Health Education Research: theory and practice

Title

Food sustainability education as a route to healthier eating:

evaluation of a multi-component school programme in English primary schools

Authors

Jones, M[1]; Dailami, N[2]; Weitkamp, E[3]; Salmon, D[4]; Kimberlee, R[1]; Morley, A[5]; Orme, J[1]

1. Department of Health and Applied Social Studies, Faculty of Health and Life Sciences, University of the West of England, Bristol, BS16 1DD, UK

2. Faculty of Engineering, Design and Mathematics, University of the West of England, Bristol, BS16 1QY, UK

3. Department of Applied Sciences, Faculty of Health and Life Sciences, University of the West of England, Bristol, BS16 1QY, UK

4. Department of Nursing and Midwifery, Faculty of Health and Life Sciences, University of the West of England, Bristol, BS16 1DD, UK

5. Centre for Business Relationships, Accountability, Sustainability and Society, Cardiff University, Cardiff, CF10 3AT, UK

Correspondence to: M. Jones. Email: matthew.jones@uwe.ac.uk

Abstract

Promising approaches to the promotion of healthier eating amongst children in primary school settings include the opportunity to practise practical cooking and growing, promoting the take up of healthier school meals and nutritional education. However less is known about the potential for strategies that integrate approaches through a focus on food sustainability issues – such as the promotion of awareness about local, seasonal, organic, fair trade and higher animal welfare foods. This paper presents an evaluation of the Food for Life Partnership, a multi-component programme that sought to address both the health and sustainability aspects of food. The study consisted of a two stage cross sectional survey of Year 5 and 6 students (ages 9-11) in 30 primary schools at enrolment and after 18-24 months, combined with an analysis of programme delivery. Higher self reported fruit and vegetable consumption in the second stage survey was associated with a range of indicators of school participation in the programme. These included the reform of school meal procurement and preparation; experiential food growing, cooking and farm-based education; and improved opportunities for stakeholder engagement. The study therefore develops a case for multi-level programmes that incorporate sustainability issues alongside experiential food education in primary school settings.

Keywords

Primary schools, Food, Environment, Sustainability

Introduction

Over the last ten years, there has been increasing concern over the health of English children particularly in relation to rising obesity rates. This is partly explained in relation to poor diets [1-3]: research suggests that significant numbers of children consume sugar, salt and saturated fat that are far in excess of recommended amounts, while at the same time failing to consume the recommended amounts of fresh fruit and vegetables [4].

With most children attending school daily, schools are in a unique position to influence and promote healthy eating amongst this age group. Research in school settings indicates that practical food education is a promising strategy for promoting children's interest in healthier eating. Development of cooking skills has been shown to promote healthier eating and encourage children to try new foods [5]; studies report that children involved in growing food for consumption are more positive about eating fruits and vegetables and tend to have higher fruit and vegetable consumption – although the actual reported shifts in intake are uncertain [6-12]. Similarly, studies suggest that children in schools with strong farm links eat more fruit and vegetables [13, 14].

Furthermore, a growing body of evidence has emerged on the significance of food in school and, in particular, the benefits of healthier school meals. Following the introduction of new standards in England, school lunches have been found to be more likely to contain all five healthy food groups (starch, protein, vegetables, fruit and dairy) in comparison to packed lunch alternatives [15,16]. More generally, longitudinal tracking studies suggest that sensible eating habits formed at school are considered to have lasting significance into later life [17, 18]. School meals can be seen to have a

wider role when understood as an additional lesson in the day. As part of a whole school approach, the lunchtime can reinforce messages on the importance of a healthy, varied diet and a willingness to try to new foods.

Participant involvement is widely accepted as an important element of successful school based health promotion programmes. Research reviews therefore highlight the need for programmes to create situations for children to have ownership over their food choices [19] and for parents to have a role in the implementation and adoption of programme messages [20].

Reviews of school-based interventions [20, 21] suggest that multifaceted approaches are likely to be most effective on diet and nutrition, combining reforms to the curriculum, school food provision and engagement of stakeholders. Van Cauwenberghe et al.'s review found strong evidence of the positive impact of multi-component programmes with children aged 6-12 years old. More specifically, De Sa and Lock's review of 30 studies found that 22 reported a significant positive intervention effect on fruit and vegetable intake at follow up. Differences in intervention effect ranged from +0.14 servings to +0.99 servings per day.

Although parts of the evidence base are coming together, there has been little research on school programmes that frame food as a matter of social and environmental sustainability – as opposed to personal nutritional health - and their role in health education. Ecological, ethical and welfare aspects of food have increasingly come to the foreground as a part of a global debate about food security and the environmental impacts of an industrialised food system.

Climate change, biodiversity, animal welfare, local economic development, social justice and cultural regeneration aspects of food are topics that may create alternative routes for health education messages. Furthermore food sustainability, as an overarching theme, may offer the opportunity to re-energise multi-component health programmes in schools as a conceptually coherent set of

practices. This study sought to examine the associations between the promotion of sustainable food issues in primary schools and student self reported fruit and vegetable consumption and a range of associated student behaviours.

Method

Programme characteristics

The Food for Life Partnership (FFLP) is an England-wide programme delivered by a partnership of four charities. The initiative evolved out of a concern that obesity and the climate change impact of food cannot be addressed unless "individuals and communities are reconnected to how their food is produced, and regain the skills and knowledge needed to take active control over what they eat" [22]. As a simple membership scheme, all schools in England can enrol with the programme. The focus of this study was on FFLP 'flagship' schools: these were selected by the programme to receive the enhanced level of staff and small grant support outlined in Figure 1. This support was delivered over approximately 18 months. Flagship schools had been selected from a pool of applications in response to regional and national advertisement. Successful enrolment on to FFLP was based upon programme officers' assessment of a school's commitment and capacity for change as articulated in the head teacher's application and through site visit.

Figure 1. The Food for Life Partnership Programme for 'Flagship' Schools

Schools were encouraged to work towards Bronze, Silver and Gold Mark awards based upon 58 criteria grouped in relation to four programme components:

1) Food leadership.

This component provided the framework for coordinating the whole school approach. In the first four months an FFLP programme officer established a food action group consisting of student representatives, lead school staff and caterers, and parents or other community members. This group set up consultations with students, parents, staff and the wider community to identify improvements in all aspects of food in school.

As an outcome of this consultation the group developed a school food policy and action plan that

provided the reference points for improving the provision of healthier foods including an emphasis on sustainability and wider engagement with food producers and the local community. After the first four months the food action group convened every six weeks to review and plan reforms on an ongoing basis. Student representatives produced bulletins on progress to peers and parents.

2) Food quality & provenance.

This component focused on school food procurement and standards. FFLP staff delivered a package of training and support for catering teams (cooks and food procurement staff) to make greater use of sustainable food in school meals. FFLP interpreted sustainable foods to include: in-season produce, high animal welfare standards meat, free range eggs, marine conservation certified fish, locally sourced produce, Fair Trade certified produce and produce from a certified organic source. All such ingredients were to be used in menus that complied or exceeded national guidelines on healthy lunch menus.

FFLP training for cooks, totalling about five days, covered the promotion and marketing of healthy diets and food sustainability; cooking with unprocessed foods; menu planning; waste reduction; and effective staff, parent and student liaison work. FFLP staff supported caterers on an ad hoc basis to switch to sustainable food suppliers. FFLP issued small refurbishment grants for, for example, the installation of fresh fruit and salad bars.

3) Food education.

FFLP provided teacher manuals, lesson plans and project activity packs covering food origins and environmental aspects of farming, growing in school, cooking with unprocessed fruit and vegetables and sustainably sourced ingredients. FFLP staff provided guidance on how to integrate these educational resources into the school curriculum such that food sustainability issues would be addressed as a regular element of lessons.

Training for school staff covered skills for food growing, cooking and food based preparation using sustainably sourced ingredients. FFLP staff advised and provided small grants to develop a school garden area, whole-class cookery facilities and educational links with food producers such as farms and community gardens.

4**) Parental & community involvement**.

This component established formal engagement with parents, by means of consultation questionnaires and interactive meetings, in the first four months of the programme. This covered strategies for promoting fruit, vegetables and sustainability issues in school at lunch time, break times, lessons and after school groups.

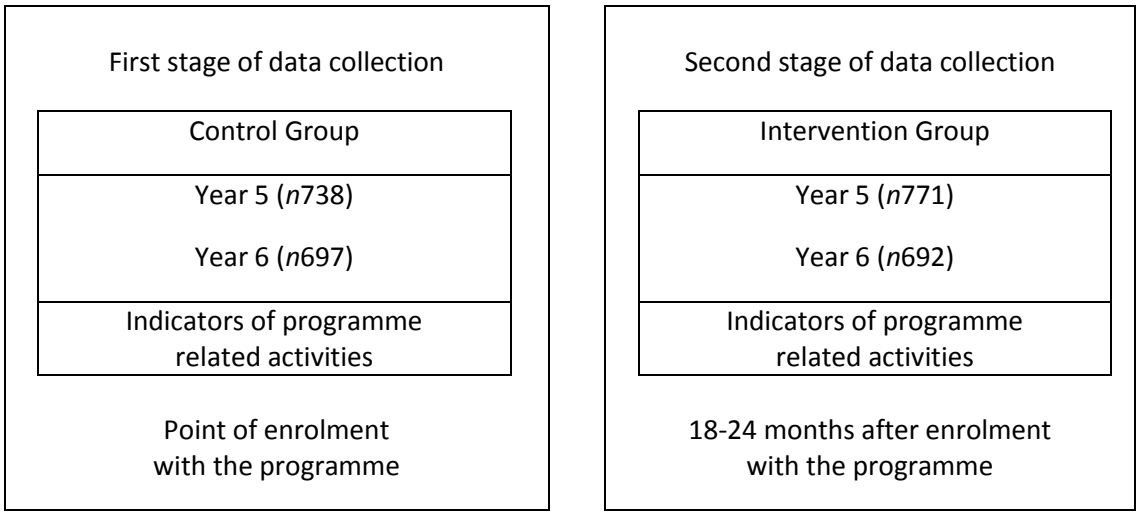
All parents were provided with written information on the aims of the programme, ideas for using healthy and sustainably sourced ingredients in home cooking projects with children, and ideas for growing fruit and vegetables at home. Parents and wider community members were invited to take part or actively deliver FFLP-related school activities such as cooking clubs, farm visits and harvest celebrations. These messages were reinforced through newsletters and other routine communications.

To encourage local ownership of the programme each school exercised considerable scope in developing their own specific strategies for implementation. For example while the FFLP provided standard educational resources, teachers decided how to incorporate them into their schemes of work. Thus the programme had many elements of a 'bottom up' social movement as opposed to an externally directed intervention [23].

Study Design

Following Somerset and Markwell [11], a historical control design was adopted. In the first stage, students completed questionnaires at the point of enrolment with the programme. These data were used as a control for the second stage of data collection with students after the programme intervention period (between 18-24 months). For complex interventions such as FFLP, Nutbeam [24], Springett [23], Victora et al. [25] and Connell and Kubisch [26] emphasise the importance of establishing plausible evidence of the links between activities and outcomes. Therefore, in addition to the student data, we collected data on multiple indicators of programme related activities in schools at both stages in the research. Figure 2 summarises the data collection design.

Figure 2: Summary of the historical control design used in the present study.



Sample

The study was conducted with a sample of 30 primary schools from the first 75 schools enrolled in the flagship programme in 2008. Using the enrolment list, we sought at least three schools from each of the nine regions in England. We then checked for representation in the sample of schools with indicators of high socio-economic deprivation. Otherwise no further information was used to inform the sample selection from the enrolment list. The schools varied in size from 51 to 671 students and were, on average, larger than the English average (mean=285; England=238). The majority of schools were located in urban areas. Sixteen percent (5/30) of the primary schools were in the top national quintile for free school meal entitlement. Free school meal entitlement for parents in receipt of income and family benefits is widely used as an indicator for socio-economic deprivation [27]. The schools were more likely than average England schools to have a track record in health promotion and environmental activity (assessed in terms of participation in the National Healthy Schools and Eco-Schools initiatives).

At the first and second stage, at least half of the Year 5 and 6 classes (ages 9 to 11) in each school took part in a questionnaire survey. School staff were asked to identify mixed ability classes that were available in on the day of questionnaire administration. In total, 1435 students completed the

stage one and 1463 students completed the stage two questionnaire. On both occasions, an average of 61% (S.D. 6.33) of Year 5 and 6 students completed the questionnaire at each school.

In each school, students completing the stage two questionnaire were of the same Year group to those undertaking the stage one questionnaire. They were not the same individuals. For each school the two groups did not statistically differ with regard to gender and Year ($P<0.05$ for both). All classes were of mixed educational ability. Average absenteeism or withdrawal was less than 2% on both survey occasions. For both surveys, the questionnaires were administered by the research team or, on occasions, programme officers using standardised guidance.

Measures

Self reported fruit and vegetable intake

Children were asked to estimate their intake of fruit and vegetables using the standard measure common to all programmes funded through the Big Lottery Well-being initiative [28, primary schools tool]. Eight written examples of one standard portion were given such as 'one apple' or 'a small bowl of salad'. To reinforce understanding of portion size, administrators of the questionnaires used pictures and standard language to read out the question to the class. After checking that students understood and had thought about the question, they were asked to record their estimate reflecting on their previous day.

Through piloting, we assessed the validity of the measure with 139 students. Two hours after recording their estimate, these students then completed the 'Day in the Life Questionnaire': a validated 24 hour food consumption recall tool for group level measures [29, 30]. The fruit and vegetable combined results showed an acceptable level of concurrent validity (Spearman's rank $=0.786$, $P<0.001$). Field notes from subsequent small group interviews with pilot students reinforced the importance of a standard verbal explanation and checks for comprehension. Although self

reported estimates are known to be unreliable for detecting change in individual behaviour [30], Moore *et al.* note their value as logistically viable tools for group level analysis within the parameters of the type of design adopted in the present study.

For the purpose of a fair comparison, the stage one results were compared to the Health Survey for England [31] data on fruit and vegetable consumption for 950 9-10 year olds. The comparison showed a statistically similar distribution of fruit and vegetable portion intake.

Implementation of programme related activities

The student questionnaire also used measures related to programme activities. Using a Likert scale these included: school meals and the dining room experience; cooking at home and school; growing at home and school; and farm activities. Students were asked to indicate their preferences towards four items that were defined by FFLP as examples of sustainable foods. These were a Fair Trade snack bar, a bag of organic carrots, a box of free range eggs and a locally sourced apple. Using simple picture and price comparisons, students were asked to opt between these items or cheaper counterparts that lacked a 'sustainable source' label. The four measures had an internal reliability value of 0.825 Cronbach's Alpha. These were combined to provide a five point attitude scale towards FFLP-related 'sustainable food'.

A second questionnaire for completion with lead school staff focused on key aspects of programme delivery, such as stakeholder involvement in decision making; use of sustainably sourced ingredients in school food; and the extent of practical food education. These data were used to assess the whether schools had met each of the 58 FFLP criteria that lead to programme awards. Taken together, these measures provided a set of indicators to assess exposure and fidelity to the programme related activities at both stages of the research.

Evaluation of a food sustainability programme in schools

Data analysis

All data were entered, cleaned and analysed using SPSS, version 17 – a statistical software package. Analyses were confined to frequency distributions, calculation and comparison of mean scores and cross tabulations between stage one and stage two groups. Statistical tests were used to examine strengths of association between key variables. Regression analysis was employed to assess the relationship between self reported fruit and vegetable consumption and FFLP programme related variables. A 0.05 significance level was applied to all analyses.

Ethical issues

The evaluation protocol was approved by UWE Research Ethics Committee. School head teachers were asked to give written consent based upon written and verbal information provided by the researchers. Schools provided parents with standard written information on the study, data protection and right of withdrawal. Students were informed of the purpose of the study. We adhered to each school's policy on the right of students to opt out.

Results

Student self reported fruit and vegetable consumption

Comparison between the survey groups shows that the intervention respondents reported eating an average of 0.31 more portions fruit and vegetables per day compared with the stage one respondents (3.11 to 3.42; SEMs: 0.03, $P<0.05$, Table I). The self reported consumption of both fruit and vegetables were higher in the intervention group. Vegetable consumption increased slightly more than fruit consumption, but the difference was not statistically significant.

Table II shows that the intervention respondents reporting eating 4 or more portions of fruit and vegetables in the previous day increased by 13.1%, from 38% to 51.1%. The difference between the

two survey groups was more pronounced for Year 5 students. Those reporting eating 4 or more portions in the previous day increased from by 15.7% from 37.5% to 53.2%. There were smaller differences between the two groups for those respondents reporting lower portions of fruit and vegetable consumption (3 portions or less).

Table I. Self reported fruit and vegetable consumption (portions in previous day). Year 5 and 6 respondents

	Mean *Control*	**Mean** *Intervention*	**Mean** *Change*	**Median** *Control*	**Median** *Intervention*	**SE Mean** *Control*	**SE Mean** *Intervention*	**Count** *Control*	**Count** *Intervention*
Year 5	3.1	3.46	+0.36 *P*<0.05	3.0	4.0	0.046	0.042	738	771
Year 6	3.13	3.37	+0.24 *P*<0.05	3.0	3.0	0.046	0.043	697	692
Years 5 & 6	3.11	3.42	+0.31 *P*<0.05	3.0	4.0	0.032	0.030	1435	1463

Baseline missing data = 32. Follow up missing data=1.

Table II. Self reported fruit and vegetable consumption (portions in previous day).

	Less than 2 portions	**2 portions or more but less than 3**	**3 portions or more but less than 4**	**4 portions or more but less than 5**	**5 portions or more**	***Total bases***
Stage 1 (Control) 2008						
Year 5 (age 9-10)						
Percentage	10.8%	25.3%	26.2%	20.4%	17.1%	
Base	*80*	*187*	*194*	*151*	*126*	*738*
Year 6 (age 10-11)						
Percentage	7.6%	27.3%	26.5%	22.2%	16.3%	
Base	*53*	*190*	*185*	*155*	*114*	*697*
Year 5 & 6 (age 9-11)						
Percentage	9.3%	26.3%	26.4%	21.3%	16.7%	
Base	*133*	*377*	*379*	*306*	*240*	*1435*
Stage 2 (Intervention) 2010						
Year 5 (age 9-10)						
Percentage	6.2%	15.8%	24.8%	32.3%	20.9%	
Base	*48*	*122*	*191*	*249*	*161*	*771*

Year 6 (age 10-11)

Percentage	6.2%	16.0%	28.9%	32.1%	16.8%	
Base	*43*	*111*	*200*	*222*	*116*	*692*

Year 5 & 6 (age 9-11)

Percentage	6.2%	15.9%	26.7%	32.2%	18.9%	
Base	*91*	*233*	*391*	*471*	*277*	*1463*

Baseline missing data = 30. Follow up missing data=1.

Table III. Examples of school level programme indicators. Measures cover 12 month period prior to each data collection point.

Programme strand & indicator	**Stage 1 Control**	**Stage 2 Intervention**
	Number of schools N=30[*]	
Food leadership		
School food policy and food action plan covering sustainability issues	5	30
Student representation on school food action group or similar group	12	30
Food quality and provenance of school food		
School menus are seasonal and highlight in-season produce	2	26
Meat is farm assured and eggs are from cage-free hens	2	26
Menu includes a range of locally sourced items	0	21
Poultry, eggs and pork conform to Freedom Food scheme or 10% ingredients are from a certified organic source	0	14
Food education		
Staff training covering skills based, food sustainability issues - staff with formal organic horticultural education training	7	28
School-wide curriculum references sustainable food education	10	29
Facilities for whole-class cookery classes	5	24
Use of sustainably sourced ingredients in cookery classes	7	31
Facilities for growing - growing area over 10 m^2	9	29
Food plant bio-diversity – growing over 5 out of 15 crop types	13	29
An ongoing educational link with a working farm	17	30
Parent and community engagement		
Parents consultation process on food in school	11	30
Home projects: growing and cooking with sustainable food ingredients	2	30
Community participation - volunteers assist in school garden	7	20
Overall programme performance		
Schools meeting FFLP award criteria: 'Bronze', 'Silver' or 'Gold'	0	26
Programme criteria achieved - mean out of 58 criteria	*12 [SEM 3.5]*	*44 [SEM4.23]*

* No missing data for all measures

Table IV. School records on student participation in programme related activities. Indicators cover 12 month period prior to each data collection point.

Area of recorded student participation	**Stage 1 Control**	**Stage 2 Intervention**
	Percentage of students for 30 schools	
Take up of school meals*	44.3%	48.2%
Take up free school meal entitlement	76.0%	90.2%
Participation in growing activities	29.0%	74.0%
Participation in cooking with sustainably sourced ingredients	54.2%	80.6%
Participation in farm visits	18.2%	26.7%

*Take up calculated using national NI52 formula. Student weighted averages. Missing data from two schools.

Table V. Student responses towards programme related activities: Years 5 and 6, 30 schools.

Questionnaire measure	**Stage 1 Control**	**Stage 2 Intervention**
	*Percentage of respondents N=1435**	*Percentage of respondents N=1463**
Rating of school meals 'good' or 'excellent'	45.6%	53.7%
Rating of dining room 'good' or 'excellent'	40.5%	50.4%
Growing fruit or vegetables in school in last year	54.1%	82.5%
Growing fruit or vegetables at home in last year	26.0%	35.2%
Practising food preparation skills at school in last month	17.3%	37.5%
Cooking at home with basic ingredients in last week	51.5%	48.5%
Enjoyment of growing fruit and vegetables	34.8%	39.3%
Participation in farm activities in last year	22.6%	26.1%
Highly positive attitude towards sustainable food	10.7%	21.8%
Reporting that school meals have become healthier in last year§	-	35.9%
Reporting improvements to dining room in last year §	-	30.2%

*Missing data for all measures <1.5%

§ Open question: "Have you noticed any changes…?" Intervention measure only.

Programme implementation: mechanisms for change

Overall the results show that the programme was associated with a range of school reforms. In most cases, training, facilities, participation and student exposure to sustainable food issues

increased over the course of the evaluation period. Tables III and IV provide examples of school level programme indicators and data on student participation. Table V summarises the results for student self report data. The results show positive trends between the two groups, although no – or only small differences – were recorded for farm visits and cooking at home.

Further data analysis: linking mechanisms and outcomes

An analysis of the characteristics of intervention participants showed that self reported fruit and vegetable consumption was positively and significantly associated with experiences and attitudes towards programme related activities (Table VI). Ordinal regression analysis was used to further test these theorised links. Table VII shows the result of a reduced model with selected questionnaire measures using the logit link. The Pearson chi-square goodness-of-fit value was p = 0.757, and the Cox and Snell test showed good predictive ability (pseudo R^2= 0.141). The analysis suggests that explanatory variables such as enjoyment of growing, school meal ratings and attitudes towards sustainable foods were significantly associated with the fruit and vegetable intake.

Table VI: Student responses towards programme related activities cross tabulated with self reported fruit and vegetable consumption. Years 5 and 6, 30 schools, N=1463

Questionnaire measure	χ^2 value	P value
Rating of school meals 'good' or 'excellent'	72.323	<0.001
Rating of dining room 'good' or 'excellent'	52.081	0.001
Growing fruit or vegetables in school in last year	39.444	<0.001
Growing fruit or vegetables at home in last year	64.456	<0.001
Practising food preparation skills at school in last month	63.293	<0.001
Cooking at home with basic ingredients in last week	189.614	<0.001
Enjoyment of growing fruit and vegetables	86.263	<0.001
Participation in farm activities in last year	90.774	<0.001
Highly positive attitude towards sustainable food	63.692	<0.001

Table VII. Ordinal regression parameters estimate for selected programme related measures and self reported fruit and vegetable consumption.

Questionnaire measure	Regression Coefficient	P-Value **significant*
Rating of school meals 'good' or 'excellent'	-3.092	0.041*
Practising food preparation skills at school in last month	-1.591	0.001*
Highly positive attitude towards sustainable food	1.352	0.020*

Enjoyment of growing fruit and vegetables	-1.299	0.014*
Growing fruit or vegetables at home in last year	-13.416	0.000*
Participation in farm activities in last year	-0.906	0.109

Further analysis tested the school-level association between self reported fruit and vegetable intake and FFLP criteria achieved (see table III). For the 30 schools, those that showed above average positive group changes for 4 or more fruit and vegetable portions were significantly more likely to have met an above average number of programme criteria after the intervention (χ^2=4.821 p=0.028). This analysis suggests a positive relationship between fidelity towards and implementation of the programme process and the programme outcomes.

Discussion

The study sought to examine the association between healthier eating amongst 9-11 year old children and a wide range of school based activities organised around issues of food sustainability. Some methodological limitations need to be taken into account when interpreting the results. The use of a historical control design meant that the study did not track longitudinal change in individual behaviour. Apart from the national data, the study has no external comparison: thus the study design does not allow for causal attribution. The programme delivery occurred in the context of other national and local school food-related reforms – all of which might have had an impact on research measures. It is also important to take into account the self selected programme recruitment process. This is likely to mean that participating schools may not reflect the wider profile of English primary schools in terms of the preparedness to work with the programme goals. Nevertheless, the study sample sought to include a diverse selection of schools, including schools with little previous track record on food sustainability issues, and the participation of mixed ability students.

The study design sought to explore the links between programme outputs and longer term outcomes. The extent, scale and temporal sequence of school level changes lend support to the proposition that the programme had an impact on increased student fruit and vegetable intake. School level data showed an upward shift in the scale, integration and range of educational sustainable food activities over the evaluation period. This was accompanied by a rapid process of staff training, improvements in facilities and redeveloping a curriculum for experiential learning. Progress across this set of organisation level indicators lends support for a positive programme effect [25]. Moreover a positive programme outcome was associated the achievement of programme criteria.

This interpretation is supplemented in the form of student self reports – a form of data triangulation [24]. These include student perceptions of school meals and the dining hall environment, food preparation at school, and participation in growing fruit and vegetables both at school and at home. External research evidence lends support to the causal mechanisms anticipated in the FFLP approach. These include the positive effect of increased take up of school meals [16], the role of skills based food preparation education [5] and fruit and vegetable gardening in school [12]. Other results showed little or no difference at the levels of school and student data collection. This suggests that elements of the programme, such as farm-based activities and cooking in the home environment are less likely to act as causal pathways for the anticipated outcomes.

The programme had a variety of levels of implementation across the school setting. This approach appears to have had some benefits that might be less evident in a programme with more restricted domains for action. Working on a wide range of issues at the same time, programme related outputs were evidenced in multiple settings – such as the classroom, the dining room and the after-school club. The focus on sustainability appears to have mobilised change amongst different agents-whether these are amongst student peer groups, catering teams or parent social networks. This reflects a health promotion approach in which there is a synergy of effort at multiple levels [26].

This focus may also allow previously disconnected areas of activity to become linked – such as the kitchen and the school garden –and in so doing lend greater visibility as part of a joined up initiative. Thus a food sustainability approach could create an overarching set of principles and practises for organising work over the longer term.

However the programme indicators also suggest a highly dispersed set of activities. This could have diluted the potential impact of the programme. The theorised links between messages on food sustainability and messages on healthy nutrition are complex and potentially contestable. For example, there is no *necessary* connection between the promotion of organic or locally sourced foods and the promotion of fruit and vegetable consumption. In part, this may account for the trajectories of the study schools as school planning groups interpreted the priorities for implementation somewhat differently. This complexity raises a challenge for the roll out and coherence of this type programme as a combined health and sustainability initiative. It also throws light on an emerging agenda to conceptualise food-health-sustainability links in the design of both programmes and their associated evaluations.

Whilst these issues demonstrate considerable scope for refinement, the changes theorised in the FFLP model were found to have an empirical basis across a number of domains of action. Thus the study reinforces a case for multi-level programmes that adopt a holistic, experiential and environmental approach to food education in primary school settings.

Funding

This work was supported by the Big Lottery Fund and commissioned by the Soil Association.

Acknowledgements

We would like to thank the students, school staff and programme staff who participated in or assisted with the research.

References

1. National Statistics Health Survey for England Children Trend Tables. National Statistics. 2009. Accessible at http://www.ic.nhs.uk/statistics-and-data-collections/health-and-lifestyles-related-surveys/health-survey-for-england. Accessed on: 13th November, 2010.
2. Government Office for Science. *Tackling Obesities: Future Choices. Summary of Key Messages*. Department of Innovation Universities and Skills: London, 2007.
3. Crowther R, Dinsdale H, Rutter H, Kyffin R, *Analysis of the National Childhood Obesity Database 2005-06.* A report for the Department of Health by the South East Public Health Observatory on behalf of the Association of Public Health Observatories. Department of Health: London, 2007.
4. Department of Health & Food Standards Agency. *National Diet and Nutrition Survey Headline results from Year 1 of the Rolling Programme (2008/2009)* DH & FSA: London, 2010.
5. Walters L, Stacey J. Focus on Food: Development of the Cooking with Kids Experiential Nutrition Education Curriculum. *Journal of Nutrition Education and Behavior* 2009, **41** (5); 371-373.
6. Libman K. Growing Youth Growing Food: How Vegetable Gardening Influences Young People's Food Consciousness and Eating Habits. *Applied Environmental Education & Communication* 2007; **6**(1): 87 - 95.
7. McAleese JD, Rankin LL. Garden-Based Nutrition Education Affects Fruit and Vegetable Consumption in Sixth-Grade Adolescents. *J American Diet Association* 2007; **107**(4):662-665.
8. Morris JL, Neustadter A, Zidenberg-Cherr S. First-grade gardeners more likely to taste vegetables. *California Agriculture* 2001; **55:**43-46.
9. Birch LL. Development of Food Preferences. *Annual Review of Nutrition* 1999; **19**:41-62.
10. Morgan PJ, Warren JM, Lubans DR, Saunders KL, Quick GI, Collins CE. The impact of nutrition education with and without a school garden on knowledge, vegetable intake and preferences

and quality of school life among primary-school students. *Public Health Nutrition* 2010; **13**: 1931–1940.

11. Somerset S, Markwell K. Impact of a school-based food garden on food knowledge and attitudes: a 12-month intervention trial. *Public Health Nutrition* 2008; **12**: 214-221.
12. Robinson-O'Brien R, Story M, Heim S. (2009). Impact of garden-based youth nutrition intervention programs: a review. *Journal of the American Dietetic Association 2009;* **109:** 273-280.
13. Joshi A, Azuma A, Feenstra G. Do farm-to-school programs make a difference? Findings and future research needs. *Journal of Hunger & Environmental Nutrition* 2008; **3**: 229-246.
14. Joshi, A., and Azuma, A. *Bearing Fruit: Farm to School Program Evaluation Resources and Recommendations.* Center for Food & Justice Urban & Environment, 2009. Available at: http://departments.oxy.edu/uepi/cfj/bearingfruit.htm. Accessed on: 12th April, 2011.
15. Evans C, Greenwood D, Thomas J, Cade J. A cross sectional survey of children's packed lunches in the UK: food- and nutrient-based results. *Journal of Epidemiology & Community Health* 2010; **64**: 977-983.
16. Rees G, Richard C, Gregory J. Food and nutrient intakes of primary school children: a comparison of school meals and packed lunches. *Journal of Human Nutrition & Dietetics* 2008; **21**:420-427.
17. Mikkilä V, Räsänen L, Raitakari OT, Pietinen P, Viikari J: Longitudinal changes in diet from childhood into adulthood with respect to risk of cardiovascular diseases: The Cardiovascular Risk in Young Finns Study. *European Journal Clinical Nutrition* 2004; **58**:1038-1045.
18. Kelder SH, Perry CL, Klepp K-I, Lytle LL. Longitudinal tracking of adolescent smoking, physical activity, and food choice behaviors. *American Journal Public Health* 1994; **84**(7):1121–6.

19. Thomas, J., Sutcliffe, K., Harden, A., Oakley, A., Oliver, S., Rees, R., Brunton, G and Kavanagh, J. *Children and Healthy Eating: A systematic review of barriers and facilitators.* London: EPPI-Centre, Social Science Research Unit, Institute of Education, University of London, 2003.

20. Van Cauwenberghe E, Maes L, Spittaels F, Frank J, van Lenthe, Brug L. Effectiveness of school-based interventions in Europe to promote healthy nutrition in children and adolescents: systematic review of published and 'grey' literature. *British Journal of Nutrition* 2010; **103**:781-797.

21. De Sa J, Lock K. Will European agricultural policy for school fruit and vegetables improve public health? A review of school fruit and vegetable programmes. *European Journal of Public Health* 2008; **18** (6): 558-568.

22. Food for Life Partnership (2010) Food for Life Partnership: Who We Are. Available at: http://www.foodforlife.org.uk/Aboutus.aspx. Accessed on: 20th November 2011.

23. Springett J, Appropriate approaches to the evaluation of health promotion. *Critical Public Health* 2001; **11** (2):139-151.

24. Nutbeam D, Evaluating Health Promotion – progress, problems and solutions. *Health Promotion International* 1998; **13** (1): 27-44.

25. Victora CG, Habicht J-P, Bryce J. Evidence-based public health: moving beyond randomized trials. *American Journal Public Health* 2004; **94**:400–405.

26. Connell J, Kubisch A. Applying a theory of change approach to the evaluation of comprehensive community initiatives: progress prospects and problems. In Fulbright-Anderson A, Kubisch A, Connell J. (eds). *New approaches to evaluating community initiatives: theory measurement and analysis*. DC Aspen Institute, 1998, 15-44.

27. Noble M, Wright G. *Indices of Deprivation*. London, Deputy Prime Minister Office: Neighbourhood Renewal Unit, 2004.

28. Abdallah S, Steuer S, Marks N, Page N. *Well-being Evaluation Tools: a research and development project for the Big Lottery Fund*. London: New Economics Foundation, 2008.

29. Edmunds LD, Ziebland S. Development and validation of the Day in the Life Questionnaire (DILQ) as a measure of fruit and vegetable questionnaire for 7–9 year olds. Health Education Research 2002; **17**:211–220.

30. Moore GF, Tapper K, Murphy R, Clark R, Lynch R, Moore L. Validation of a self-completion measure of breakfast foods, snacks and fruits and vegetables consumed by 9-to 11-year-old schoolchildren. *European Journal of Clinical Nutrition* 2006; 1-11.

31. Health Survey for England. Children Trend Tables. National Statistics, 2009 Available at: http://www.ic.nhs.uk/statistics-and-data-collections/health-and-lifestyles-related-surveys/health-survey-for-england. Accessed on: 26th November, 2010.