on a rolling programme.*" Teacher, School 2

> "*Whether someone could invest some time revisiting, sharing those same messages again but in different ways, in assemblies, in classes would have been good.*" Teacher, School 4

> "*It needs to be something we need to do again and again and again. If it is just seen as a one-off, it won't work. Anyone who's taught primary school children will know that for a child to learn how to write a simple sentence can take years and the same applies to attitudes to healthy eating. It's not a one off lesson or one-off week.*" Teacher, School 2

Discussion

This study explored the perceptions and experiences of primary school teachers responsible for implementing the *Food Dudes* programme in one West Midlands city. Overall, teachers were positive about the programme and agreed that they would participate in the programme if it were to be rolled out in the future. Teachers perceived the programme to have a beneficial impact upon children's awareness of healthy eating and the opportunities provided to taste new foods. The materials associated with the programme, particularly the rewards given to children, were also potent. This is important as the use of incentives to change behaviour is only likely to be effective if these are highly desirable to the child (Lowe et al., 1998).

However, a number of barriers to implementing the programme were identified. The time required to implement the programme was highlighted as a significant challenge. As Langille and Rodgers (2010) identified, schools may have difficulty implementing health promotion programmes due to competing priorities, particularly raising standards of academic attainment. Consequently, it is important that health promotion initiatives such as the *Food Dudes* programme consider the needs and interest of teachers and are incorporated into the primary curriculum (Pérez-Rodrigo & Aranceta, 2003). The need to maintain children's interest and consumption of fruit and vegetables in the long term was also recognised by teachers. Sustaining behaviour change is a crucial issue within health promotion programmes and as such may require more than just a one-off intervention found to be efficacious in a controlled research environment (Altman, 2009). This highlights the importance of continual education to children regarding healthy eating and the integration of nutrition education into the primary curriculum to reinforce these messages once the programme has come to an end.

In conclusion, the perceptions and experiences of teachers involved in implementing the *Food Dudes* programme should be taken into account when developing and refining the programme. Further work is required to develop ways in which the programme could be integrated into the curriculum to support the maintenance of healthy eating behaviours.

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Chapter 5

A chronological description tracing the development of the outputs

The critical overview document details research conducted from May 2010-January 2012 and consists of six research outputs published in peer-reviewed journals between 2012-2015. The outputs are grouped into two clusters: studies which provided the rationale for the research and assessed the need for the Food Dudes programme, and those which measured its effectiveness (see Figure 3).

At the outset of the project, a writing strategy was formulated by the research student outlining: how the findings from each of the studies would be disseminated, including academic articles and professional publications; target journals and an anticipated timeline for publication (see Table 1). An outline of data collection, analysis, drafting and submission of the outputs, and publication dates is provided in Table 5.

Studies assessing the need for the Programme (outputs 1-2)

Data collection for output 1 (Upton, Upton & Taylor, 2012) took place between May-November 2010 (the baseline phase of the study), and the analysis and writing of the paper between June-September 2011. The output examined children's fruit and vegetable consumption in 15 primary schools across the West Midlands region, prior to implementation of the Food Dudes programme. The output highlighted the poor levels of fruit and vegetable consumption and high levels of consumption of high fat foods in primary schools across the West Midlands thus supporting the rationale for the need for the programme in this locality.

In order to inform the project proposal to the Department of Health West Midlands (prepared in April 2010), a literature review was conducted to establish the existing evidence base for the Food Dudes programme. This initial review was subsequently developed into a more substantial review of the evidence base for the programme. At the time of publication, no published reviews of the Food Dudes programme existed, despite the extensive roll-out of the intervention. Consequently, a thorough appraisal of the available literature was timely. The review process began in June 2010, and was completed in June 2013. At the outset of the study, the research team were aware that other evaluation studies were currently underway or near completion and would likely form published outputs. Consequently, the review was continually updated, incorporating new literature when it became available. The review was completed in June 2013 and initially submitted for publication in September 2013. The first submission was rejected as it was not deemed to fit with the journal's aims and scope. The paper was then submitted to an alternative journal, *Health Education,* in February 2014 and published in its online and print format in February 2015.

Studies assessing the effectiveness of the Programme (outputs 3-6)

Data collection for each of the published outputs occurred between May 2010-October 2011. As evidenced in Table 5, there was some degree of overlap in the data analysis process and the writing of outputs 3-6. It should be noted that whilst outputs 4 and 5 (Taylor, Darby, Upton & Upton, 2013; Upton, Taylor & Upton, 2015) were published in print form almost 2 years apart, the outputs were submitted at a similar time (July and August 2013 respectively). Delays in the publication process were in

response to an increased volume of articles being submitted to the journal, and restrictions in print space.

One of the objectives of the research was to explore reasons why school-based healthy eating interventions, may not lead to long-term changes in children's eating habits. Output 6 (Upton, Taylor & Upton, 2012) explored teachers' experiences of implementing the programme, including perceived facilitators and barriers to successful implementation. This output was published soon after the completion of the research in a professional peer reviewed publication, *Education and Health*. The submission of this publication coincided with a dissemination event in January 2012, convened by Wolverhampton Primary Care Trust to discuss recommendations of the research and to consider ways of taking the Food Dudes programme forward in Wolverhampton and neighbouring areas of the West Midlands.

A key objective of the programme of research was to examine the effectiveness of the programme in increasing children's fruit and vegetable consumption at school and at home, and identify which individuals and/or subgroups might readily benefit from the programme. Output 3 (Upton, Upton & Taylor, 2012), was the first of two outputs to examine the effectiveness of the Food Dudes programme at school. This paper was written and published (online) soon after the completion of the research in 2012. Output 4 (Upton, Taylor & Upton, 2015) also examined the potential of the programme to change children's eating behaviours at school, assessing the extent to which unhealthy foods, i.e. those high in fat and/or sugar were displaced from children's diets. Whilst the Food Dudes intervention primarily aimed to increase children's fruit and vegetable

consumption, it also claimed to decrease consumption of high fat and/or sugar foods. In light of this, the findings from the school study were further disseminated, exploring whether any increases in children's fruit and vegetable consumption resulted in any changes in their consumption of high fat and/or sugar foods.

In addition to exploring the effectiveness of the programme at school, the research also aimed to examine the potential for the programme to bring about changes in children's eating behaviours at home. Output 5 (Taylor, Darby, Upton & Upton, 2013) investigated the potential for the intervention to lead to changes in children's fruit and vegetable consumption in the home environment.

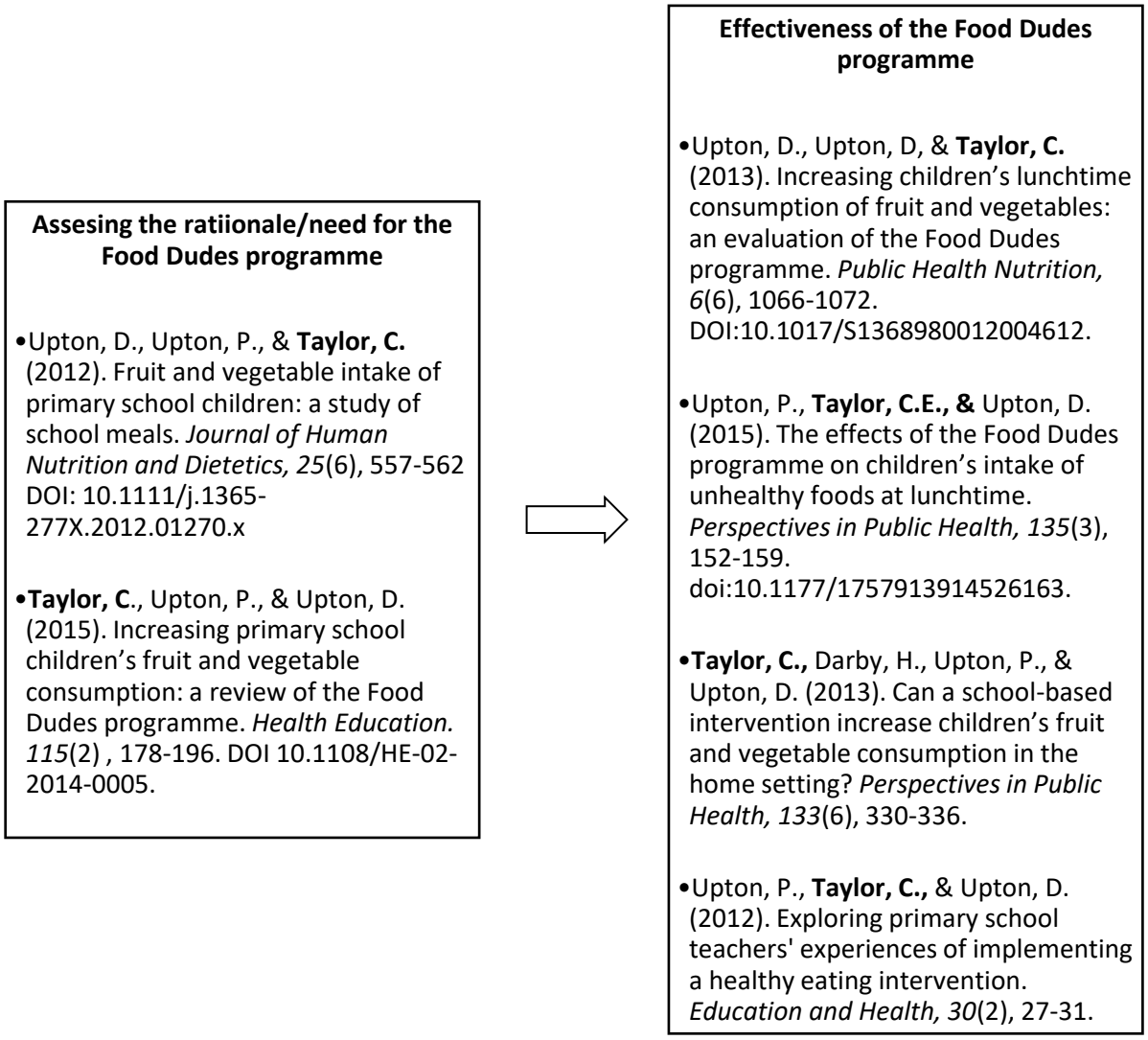

Figure 3. Research study clusters

Table 5.

Description of publication dates

	Data collection	Analysis/Writing	Submitted for publication	Accepted for publication	Published (online first)	Published (print)
Output 1	May-November 2010	June 2011-September 2011	18th October 2011	26th May 2012	19th July 2012	December 2012
Output 2	NA	June 2010-June 2013	1st February 2014	13th May 2014	2nd February 2015	February 2015
Output 3	May 2010 – October 2011	November 2011-January 2012	1st February 2012	24th August 2012	16th October 2012	June 2013
Output 4	May 2010 – October 2011	December 2012 - July 2013	6th August 2013	7th February 2014	20th March 2014	May 2015
Output 5	May 2010 – October 2011	December 2012 – June 2013	10th July 2013	4th September 2013	8th November 2013	November 2013
Output 6	June 2011	August-December 2012	January 2012	February 2012	March 2012	March 2012

Chapter 6

An evaluative description of the originality of each output

This chapter provides an evaluative description of the originality of each of the six outputs, at the time of publication. Philips and Pugh's (2010) list of originality statements is also used to provide evidence for elements of originality in each of the outputs (see Table 6). The concept of 'originality' was also explored in chapter 3, specifically in relation to the theoretical framing of the study.

Description of aspects of originality in each of the six outputs

Output 1:
Upton, D., Upton, P., & **Taylor, C.** (2012). Fruit and vegetable intake of primary school children: a study of school meals. *Journal of Human Nutrition and Dietetics, 25*(6), 557-562 DOI: 10.1111/j.1365-277X.2012.01270.x

This output provided the context for the subsequent outputs, and highlighted the need for intervention within the region in which the Food Dudes programme was implemented. Despite the introduction of food-based standards for school meal provision (School Food Trust, 2008), children were not consuming adequate portions of fruit and vegetables as part of their school meal, suggesting that the introduction of these standards alone was not sufficient to modify children's consumption patterns at school within the West Midlands region.

Output 2:
Taylor, C., Upton, P., & Upton, D. (2015). Increasing primary school children's fruit and vegetable consumption: a review of the Food Dudes programme. *Health Education. 115*(2), 178-196. DOI 10.1108/HE-02-2014-0005.

The output was published in a special issue of the journal, 'Diet and the Health Promoting School', indicating that the paper was an area of particular interest to the

journal readership. This output critically reviewed the evidence base for the Food Dudes programme and highlighted the methodological limitations of study design, specifically the high level of experimental control. The findings indicated that the programme was moderately effective in the short-term; however, the long-term effectiveness of the programme was equivocal. This was the first review of the Food Dudes programme. In light of the extensive roll out of the Food Dudes programme across schools in the UK and Ireland, an appraisal of the evidence surrounding the programme was timely.

Output 3:
Upton, D., Upton, D, & **Taylor, C.** (2013). Increasing children's lunchtime consumption of fruit and vegetables: an evaluation of the Food Dudes programme. *Public Health Nutrition, 6*(6), 1066-1072. DOI:10.1017/S1368980012004612.

This was the first of two outputs which analysed the effects of the Food Dudes programme on children's dietary intake at school and was published in the journal's special issue: 'Hot Topics: School Food'. This was the first independent research study of the programme (all previously published studies were conducted and written by the programme developers at Bangor University). A key feature of the research was the use of a novel measure of food consumption for children who brought in packed lunches from home (criteria 5, Philips and Pugh, 2010). Although this method has been used in studies assessing dietary intake in a cafeteria setting (Swanson, 2008), at the time of publication, this method had not been used to measure consumption for children who consumed home prepared lunches. This was the first paper to use digital photography to measure dietary intake for children who consume packed lunches and the first study to assess this within the UK, as evidenced by the independent peer reviewer comments:

> *"The paper contains new and significant information on a topical subject especially in the context of current publicity regarding the standards of nutrition in foundation and free schools compared to state maintained schools. The authors use an interesting methodology – the use of digital photography to assess lunch box contents before and after consumption and the use of inter-rater reliability provides level of rigour in analysis." (Reviewer 1)*
>
> *"The paper is novel in that it focuses on an area that has only been looked at in Ireland and not in the UK. Although the findings indicate that fruit and vegetable consumption did not increase following the intervention, the discussion outlines possible reasons for this and refers to related interventions." (Reviewer 2)*

Output 4:
Upton, P., **Taylor, C.E., &** Upton, D. (2015). The effects of the Food Dudes programme on children's intake of unhealthy foods at lunchtime. *Perspectives in Public Health, 135*(3), 152-159. doi:10.1177/1757913914526163.

Research had not previously evaluated whether the Programme can decrease the consumption of high fat and sugar foods. This was important as it is unlikely that the positive health outcomes associated with eating more fruit and vegetables, such as weight loss can be achieved if this is not accompanied by a decrease in the intake of foods high in fat and sugar. Interventions that can change consumption of unhealthy foods to healthier foods (such as fruit and vegetables) may contribute to the treatment of childhood obesity by reducing calorific intake (Tak, te Velde, Sing & Brug, 2010).

At the time of publication, this study was the first study to explore whether the Programme could change children's lunchtime fruit and vegetable consumption and consumption of high fat and sugar foods following the intervention and explore any relationship between these variables. The findings showed a significant increase in the consumption of lunchtime fruit and vegetables was found at three months for children in the intervention schools, but only for those eating school-supplied lunches. For

children consuming school meals, consumption of high-fat and high- sugar foods for children in the intervention and control schools increased over time. No relationship was found between increases in fruit and vegetable consumption and decrease in consumption of high-fat and high-sugar foods following the Food Dudes intervention.

Output 5:
Taylor, C., Darby, H., Upton, P., & Upton, D. (2013). Can a school-based intervention increase children's fruit and vegetable consumption in the home setting? *Perspectives in Public Health, 133*(6), 330-336.

The Food Dudes programme claims to increase children's consumption of fruit and vegetables at home in addition to the school environment, however the evidence for the programme's effectiveness in the home setting is unclear. This study was the first large scale study which aimed to establish whether the Food Dudes intervention can influence home consumption of fruit and vegetables, and the extent to which any changes in eating behaviour following the intervention could be sustained. Previous studies were conducted with small numbers of children aged 5-7 years (Horne, Lowe, Fleming & Dowey, 1995) or without a control group (Lowe et al., 2004). Whilst one study (Horne et al., 2004) did include a control group, due to missing data, only one weekday and one weekend day were used to calculate consumption; therefore, did not provide a reliable measure of dietary intake. Consequently, this study investigated an area that had not been fully addressed before and significantly added to the evidence base in this area. The findings indicated that the Food Dudes programme did not influence either short- or long-term changes in children's consumption of fruit and vegetables at home during weekdays or at the weekend.

Output 6:
Upton, P., **Taylor, C.,** & Upton, D. (2012). Exploring primary school teachers' experiences of implementing a healthy eating intervention. *Education and Health, 30*(2), 27-31.
This paper explored primary school teachers' perceptions of the Food Dudes programme. A number of barriers to implementing the Food Dudes programme were identified and suggestions for how the programme could be improved and developed discussed, including how schools may have difficulty implementing health promotion programmes due to competing priorities, e.g. raising standards of academic attainment. At the time of publication, this was the only published study to explore the perspectives of those responsible for implementing the programme.

Statements of originality

Philips and Pugh (2010) list fifteen statements to define originality of research. Table 6 maps each of the outputs against the originality statements suggested by Philips and Pugh (2010).

Table 6.

Summary of originality statements (Philips and Pugh, 2010)

Criteria	Evidence
1. Setting down a major piece of new information in writing for the first time **(outputs 1-6)**	Outputs 1-6 examine the effectiveness of the Programme in a way which had not been done at the time of publication (see criterion 7).
2. Continuing a previously original piece of work **(outputs 3-6)**	Output 3-6 are an extension of previous research which evaluates the Food Dudes Programme.
3. Carrying out original work designed by your supervisor.	NA.
4. Providing a single original technique, observation, or result in an otherwise unoriginal but competent piece of research **(outputs 3-5)**	Use of digital photography to assess food consumption for children eating packed lunches
5. Having many original ideas, methods and interpretations all performed by others under the direction of the postgraduate.	NA
6. Showing originality in testing somebody else's idea	Although the Intervention was developed by an external team, the scope of the research provides clear elements of originality (see criterion 7-9).
7. Carrying out empirical work that hasn't yet been done before **(outputs 1, and 3-6)**	These studies were the first to examine the effectiveness of the Intervention in a number of ways: • large scale study (15 schools compared to 3 in previous research);

	• included a control group; • used robust measures of dietary intake beyond visual estimation used in previous research; • assessed the impact of the intervention in the UK for children eating packed lunches; • over time – previous research only examined the short-term impact (up to 12 months post intervention); • effectiveness in the home setting; • on the displacement of unhealthy foods; • considered the views of teachers and those implementing the programme.
8. Making a synthesis that hasn't been made before **(output 2)**	Synthesises the available evidence on the Food Dudes Programme, highlighting the methodological limitations of study design and the impact on effectiveness of the Programme.
9. Using already known material but with a new interpretation **(critical overview)**	Explores how the Food Dudes Programme can be situated within an ecological framework, and identifies further areas for development.
10. Trying out something in this country that has previously only been done in other countries **(output 3)**	First study to assess Intervention effectiveness in the UK for children eating packed lunches. Previous research was conducted in Ireland.
11. Taking a particular techniques and applying it to a new area **(outputs 3-4)**	Use of digital photography to assess food consumption for children eating packed lunches.
12. Bringing new evidence to bear on an old issue **(outputss 2-6)**	First studies to provide evidence for the inability of the Programme to sustain behaviour change.
13. Being cross-disciplinary and using different methodologies.	NA
14. Looking at areas that people in the discipline haven't looked at before **(outputs 2-6)**	See criterion 7.

15. Adding to knowledge in a way that hasn't previously been done before **(outputs 2-6)**	See criterion 7.

In summary, the claim for originality is principally based on the following:

- At the time of publication, all empirical studies of the Food Dudes Programme were conducted and published by the creators of the Programme, i.e. the Bangor Food and Research Unit therefore are likely to be subject to reporting bias. In contrast, each of these publications (2-5) represent an independent examination of the potential for the Programme to promote changes in children's eating behaviours.
- These studies were the first to examine the effectiveness of the Intervention: on a large scale, to include a control group of more than one school, to use robust measures of dietary intake beyond visual estimation used in previous research; to assess the impact of the intervention in the UK for children eating packed lunches; and to examine effectiveness in the home setting;
- The published outputs represent the first studies to provide evidence for the inability of the programme to sustain behaviour change in the long-term.
- The use of a novel method of measuring of food consumption for children who brought in packed lunches from home. This was the first study to use digital photography to measure dietary intake for children who consume packed lunches and the first study to assess this outside of the UK.
- At the time of publication, output 4 was the first study to explore whether the Programme could change children's lunchtime fruit and vegetable consumption and consumption of high fat and sugar foods following the intervention.

Chapter 7

An evaluative review of the contribution made by the outputs to the subject or discipline area and any subsequent developments since the work was completed

A contribution to knowledge, or academic impact, is typically defined in terms of academic advances within and across disciplines in understanding, advances of methods, theory, application or re-interpretation. More recently however, understanding of impact has been reconceptualised to encompass broader benefits. Research Councils UK (RCUK) (2014) define impact as 'the demonstrable contribution that excellent research makes to society and the economy'. The REF, a system for assessing the quality of research in UK higher education institutions, expands on this definition, suggesting that impact is 'an effect on, change or benefit to the economy, society, culture, public policy or services, health, the environment or quality of life, beyond academia' (REF 2014). Therefore, impact can be understood not only in terms of a contribution to subject knowledge, but also in terms of its real-world benefits and application. This chapter discusses the public health impact of the research utilising the reach and adoption aspects of the RE-AIM model outlined in chapter 1 with reference to the impact case study submitted to the REF in 2014 (see Appendix E).

Impact beyond academia – development and roll-out of the Food Dudes Programme in the West Midlands

Research impact embraces the diverse ways in which research can benefit individuals or organisations. This includes the potential for research to increase the effectiveness of services or interventions, often termed instrumental impact. The programme of research discussed within this critical overview formed an impact case study submitted

to the Research Excellence Framework (REF) exercise in 2014. The case study was drafted by the research student and edited by the Principal Investigator of the research project (Professor Upton) and the former Deputy Vice Chancellor of the University of Worcester, Professor Rosalind Foskett. The case study was assessed according to the 'reach' and 'significance' of the work and received a 3* rating, indicating a very considerable impact in terms of the reach and significance (REF, 2011).

Glasgow et al. (1999) defined reach as the absolute number and proportion of individuals who are willing to participate in a given initiative. During the time of the evaluation, the 2010-2011 academic year, the Food Dudes programme reached 3,384 children aged 5-11 years, which represents 15% of children attending primary schools in Wolverhampton during that year (22,600). In January 2012, Wolverhampton Primary Care Trust convened a workshop to discuss recommendations of the report and to consider ways of taking the programme forward in Wolverhampton and neighbouring areas of the West Midlands. Workshop participants included the Food Dudes programme developers, local project coordinators, staff from schools, head teachers, representatives from agricultural groups and public health managers. A key recommendation of the research was the need for on-going development of the programme to ensure its short and long-term effectiveness. In response, the Food Dudes Programme was developed to include a second key phase called "Food Dudes Forever". This phase was designed to maintain improvements in fruit and vegetable consumption established in the initial phase of the programme and would run each year in participating Primary Schools. The report to the Department of Health West Midlands further recommended that environmental factors should reinforce the intervention's

healthy eating messages. This too was taken into account through the development of "Choice Architecture of School Catering" scheme. This scheme maximised the environmental and behavioural cues for children to choose fruit and vegetables over high-fat and sugar-rich foods. The findings from the research project were reported to the Department of Health West Midlands and Wolverhampton Primary Care Trust in December 2011. Following the submission of the report, the Trust agreed to fund the Food Dudes programme for a further two years (until December 2013) enabling more children to participate, bringing the total number of children to 29,000 (Locally Healthy, 2012).

The research can therefore be argued to have demonstrated what is referred to by the Economic and Social Research Council (ESRC) as instrumental impact, i.e. influencing the development of policy, practice or service provision, shaping legislation, or altering behaviour. Food Dudes is a theoretically driven programme, yet commissioners need to ensure that funding and/or resources are directed to interventions that make a demonstrable contribution to society, regionally or nationally. The programme of research has enabled the development and improvement of the Food Dudes programme, and allowed commissioners and programme leads to make more informed decisions about further investment in the intervention at the end of the study period (2012). However, whilst the programme demonstrated reach, and short-term effectiveness in the school setting, adoption of the Food Dudes programme in Wolverhampton and beyond was halted in 2015 when Food Dudes Health went into liquidation. As a result, the programme ceased to be implemented in schools in England or Wales (BBC, 2017).

Academic Impact

Citation Indices and evidence of impact.

Table 7 provides the citation indices for each of the published outputs, number of reads on ResearchGate and downloads from the University of Worcester Research and Publications repository (WRaP). As may be expected, publications with the highest number of citations were typically those which were published earlier chronologically, e.g. outputs 1 and 3. Output 3 (Upton, Upton & Taylor) in particular has led to development of the Food Dudes programme since the work was completed, cited in work published by research teams in the USA (Jones, Madden & Wengreen, 2014; Jones, Madden, Wengreen, Aguilar & Desjardins, 2014; Wengreen, Madden, Aguilar, Smits & Jones, 2013) and Italy (Laureati et al., 2014; Presti et al., 2015). Similarly to the findings of our research (Upton, Taylor & Upton, 2013), Wengreen et al., (2013) only found short-term increases in fruit and vegetable consumption, i.e. in the period immediately following the intervention phase. At 3 month follow-up, fruit and vegetable consumption returned to baseline, thus demonstrating that the programme is unable to lead to long-term changes in children's consumption of fruit and vegetables. Hoffman, Franko, Thompson, Power and Stallings (2010) suggest that two shortcomings of multicomponent approaches such as Food Dudes are its labour and material costs, which may lead to poor intervention fidelity. For example, teachers and catering staff may not have the time to carry out aspects of the programme such as showing videos, managing the reward reinforcement or monitoring of children's consumption of fruit and vegetables (Upton, Taylor & Upton, 2012). This led to the development of an alternative version of the programme using principles of gamification to address these labour and material challenges (Jones, Madden & Wengreen, 2014; Jones, Madden,

Wengreen, Aquilar & Desjardins, 2014). Gamification use principles of videogame design to influence human behaviour change (Reeves & Reed, 2009), for example providing a narrative in which a character(s) complete quests, earn in-game currency and equipment to complete their quests. However, although increases in fruit and vegetable consumption were found after the intervention phase, long-term changes in children's eating behaviours were not reported in either study, suggesting the inability of the programme to promote sustainable behaviour change.

Morill, Madden, Wengreen, Fargo and Aguilar (2016) further developed the programme, and conducted a randomized controlled trial to investigate whether social rewards, e.g. praise were more effective than tangible rewards, e.g. traditional Food Dudes prizes such as drinks bottles, stationery etc for increasing short and long term fruit and vegetable consumption. Similarly to our studies (Upton, Upton & Taylor, 2013; Upton, Taylor & Upton, 2015), Morrill and colleagues found that increases in fruit and vegetable consumption evident following the Food Dudes programme decreased in the long term, highlighting the need for interventions such as Food Dudes to maintain and make habitual consumption of fruit and vegetables.

The weighed intake method reported in Outputs 3 and 5 was used in Presti et al's (2015) study which aimed to increase home provided fruits and vegetables in overweight, obese and normal weight children. Findings from the study were also consistent with those reported in outputs 3-5 in that changes in fruit and vegetable consumption were only apparent in the period following the intervention and not sustained in the long-term.

Output 4 (Upton, Taylor & Upton, 2015) was cited in Advances in Food and Nutrition Research (Evans, Albar, Vargas-Garcia & Xu, 2015), a book series which provides the latest advances in health and nutrition research. This study was included in a systematic review of school-based interventions to reduce obesity risk in children in high- and middle-income countries, specifically highlighting the disparity in fruit and vegetable intake for children bringing homemade lunches to school versus those who consume school prepare meals.

Table 7.

Citation indices and other sources of impact

Output		Citations[a] (n)	Reads on ResearchGate[b] (n)	WRaP downloads[c] (n)
1	Upton, D., Upton, P., & Taylor, C. (2012). Fruit and vegetable intake of primary school children: a study of school meals. *Journal of Human Nutrition and Dietetics, 25*(6), 557-562 DOI: 10.1111/j.1365-277X.2012.01270.x.	19	576	0
2	Taylor, C., Upton, P., & Upton, D. (2015). Increasing primary school children's fruit and vegetable consumption: a review of the Food Dudes programme. *Health Education. 115*(2), 178-196. DOI 10.1108/HE-02-2014-0005.	3	75	138
3	Upton, D., Upton, D, & Taylor, C. (2013). Increasing children's lunchtime consumption of fruit and vegetables: an evaluation of the Food Dudes programme. *Public Health Nutrition, 6*(6), 1066-1072. DOI:10.1017/S1368980012004612.	39	230	0
4	Upton, P., Taylor, C.E., & Upton, D. (2015). The effects of the Food Dudes programme on children's intake of unhealthy foods at lunchtime. *Perspectives in Public Health, 135*(3), 152-159. doi:10.1177/1757913914526163.	3	150	108
5	Taylor, C., Darby, H., Upton, P., & Upton, D. (2013). Can a school-based intervention increase children's fruit and vegetable consumption in the home setting? *Perspectives in Public Health, 133*(6), 330-336.	3	201	0
6	Upton, P., Taylor, C., & Upton, D. (2012). Exploring primary school teachers' experiences of implementing a healthy eating intervention. *Education and Health, 30*(2), 27-31.	0	51	0

[a] Citation count for each published output (source: Google Scholar, accessed 29/08/2017) [b] Article reads on ResearchGate (accessed 29/08/2017) [c] Downloads from Worcester Research and Publications (WRaP), University of Worcester repository (January 2011-August 2017)

Chapter 8
A critical reflection using the Researcher Development Framework on my development as a researcher

"The product that the PhD researcher creates is not the thesis – vital though that is to their subject area through the creation of original knowledge – no, the product of their study is the development of themselves." Sir Gareth Roberts

The Researcher Development Framework (RDF) is a professional development framework for planning, and supporting the personal, professional and career development of researchers, including postgraduate research students (Careers Research and Advisory Centre, 2010). The framework (see Figure 4) is organised into four domains: knowledge and intellectual abilities (Domain A), personal effectiveness (Domain B), research governance and organisation (Domain C), and engagement, influence and impact (Domain D) with 12 subdomains and 63 descriptors. The RDF is further divided into phases, 1-5 which indicate distinct stages or the level of progression within each descriptor. My development as a researcher has been shaped, not only through my PhD study but also through my employment as a Research Assistant (2009-2016) and my current post as a Researcher Development Officer at University of Worcester in addition to my active involvement with the Division of Academics, Researchers and Teachers in Psychology of the British Psychological Society. This chapter will provide a critical reflection on my development as a researcher, utilising the four domains, relevant subdomains and descriptors of the Researcher Development Framework. Further areas for development are also highlighted. Reference to the RDF subdomain, descriptor and phase are shown in parentheses.

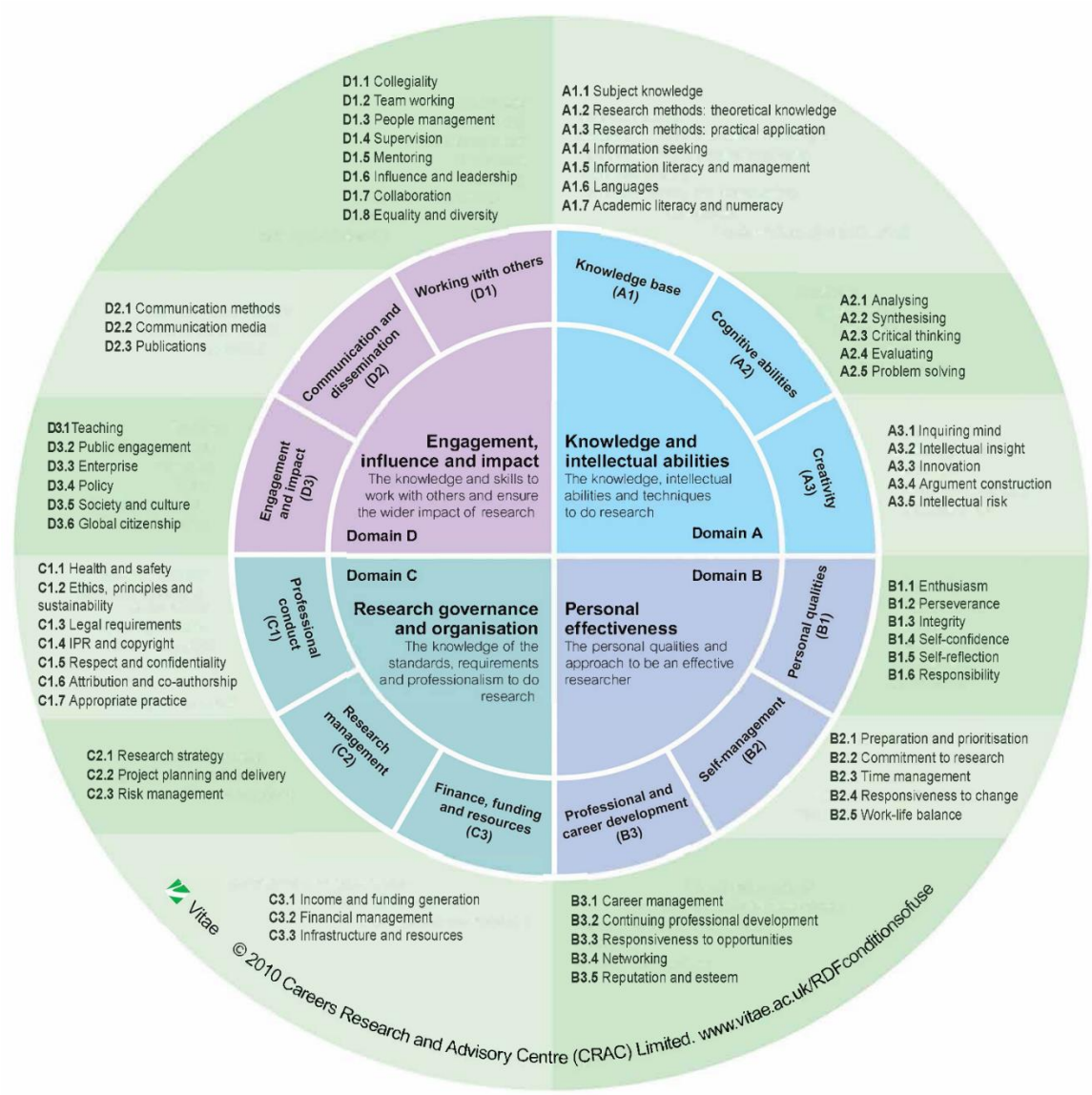

Figure 4. *Researcher Development Framework*

Domain A: Knowledge and Abilities

Domain A describes the knowledge and intellectual abilities required to carry out research and includes three subdomains: knowledge base (A1), cognitive abilities (A2) and creativity (A3).

A1. Knowledge base.

I have developed a detailed and thorough knowledge of my own and related subject areas throughout the course of my research degree, not only through independent study and use of print and online resources (A1.4), but also through attendance at discipline conferences, e.g. Division of Health Psychology annual conference and Midlands Health Psychology Network. Attending these events provided opportunities to meet with other researchers in my field, find out what others are working on and how this may inform my own work (A1.1, phases 2 and 3). I have an excellent knowledge of research methods, in terms of theory and application and am able to advise others in the selection and use of appropriate research design, data collection and analysis (A1.2 and 3, phase 3). For example, in my current post, I lead sessions on research approaches and research design, challenging students to consider how issues of epistemology and ontology are related to the selection and use of methods.

A2. Cognitive abilities.

I am able to critically analyse and evaluate research findings, see the connection between my own research and previous research in the area (synthesis) and develop independent and critical thinking, as demonstrated in earlier chapters of this thesis (A2.1 and 2, phase 1; A2.3, phase 2). In my role as a Researcher Development Officer, I am also now able to develop these skills in less experienced researchers, through delivery

of the research training module (RTP401), part of which aims to specifically develop students' analysis, synthesis skills and critical thinking skills (A2.1, phase 3).

A3. Creativity.

Whilst creativity falls under the domain of knowledge and skills, creativity is also reflected in domain D, specifically in communication and dissemination. Argument construction is recognised as a key component of creativity, particularly in developing a conceptual approach to understanding a topic (A3.2, phase 2) and producing a convincing argument to defend a research thesis, as evidenced in chapters 3 and 4 (A3.4, phase 2). A further element of creativity in the work is evidenced in the use of the photographic diet method to measure food consumption for children who brought in lunch from home. At the time of publication, this method had only been used to measure consumption in a cafeteria setting, (see Swanson, 2008) and so represented a novel and creative way to assess consumption for children eating packed lunches.

Domain B: Personal Effectiveness

Domain B focuses on developing personal effectiveness, including the subdomains: personal qualities (B1), self-management (B2) and professional and career development (B3).

B1. Personal qualities.

As a part-time research student in full-time employment, my personal qualities and self-management strategies have been strongly tested. Perseverance is necessary for any student to complete a research degree, but perhaps is of greater significance for those studying part-time with employment demands. I am able to use these experiences to advise and mentor students, who I now support in my role as a Researcher Development

Officer, in developing strategies for self-discipline and motivation, particularly in the face of obstacles (B1.2, phases 2 and 3). I am confident in my own abilities, but recognise the boundaries and limits in my own skills and expertise (B1.4, phase 1). I value the need for collegiality and the support of others and actively seek opportunities to build support structures (B1.4, phase 3). For example, my involvement in the Psychology Postgraduate Affairs Group (PsyPAG) has provided an important infrastructure throughout my PhD study. I am able to reflect on my own performance and actively seek feedback on my development from senior colleagues. For example, I am part of the Vitae mentor pilot scheme which enables researcher developers, like myself, to identify areas for further development, in their own career and in supporting others (B1.5, phase 3). This will enable me to better support the students I work with and enhance researcher development provision at University of Worcester. One aspect of my work which I wish to develop further is the support for well-being of our research degree students. As a researcher development officer, I feel it is my duty to support students in achieving positive well-being and I am working with senior colleagues in developing mechanisms to embed well-being into our researcher development programme (B1.6, phase 3).

B2. Self-management.

I have demonstrated my commitment to research, not only through the completion of my research degree, but also in disseminating my research widely and establishing a good track record of publications for my early career stage (B2.2, phase 2). Establishing and maintaining work-life balance is an area in which I have grappled with throughout my research degree, and one which I need to develop further. I am highly sensitive to signs of stress and burnout in my colleagues, yet whilst I am aware of and able to advise

others of ways in which to manage pressure and enhance wellbeing, I do not always apply these principles to my own work-life balance needs (B2.5, phase 2). This is an area of development which I have highlighted to my Vitae mentor, and will continue to work on following the completion of my research degree.

B3. Professional and personal development.

I actively seek professional and career development opportunities and have embedded these in my work, and my PhD study. I have been actively involved with PsyPAG throughout my research degree, serving as a committee member and representative for the Division of Academics and Teachers in Psychology (DARTP) of the British Psychological Society (BPS) from 2013-2017. Involvement in these networks has enabled me to build relationships, not only with other postgraduate researchers but with senior academic and researchers who have provided opportunities for me to actively develop as an academic. For example, I facilitated a session on transitions in psychology education at the DARTP annual CPD event in 2014 and contributed to a Higher Education (HEA) research project on issues relating to the teaching of psychology (B3.1, phases 2 and 3). My involvement with PsyPAG has provided a vital support network, but has also developed my employability in what can be a challenging academic job market, e.g. experience of reviewing conference submissions, bursary applications and the creation of the postgraduate teaching award which I set up in collaboration with two of my PsyPAG colleagues. I intend to use these networks to enhance the employability of the students I work with in my current post by encouraging them to become involved with PsyPAG and the opportunities which being involved with this network creates (B3.1, phase 3 and B3.4, phase 3). I am committed to continuing professional development and

have maintained a portfolio of achievements and experiences throughout my postgraduate study, documented in an Excel spreadsheet, mapped directly onto the four domains of the RDF (B2.2, phase 2). I have a realistic view of my own potential in seeking future employment opportunities and have taken steps to address development needs, e.g. I am currently studying for the Postgraduate Certificate in learning and Teaching in Higher Education which will confer Fellowship of the Higher Education Academy – a necessary requirement for most academic positons (B2.2, phase 3).

Domain C: Research, Governance and Organisation

Domain C describes the knowledge of standards requirements and professional conduct that is required to effectively management research, including the subdomains: professional conduct (C1), research management (C2) and finance, funding and resources (C3).

C1. Professional Conduct.

I have a basic understanding of Intellectual Property Rights (IPR) and copyright (C1.4, phase 1) but not sufficient knowledge to be able to advise peers or less experienced researchers (C1.4, phase 2). However, I have a good understanding of open access publishing and depositing research outputs, e.g. in the institutional research repository WRaP and have assisted colleagues in understanding and depositing their research in line with recognised copyright and self-archiving guidelines, e.g. SHERPA Romeo (C1.4, phase 2). I value academic and personal integrity and have advised postgraduate research students on appropriate attribution in dissemination activities, e.g. conference presentation and journal articles (C1.6, phase 3). I have an excellent knowledge of codes of conduct in relation to attribution and co-authorship; however my knowledge of

regulations on academic malpractice, i.e. those of my institution and my professional body (The British Psychological Society) is not sufficient to advise peers and less experienced researchers (C1.7, phase 2) and is an in which I need to develop greater awareness.

C2. Research Management.

I am able to independently define and manage a research project (C2.2, phase 2). My contributions to the programme of research discussed in this critical overview document were extensive. My specific contributions to the research are outlined below:

- Developing and writing of the literature review which formed the project proposal;
- Design of the study
    - Methods of measuring fruit and vegetable consumption at school and at home;
    - Qualitative component to explore perceptions of teachers and children
- Identification of project risks (included in the project proposal)
- Creating the project timeline (1 year longitudinal study)
- Planning and design of each study
- Development of data collection materials:
    - Design of the digital photography method for measuring food consumption for children with home-prepared lunches
    - Spreadsheet to record food consumption at school
    - Developed the food diary to measure food intake at home
    - Development of the interview schedules
- Training of masters students who assisted with data collection;
- Project management tasks:
    - Organised data collection at each phase of the study (baseline, 3 month follow-up, 12 month follow-up)
- Developed and implemented the dissemination strategy, including the writing strategy
- Collected, cleaned and analysed the data (all publications)
- Proposed data analysis methods
- Drafted, revised and submitted each of the included outputs
- Other dissemination activities: writing each of the interim project reports, drafting the final project report to the Department of Health West Midlands, school newsletters, planning and conducting assemblies and writing of conference presentations.
- Drafted the impact case study which was submitted to the Research Excellence Framework (REF) exercise in 2014.

C3. Finance, funding and resources.

I have an understanding of the processes involved in research funding bids, and have written research proposals and co-written research proposals to gain funding, i.e. the Food Dudes evaluation proposal for the Department of Health West Midlands (C3.1, phases 1 and 2). Whilst I recognise the significance of income and funding generation for my institution (C3.1, phase 2), I have limited experience in applying for small grants or other funding opportunities. This is an area which I would like to develop following the completion of my research degree.

Domain D: Engagement, Influence and Impact

Domain D reflects the knowledge, understanding and skills needed to engage with and evidence academic, social, cultural and/or economic impact including three subdomains: working with others (D1), communication and dissemination (D2) and engagement and impact (D3), with corresponding descriptors (See Figure 4).

D1. Working with others.

I value collegiality and team working and actively seek opportunities to work collaboratively. For example, I am actively involved with the British Psychological Society, and have served as the secretary of the West Midlands Branch between 2011-2013 and currently sit on the Division of Academics, Researchers and Teachers in Psychology (DARTP) committee as the PsyPAG (Postgraduate Affairs Group) representative. I am also part of a collaborative research project with Worcestershire Acute Trust (D1.7, phase 2). In the next phase of my career, I would like to develop skills around supervision of undergraduate students and possibly of postgraduate students, either in a formal capacity as a supervisor or informally, e.g. encouraging less

experienced researchers to present their research at conferences and publish papers (D1. 4 and 5, phase 2).

D2. Communication and dissemination and D3. Engagement and impact.

I am an eloquent presenter, and have often received positive feedback on my ability to present my work with confidence, at conferences and in my teaching practice (D2.1, phase 2). I can communicate my research effectively to a diverse and non-specialist audience. For example, I won a public choice award for my entry to the Inaugural Images of Research competition in 2015 (see Figure 5). The competition seeks to challenge researchers to articulate the core ideas of their research in a single image, in a way which is visually appealing and creative and accompanying text accessible to a non-specialist audience (D2.1, phase 2; also, D3.2, D3.5, and A3.3, phase 2). My entry was a visual representation of the key findings from output 4 (Upton, Taylor & Upton, 2015) and is shown in Figure 5.

Figure 5. Images of Research 2015 Do healthy eating programmes really persuade children to swap sweet snacks for fresh fruit?

"Increases in childhood obesity and poor fruit and vegetable (FV) consumption have paved the way for school-based interventions to change children's dietary habits. However, do these interventions really encourage children to swap sugary snacks for FV? A study of 2,433 5-11 years olds found that children who took part in a healthy eating intervention did eat more FV, however they were still eating calorific foods. Sugary snacks were not replaced by healthy alternatives; children were simply eating more. If school-based interventions are to contribute to reducing calorific intake, targeting FV consumption alone is not sufficient to change children's eating habits."

I am proficient with a variety of communication media, skills which I have developed throughout the course of my PhD study, and particularly in my role as a Researcher Development Officer. I have a web presence as a researcher (D2.2, phase 1) including profiles on ResearchGate and Twitter which I use to share publications, current projects and potentially build collaborations. Engaging in Twitter chats, e.g. #PhDchat on Twitter has provided a useful platform to network with other postgraduate research students,

share experiences of PhD study and offer advice and guidance (D2.2, phase 2). I can confidently use e-resources and lead virtual learning environments (D2.2, phase 3). For example, I have developed a Blackboard site for University of Worcester postgraduate research students to support their learning as they progress through their postgraduate study. I am keen to develop my knowledge of media usage, e.g. I have recently attended a workshop focused on the implementation of Blackboard Collaborate, a virtual classroom facility contained within our Blackboard Learn package (D2.2, phase 2). Technology enhanced learning is a fundamental part of the University learning and teaching strategy (University of Worcester, 2015), and is an area in which I would like to further develop my skills. I am currently developing an online resource for research degree supervisors, to supplement our current supervisor training programme.

I am a skilled researcher with a good track record of publications for my career stage, publishing 18 articles in peer-reviewed and professional journals, in addition to presentations at national conferences (D2.3, phase 2). I have co-authored a number of texts aimed at undergraduate psychology students, including a revision series published by Learning Matters (Upton & Upton, 2011) which included the development of multiple choice questions, essay questions, concept maps for each chapter and essay writing guidance. I have also co-authored a chapter on the teaching of psychology in higher education (Upton & Taylor, 2012), an Educational Psychology revision guide (Upton & Taylor, 2014) and, most recently, co-authored a chapter on the history of psychology as part of the new undergraduate introductory textbook published by the British Psychological Society and Wiley-Blackwell in late 2017 (Upton, Taylor, Penn & Andrews, in press) (D2.3, phase 2). In my role as a Researcher Development Officer, I support and

enable less experienced researchers to publish through delivering a series of workshops focusing on planning for publication (D2.3, phase 3). I am also a peer reviewer for the Journal of Health Psychology and have reviewed submissions to the Psychology Teaching Review (D2.3, phase 3).

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Appendices

Appendix A. Description of the Food Dudes intervention

The three phases of the Food Dudes programme are outlined below. (Taken from http://www.thensmc.com/sites/default/files/Food%20Dudes%20FULL%20case%20study.pdf)

Preparation
Children's consumption of fruit and vegetables is measured before the Food Dudes programme is introduced. This baseline measurement lasts one to four days.

Phase One (16 days)
Children are introduced to the Food Dudes who, via a series of materials and rewards, encourage them to eat fruit and vegetables. Each day, children are read a letter and/or watch a specially designed DVD episode, lasting six minutes, starring the Food Dudes, who act as influential role models for children to imitate. This introduction provides opportunities for children to sample fruit and vegetables, and in the process, develop a liking for them. Phase One procedures can either take place during snack time or lunchtime at school.

DVD: The Food Dudes are young superheroes involved in saving the Life Force from the Junk Punks, who plot to take away the energy of the world by depriving it of fruit and vegetables. By watching the Dudes defy the Punks in a series of DVD adventures, and seeing them eating and enjoying a range of fruit and vegetables while extolling their health-giving properties and taste, children associate these eating choices with the Dudes' winning strategy.

Letters/emails: Teachers read out a series of short Food Dude letters/emails to their class. The letters/emails are a key means of communication between the Food Dudes and the children, providing important information about prizes and the benefits of eating a healthy diet, as well as giving encouragement and praise for the children's eating efforts

Rewards: Children are given small rewards (like juggling balls, pencils, stickers, and pedometers) if they succeed in eating the piece of fruit or vegetable they are given.

This gives them an incentive to follow the Food Dudes' healthy eating advice and ensures they get enough repeated tastes of the foods to begin liking them for their own intrinsic qualities

Home pack: Children are provided with a Food Dudes Home Pack to encourage them to eat more fruit and vegetables at home through involving parents and a system of self-monitoring

Phase Two (up to one year)

Phase Two is the 'maintenance' phase of the programme, in which the school supports the children's increased consumption of fruit and vegetables. Classroom wall charts are used to record consumption levels of these foods, and as the children achieve more advanced goals they earn further rewards and Food Dudes certificates. The aim is for the school to move towards a self-sustaining system of rewarding fruit and vegetable consumption to ensure a culture of healthy eating is maintained over time.

Phase Three (ongoing)

By this phase, the aim is that schools will have developed their own systems of supporting healthy eating alongside the Food Dudes programme, 'Keeping the Force Alive'. It is also important to involve the new intake of children each year, through the 'Next Generation' Food Dudes programme to introduce them to the Food Dudes and the healthy eating culture of the school.

Appendix B. Food Diary

What Kids Eat study

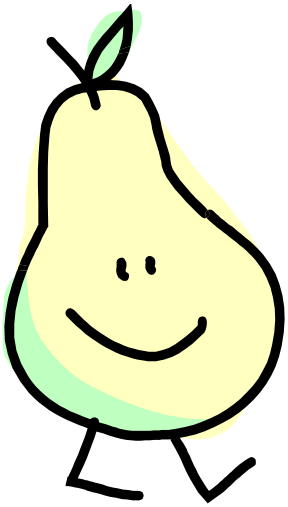
This food diary belongs to:

School:

Class:

What Kids Eat study, University of Worcester, Henwick Grove, Worcester, WR2 6AJ
whatkidseat@worc.ac.uk

How to complete your food diary…



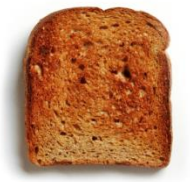
- We would like you to write down everything that your child eats and drinks for this week.
- Try and tell us as much as you can.
- Please remember to take a picture of each meal.
- If your child has a packed lunch at school, please write down what is in their lunchbox too.
- Please send back your food diary and camera in the envelope in your pack.

1. **How much did you eat? E.g. Bowl of cereal, slice of toast etc.**

Tablespoon

Bowl

Plate



Slice of bread/toast

2. **Was the food homemade or readymade?**

3. **How was it cooked?** E.g. was it fried, boiled, steamed, baked, roasted or raw?

4. **Who made the food?** E.g. Asda, Kellogg's, Cadbury

ASDA Kellogg's® Cadbury

5. Was it meat, fish or vegetarian?
What type of fish or meat was it? i.e. salmon fillet, lamb chop? Was the meat battered/bread crumbed/served with sauce?

Meat

Fish

Vegetarian

6. Did they have...?

Pasta

Rice

Bread

Was it wholegrain, brown or white?

7. Did they put anything on their food? E.g. Was milk added to tea or was there ketchup/salt/vinegar added?

8. How much drink was served?

Can of pop

Bottle

Cup

Small glass

Large glass

Here is an example of how to fill out your food diary:

Date: Day __/__/2010	
At...	**What did you eat and drink?**
...breakfast, I ate...	*1 small glass orange juice* *1 bowl Kellogg's cornflakes* *2 pieces toast (white bread, Hovis) with margarine and strawberry jam (1 teaspoon)*
...lunchtime, I ate...	*School dinner*
...dinner, I ate...	*1 medium serving Shepherd's pie, boiled potatoes (1 tablespoon), small serving carrots and green beans.* *1 large banana*
Did you have any snacks?	*1 can Pepsi* *1 packet Walkers Ready-salted crisps* *1 small Kitkat chocolate bar*

Please turn over to begin filling in the 7 day food diary.

Thank you.

Date: Monday __/__/2010	
At...	**What did you eat and drink?**
...breakfast, I ate...	
...lunchtime, I ate...	
...dinner, I ate...	
Did you have any snacks?	

Date: Tuesday __/__/2010	
At...	**What did you eat and drink?**
...breakfast, I ate...	
...lunchtime, I ate...	
...dinner, I ate...	
Did you have any snacks?	

Date: Wednesday __/__/2010	
At...	**What did you eat and drink?**
...breakfast, I ate...	
...lunchtime, I ate...	
...dinner, I ate...	
Did you have any snacks?	

Date: Thursday __/__/2010	
At...	**What did you eat and drink?**
...breakfast, I ate...	
...lunchtime, I ate...	
...dinner, I ate...	
Did you have any snacks?	

Date: Friday __/__/2010	
At...	**What did you eat and drink?**
...breakfast, I ate...	
...lunchtime, I ate...	
...dinner, I ate...	
Did you have any snacks?	

Date: Saturday __/__/2010	
At...	**What did you eat and drink?**
...breakfast, I ate...	
...lunchtime, I ate...	
...dinner, I ate...	
Did you have any snacks?	

Date: Sunday __/__/2010	
At...	**What did you eat and drink?**
...breakfast, I ate...	
...lunchtime, I ate...	
...dinner, I ate...	
Did you have any snacks?	

Please remember to take me with you to school tomorrow.
Don't forget your cameras too!

Appendix C. Pictorial instructions

How to use your Photo Diary

Thank you for your help with the 'What Kids Eat' Project. Below are some things that you will need to think about before completing your photo diary.

- One photo should be taken of your child's **breakfast, lunch and dinner** (meal and any drinks) **before** they eat.
- One photo should also be taken **after** they have finished eating.

This should be done for 7 days from Monday-Sunday.

Taking each photo:

1. Make sure you are in a well-lit room. Place your child's place mat on a table that is waist/thigh height (i.e. not a low coffee table).
2. Place your plate on top of the place mat with the number clearly showing (see Picture A)
3. Place any drinks etc next to the plate.

PICTURE A

4. Stand next to the table, directly above the plate. Take one small step back. Now hold the camera to your eye. The camera should be roughly an arm's distance away from the plate (See Picture B)

PICTURE B

5. Make sure the wheel on the camera is fully wound on and won't turn any further.

6. Press and hold the flash button on the camera until the red light glows.

7. Look through the camera viewfinder and check that the whole plate, drink and ID number can be seen.

8. Press the shutter button to take the photo.

Please remember:

- Not to wind on the camera wheel until you are ready to take another photo.
- Take a photo with your child's ID number showing.
- Only use the camera to take a photo of your child's food for the food diary.

Thank you for your help!

Appendix D. Structured interview schedule

The purpose of this interview is to talk about your experiences of the Food Dudes healthy eating intervention which has recently taken place in your school. I would like to know what you feel worked well, aspects of the intervention that may not have worked quite as well and how the intervention has impacted upon the children in your school. The discussion will be recorded however; anything that you say will not be identifiable and will remain confidential.

1. So, first of all, what did you know about the Food Dudes programme before the intervention?
   Prompt: Aims, purpose etc.

2. How did the children feel about eating fruit and vegetables before Food Dudes?

3. Why did you decide to take part in the Food Dudes programme?
   Prompt: Were you asked to take part or did you volunteer?

4. What do you think has worked well so far?
   Prompt: Why?

5. What aspects of the intervention (if any) have not worked as well?
   Prompt: What has been particularly challenging?

6. How have the children responded to the Food Dudes intervention?
   Prompt: What have they enjoyed? What haven't they enjoyed? What have they learnt? How has the program changed how they feel about healthy eating?

7. *How have the teaching staff responded to the Food Dudes intervention?*
   Prompt: How easy/difficult has it been to implement the programme in addition to their teaching responsibilities? How effective was the support given by the Food Dudes Co-ordinator?

8. What about the lunchtime staff?
   Prompt: How has this impacted upon their usual lunchtime duties?

9. How have you been able to link the Food Dudes programme to the curriculum?

10. What impact has the intervention had on the 'culture' of your school in terms of healthy eating?
    Prompt: Is healthy eating supported more? If so, in what way?

11. So far, how have you maintained children's interest in eating fruit and vegetables after the Food Dudes intervention?
    Prompt: In what way(s) have eating fruit and vegetables been encouraged?

12. How easy do you think it will be to maintain children's interest in eating fruit and vegetables in the long term?
    Prompt: What steps will you take as a school to keep children interested in healthy eating?

13. If given the opportunity, would you take part in the Food Dudes programme again?
    Prompt: Why or why not?

14. Would you recommend the Food Dudes programme to other Primary Schools?
    Prompt: If not, why not?

Appendix E. REF 2014 Impact Case Study

Impact case study (REF3b)

REF2014 Research Excellence Framework

Institution: University of Worcester

Unit of Assessment: 4 Psychology, Psychiatry and Neuroscience

Title of case study: Enhancing the evidence base for child health interventions

1. Summary of the impact

Childhood obesity is an increasing problem in the UK with roughly one in seven school aged children in Scotland and England being classified as obese. The picture is similar in Wales where the prevalence is one in eight. The direct cost of obesity to the NHS is estimated to be £4.2bn a year, with this set to rise if the causes of childhood obesity are not addressed. The contribution of the research described below to tackling this issue is manifold: it has enabled the development and improvement of child health interventions/programmes; it has allowed commissioners and programme leads to make more informed decisions about investment in these interventions/programmes; and it has contributed to the development of regional healthy weight strategies and national guidelines on weight management.

2. Underpinning research

The research has been an on-going series of studies since 2005 led by Professor Dominic Upton (2005-present) and Dr Penney Upton (2007-present), with colleagues from the Psychological Sciences (PS) Unit and the wider University (e.g. Dr Victoria Mason (2007-2012), Haydn Jarrett (2001-present), Professor Derek Peters (2001-present), Charlotte Taylor (2009-present), Justine Bold (2008-present) and Dr Rosie Erol (2010-present)). On the basis of previous health psychology outputs and successfully completed evaluations, the research team was commissioned to undertake two research studies.

Regional evaluation of weight-management programmes for children and families

Family based weight-management programmes (commissioned by Primary Care Trusts (PCTs) through NHS or Department of Health West Midlands (DOHWM)) have been developed in response to the increasing prevalence of childhood obesity in the region. These programmes, however, have not been systematically evaluated resulting in a lack of robust evidence regarding their effectiveness. A study conducted from March-December 2009, examined the benefits on health and behaviour change to children and families involved in 7 distinct weight-management programmes (**Reference 1**). This evaluation, commissioned by DOHWM (**Grant a**), represented the first application of the National Obesity Observatory (NOO) Standard Evaluation Framework (SEF) for weight-management programmes at a regional level. The study involved using the SEF to audit the data collected by each programme, a review of programme materials, including the theoretical rationale and evidence base for each programme, an assessment of physical and psychosocial benefits to participants and an economic evaluation of the programmes. The findings identified that on-going evaluation of all programmes, using a standard approach and validated measures was essential in order to improve the evidence base and support future commissioning. Providers were recommended to use the SEF to inform what outcomes are measured (e.g. measures of adiposity, dietary intake and physical activity) and how this data is collected and stored.

Evaluation of the Food Dudes programme

While previous evidence suggested that the Food Dudes programme – a healthy eating intervention – was effective in increasing children's fruit and vegetable consumption in the short term, evidence for the long-term effectiveness of the programme was limited. The team undertook commissioned research (**Grant b**) to evaluate the programme as it was rolled out across schools in Wolverhampton (**Reference 2**). This study was the first independent evaluation of the programme to assess the long-term impact on children's fruit and vegetable consumption at school and at home, in addition to changes in unhealthy snack consumption. The evaluation involved measuring food intake at home and school in 7 intervention and 8 control schools before the programme started, then at three months and 12 months post intervention (**Reference 3**). A combination of weighed intake, visual estimation and photographic food diaries were used. Children's knowledge and attitudes towards healthy eating, family eating habits and the experiences of school staff were also assessed (**Reference 4**). The results from this evaluation were used to inform further rollout of

the intervention in the area. The results demonstrated that the programme was somewhat effective in the short-term; however, long-term increases in children's consumption of fruit and vegetables at lunchtime were equivocal suggesting further development of the programme to sustain behaviour change.

3. References to the research

1. Upton, P., Taylor, C. E., Peters, D. M., Erol, R. and Upton, D. (2013). The effectiveness of local child weight management programmes: an audit study. *Child: Care, Health and Development*, 39(1), 125-133. DOI: 10.1111/j.1365-2214.2012.01378.x.
2. Upton, D., Upton, P, & Taylor, C. (2012). Increasing children's lunchtime consumption of fruit and vegetables: an evaluation of the Food Dudes programme. *Public Health Nutrition*, 6(6), 1066-1072. DOI: 10.1017/S1368980012004612.
3. Upton, D., Upton, P., & Taylor, C. (2012). Fruit and vegetable intake of primary school children: a study of school meals. *Journal of Human Nutrition and Dietetics*, 25(6), 557-562. DOI: 10.1111/j.1365-277X.2012.01270.x.
4. Taylor, C.E., Darby, H., Upton, P. & Upton, D. (2013). Can a school-based intervention increase children's fruit and vegetable consumption in the home setting? *Perspectives in Public Health*, 133(6), 330-336. DOI: 10.1177/1757913913506575.

Grants

a. Upton, D. (PI), Regional Evaluation of Weight Management Programmes for Children and Families, Department of Health West Midlands, 2009-10, £79, 835.

b. Upton, P. (PI), Evaluation of the Food Dudes Programme, Department of Health West Midlands, 2010-11, £162,086.

The University is confident that the underpinning research meets the 2* quality threshold. All outputs are based upon funded research where the funding was won through competitive tender. All these references are returned to UoA4 in REF2014 as: "UptonP4", "UptonD1", "UptonP1" and "UptonD4" respectively.

4. Details of the impact

Findings from the research into child weight management programmes were reported to the Department of Health West Midlands (DOHWM) in January 2010. In addition, a set of recommendations for commissioners of weight management programmes and a toolkit of validated measures for use by programme leads were also produced (**Source A**). The research was disseminated through publications which have been made available through various *Public Health England* websites (**Source B**). In February 2010, the research team presented the findings from the research at a workshop held by the DOHWM which was attended by weight management programme leads, commissioners, health improvement specialists and others involved in developing, running and evaluating public health interventions from across the region including: Birmingham, Coventry, Dudley, Sandwell, Shropshire, Solihull, Staffordshire, Stoke, Telford and Wrekin, Walsall, Wolverhampton and Worcestershire. Recommendations were discussed and shared with localities to enable them to improve their practice. A follow up survey to assess the impact of the research (**Source C**)was conducted in July 2010 as part of a workshop on the SEF which found that the research:

- Enabled Primary Care Trusts (PCTs) to improve measurement, data collection and evaluation;
- Reassured PCTs that they were commissioning effective programmes;
- Led to PCTs adopting the SEF to evaluate child weight measurement programmes when making future commissioning decisions.

Furthermore:

- One PCT specified that the SEF and the University of Worcester's evaluation tools and findings *must* be used by service providers. The same PCT also used the evaluation and tools for their revised National Child Measurement Programme service;

- One PCT decided to pilot their own in-house child weight management programme, incorporating best practice (including longer-term follow-up and measurements) identified through the evaluation and using the SEF evaluation tool;
- One PCT decided not to continue funding their current programme which had been evaluated as part of this work.
- All West Midlands' PCTs accepted the recommendation that they should continue to invest in child weight management programmes and that they should use the SEF.

The research thus enabled an improvement in these programmes across West Midlands PCTs. In addition, however, the research has informed regional health weight strategies (**Sources D & E**); it has featured in NICE reviews and guidelines (**Source F**) and informed the work of the London Assembly's Health and Public Services Committee on childhood obesity (**Source G**).

Findings from the Food Dudes Project were reported to DOHWM and Wolverhampton PCT in December 2011. Following submission of the report, the PCT agreed to fund the programme for a further two years (until December 2013) enabling a further 9,000 children to participate, bringing the total number of children to 29,000 (**Source H**).

In January 2012, Wolverhampton PCT convened a workshop to discuss recommendations of the report and to consider ways of taking the programme forward in Wolverhampton and neighbouring areas of the West Midlands. Workshop participants included the Food Dudes programme developers, local project coordinators, staff from schools, head teachers, representatives from agricultural groups and public health managers. A key recommendation of the research was the need for on-going development of the programme to ensure its short and long-term effectiveness. In response, the Food Dudes Programme now includes a second key phase called "Food Dudes Forever". This phase is designed to maintain improvements in fruit and vegetable consumption established in the initial phase of the Programme and will run each year in participating Primary Schools (**Source I**). The report further recommended that environmental factors should reinforce the intervention's healthy eating messages. This too has been taken into account through the development of "Choice Architecture of School Catering" scheme (**Source J**). This scheme maximises the environmental and behavioural cues for children to choose fruit and vegetables over high-fat and sugar-rich foods.

5. Sources to corroborate the impact

A. Toolkit: http://www.foodwm.org.uk/resources/CWM_-_Revised_toolkit_final_20_04_2010.pdf

B. Dissemination of research through open access websites:

- Public Health England Obesity Knowledge Update: https://www.noo.org.uk/NOO_pub/KU/9613
- Public Health England Child and Maternal Health Intelligence Network: http://www.chimat.org.uk/resource/item.aspx?RID=126687 (Downloaded 78 times as of 20/10/2013)

C. Saunders, K., Baker, J., & Davis, J. (2011). *Department of Health The Healthy Weight Programme in the West Midlands Legacy Document*. Department of Health: www.obesitywm.org.uk/resources/Report_24_V6_(Legacy)_2.doc

D. NHS Coventry: Coventry Healthy Weight Strategy 2010 to 2015.

E. NHS Dudley Public Health (2012). Tackling Obesity – A Health Needs Assessment for Dudley

F. NICE (2013) Managing overweight and obesity among children and young people: lifestyle weight management services Review 1: Effectiveness and cost effectiveness of lifestyle weight management services for children and young people: http://guidance.nice.org.uk/PH47/SupportingEvidence

G. GLA Intelligence Unit (2011) Obesity in London: http://www.london.gov.uk/sites/default/files/glae-childhood-obesity.pdf

H. News story announcing continuation of the Food Dudes Programme:

http://www.nhslocal.nhs.uk/story/food-dudes-continue-wolverhampton-further-two-years

I. Food Dudes Forever: http://www.fooddudes.co.uk/food-dudes-forever.aspx

J. Choice Architecture of School Catering: http://www.fooddudes.co.uk/school-catering.aspx