Current classroom practice in the teaching of food technology: is it fit for purpose in the 21st Century?

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Paper: Current classroom practice in the teaching of food technology: is it fit for purpose in the 21st Century?

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Abstract
This paper builds on a research project exploring what secondary school pupils in England should learn in a modern food technology curriculum. The early stages of the research investigated the views of a range of professionals interested in teaching food technology and suggested a framework for a modern food technology curriculum, which would include:

- Designing and making food products;
- Underpinned by an understanding of the science of food, cooking and nutrition;
- Incorporating an exploration of both existing and new and emerging food technologies;
- In the context of sustainable development of food supplies locally, nationally and globally;
- Including an appreciation of the roles of the consumer, the food industry and government agencies in influencing, monitoring, regulating and developing the food we eat. (Rutland, 2009, p5).

The next stages of the project explored the views of a number of stakeholders of the framework. These included initial teacher educators, teachers, providers of professional development courses for design and technology teachers, higher education lecturers, examining bodies concerned with the General Certificate of Secondary Education (GCSE) food technology courses for pupils aged 16 years and the General Certificate of Education (GCE) for pupils aged 18 years and researchers working for the food industry.

This paper presents the findings of an analysis of a small sample of Key Stage 3 (pupils aged 11-14 years) English secondary schools' food technology schemes of work (SoW), against the suggested food technology framework. The framework was elaborated to give more details of the potential content and used to critique the schemes of work based on current practice in the classroom.

The key findings were that to ensure a modern technologically challenging food technology curriculum fit for the 21st Century, Key Stage 3 pupils need a broader and more challenging curriculum. It should teach pupils a wider range of appropriate designing strategies aimed at making design decisions other than aesthetic, such conceptual, technical, constructional or marketing. There should be more attention given to progression and continuity from the primary Key Stage 2 (children aged 7-11 years) in the products the pupils design and make and the scientific and nutritional knowledge and understanding that underpins their work. The pupils should learn about new and existing food technologies, issues related to food sources and sustainability and gain more understanding of themselves as consumers and the role of the food industry and government agencies in their lives.

Key words: food technology, conceptual framework, schemes of work (SoW), Key stage 3 (pupils aged 11-14); modernised curriculum.

Introduction

Food science and food technology are important aspects of Britain's economy; the food and drink industry is the largest sector of manufacturing activity, employing 400,000 workers, 16% of the manufacturing workforce. The role of food science and food technology is, therefore, an important issue as if pupils do not study food science and technology in school they are unlikely to study it at higher education levels leading to too few graduates to meet industry demands. One representative of the food industry noted that 'Since it [chilled food] is technically demanding it is most likely to suffer from the shortage of food science-relevant graduates' (Monks, 2012, p.17). This is not the only reason, however, for considering the importance of food in the school curriculum. Two other key issues are:

1. The importance of pupils learning to cook as a life skill (Rutland, 2008).
2. The study of food technology, within design and technology (D&T), as an academic study of worth.

Cooking as a life skill is an important contributor to pupils developing healthy lifestyles, whilst studying food as an academic subject can provide motivation and challenge, support the development of higher order thinking skills and develop pupils' understanding of scientific concepts.

However, HMI have commented that 'there has been confusion about food technology's basic aims (Ofsted, 2006, p.5) and 'a lack of clarity about the relationship between the teaching of food as a life skill and the use of food as a medium for teaching D&T' (ibid, p.2). It was recommended that the nature of food technology should be clarified (2006) and recently that learning concerned with food technology should be more intellectually challenging and include 'designing, product development, empirical testing and applying maths and science' (Ofsted, 2008, p.5).

A research project (Rutland, 2009) investigated what secondary school pupils in England should learn, understand and be able to do in a modern food technology curriculum. Data was gathered from two conferences on nanotechnology and interviews with five informants specifically interested in food teaching in schools. The outcome was a conceptual framework to modernise the food technology curriculum which consisted of:

I. Designing and making food products
II. Underpinned by an understanding of the science of food and cooking and nutrition
III. Incorporating an exploration of both existing and new and emerging food technologies
IV. In the context of the sustainable development of food supplies locally, nationally and globally
V. Incorporating an appreciation of the roles of the consumer, the food industry and government agencies in influencing, monitoring, regulating and developing the food we eat.

The conceptual framework was used as a basis for interviews in phases one, two and three of a further research project (Rutland, 2010a; Rutland 2010b; Rutland 2011). Data was collected from a range of stakeholders, including teacher trainers; D&T and science inset providers; teachers; external examiners; higher education lecturers and people involved in food researcher for industry. The key findings of the earlier research:

- Designing with food is a complex process involving a wide range of skills and knowledge of how ingredients interact.

- Food technology teaching and learning should be underpinned with an understanding of the relevant scientific principles of food science, as well as nutrition.
- Food technology can play an important role in supporting the development of pupils' scientific understanding within the science, technology, engineering and maths (STEM) school agenda.
- Progression in food technology across the age phases is essential
- Pupils should learn about existing and emerging food technologies used in the food industry and the implications for their future lives
- Food sustainability is an important issue both at a national and international level.
- Pupils should become informed consumers so that they can make knowledgeable choices and decisions about what they eat (Rutland, 2011)

The paper recommended that a group of interested people should work together to research and develop resources to support food technology teachers in the classroom.

The current paper presents the findings from a critical analysis of a range of current secondary schools' food technology schemes of work against the suggested food technology framework. It was considered important to evaluate examples of existing practice as HMI have indicate that schools are facing a considerable challenge modernising the D&T curriculum, including food technology, so that it keeps pace with technological developmental (Ofsted, 2011). The framework was developed to give more details of the potential curriculum content and used to critic the schemes of work based current practice in the classroom. The findings will be discussed to help identify areas of a modern food technology curriculum that should be included if pupils are to become confident and capable members of a technologically advanced society' (ibid, p.4).

Methodology

The data collected in this study came from schemes of work (SoW) from a total of nine schools across England in the, West Midlands, London Region and one from Oxfordshire. Seven schools provided seven Year 7 SoW, nine schools Year 8 SoW and six schools Year 9 SoW. The SoW came from teachers within the schools through their Initial Teacher Education (ITE) colleagues and with the permission of the teacher/student teacher in the schools. Each of the SoW was analysed against the framework for a modernised food technology curriculum and the results for each year group are presented in a table (Table 1).

	Year 7 Schools = 7	**Year 8 Schools = 9**	**Year 9 Schools = 6**
Designing and making food products			
A Designing			
Design strategies			
1 Product evaluation	2	3	1
2 Attribute analysis		1	
3 Image Boards		1	
4 User trips			
5 Sensory Analysis	6	7	3
6 Nutritional Analysis	2	1	
7 Modifying recipes - changing flavour, texture, shape and finish, way it is cooked and nutritional content	5	7	3
B Making			
Ways of combining food materials			

1 Rubbing in	3	7	3
2 Creaming	4	4	2
3 Blending	1	2	1
4 Folding			
5 Whisking		1	2
6 Kneading	1	1	
7 Mixing	3	3	1
Stages in Product development			
1 Understanding the market - initial ideas	2		
2 Writing a specification	2	2	1
3 Product development		1	
4 Product testing	1	1	
5 Packaging	2	3	1
Making design decisions			
1 Conceptual			
2 technical			
3 Aesthetic	2		
4 Constructional			
5 Marketing			
Food choices			
1 Guidelines for a healthy diet	7	7	3
2 Understanding needs needs of target markets		1	2
Underpinned by an understanding of the science of food, cooking and nutrition;			
The properties of food			
1 physical		1	2
2 appearance			1
3 taste	1		
Understanding what ingredients do		(bread)	
1 Colloids			1
2 Raising agents - mechanical, chemical and biological	1	3	
3 Thickening liquids - gelatinisation			1
protein coagulation			1
Cooking food			
1 Different methods of cooking	3	1	2
2 What happens when food is cooked			1
3 Changes that take place when food is cooked			1
4 Finishing touches	1		
Nutrition			
1 Nutrients, carbohydrates, proteins, fats, vitamins and minerals (and fibre)	1	2	3
2 Nutritional intake - reference nutrient intake (RNI)			1
3 Nutritional content of foods	2	2	2
Incorporating an exploration of both existing and new and emerging food technologies;			
1 Ways of preserving food - prolonging shelf life, preserving food			2
2 Manufacturing processes used by the food industry		1	1
3 Emerging food technologies - GM foods, nanotechnology			
5 New approaches to food packaging			
4 Impact and implications of eating highly processed foods			

The context of sustainable development of food supplies locally, nationally and globally;			
1 Food sources - where they come from		3	1
2 How they are grown		1	
3 How they are transported			
4 Air miles		1	1
5 Food waste			
6 National and global issues of food sustainability		1	
An appreciation of the roles of the consumer, the food industry and government agencies			
in influencing, monitoring, regulating and developing the food we eat.			
1 How to become informed consumers		2	1
2 To be able to make informed decisions on the foods eaten			
3 The structure of the food industry and its impact on how we live.			
4 The role and support of the government agencies			
5 Food health and safety issues			Eggs

Table 1 Analysis of SoW

Analysis of results.
The focus for this analysis was Key Stage 3 (pupils aged 11-14 years) SoW in England, as Key Stage 4 (pupils aged 14-16 years) food technology teaching will match external examination specification requirements. An analysis of Key Stage 4 SoW has been down but is not reported in this paper. At Key Stage 3, there is variety in the time allocated to food technology and the topics covered, so it was thought worthwhile to try and discover what is being taught.

The SoW were obtained from a small number of schools (9 schools) across diverse locations in England. Although the number of SoW analysed is small this was a random sample and is likely to represent teaching across schools in England. As the SoW were produced by each school independently there was no common template for presentation, although most contained similar information the level of detail varied. The SoW were analysed against the framework suggested by the earlier research. Analysis was undertaken by reading through each scheme of work and, where a match was found, assigning content to the pre-designated terms on the 21st century framework.

It should be noted that, although this analysis is based on the Key Stage 3 curriculum, three of the schools had started their Year 9 pupils on General Certificate Examination (GCSE) courses, so the curriculum in these schools would be based on the Key stage 4 examination specifications. The examinations being followed were GCSE Food Technology, GCSE Food & Nutrition and Catering.

Designing and making food products
The analysis shows that schools are attempting to engage pupils in 'designing' food products, but the strategies used to do this are limited. Five schools used evaluation of existing products, although this seemed to be at a superficial level of appearance and

sensory evaluation and were conducted on only one or two occasions rather than being a regular feature of product development. Sensory analysis was also a common strategy (6 cases), sometimes of commercial products and sometimes of pupils own products. Modification of existing recipes was the most common strategy for developing new ideas, used by all schools.

Two schools required pupils to consider the market when developing new ideas, and three schools required pupils to write specifications, one school used specifications with pupils in Year 7 and Year 8, one with Year 7 and Year 9 and one with Year 8 only. When making design decisions pupils focused on aesthetic considerations, there was no evidence that consideration was given to other aspects, such as conceptual, technical, constructional or marketing.

There was also evidence that pupils are being asked to draw food design ideas, examples were seen of requests for drawings of pizza topping designs, using the 4x4 strategy from the *Key Stage 3 National Strategy: Design and Technology* (DfES, 2004), fruit smoothies, fruit crumble, 2D sketches for a stir fry, top and side views of a cheesecake. Pupils also looked at packaging, focusing on packaging design and food labelling. Two schools did this in Year 7, one school in Year 8 and one school in Year 9.

There was evidence of lots of practical work taking place, to develop pupils' making skills as well as their familiarity with tools and equipment, knowledge of safety and hygiene and safe working practices. In Year 7 and Year 8, dishes made were simple, including soup, pizza, crumble, muffins, scones, flapjack, fruit salad, fruit smoothie. In one school pupils made burgers and in another noodle stir fry in Year 7, and in Year 8 pupils in different schools made spaghetti Bolognese and other pasta plus sauce dishes, but in general the level of skills required was low and focused on rubbing-in, creaming and mixing. This could be due to pupils' own low level of skills or to the time constraint limiting what is possible. In Year 9, practical work became a little more skilled with the introduction of roux sauces (one school), whisking and choux pastry (one school). A wider range of dishes was made in Year 9, including quiche, cheesecake, paella and pavlova. In one school, where pupils were studying 'Catering', they had several opportunities to choose dishes they were going to make.

Underpinned by an understanding of the science of food, cooking and nutrition;
All the schools taught pupils about nutritional guidelines and healthy eating, sometimes focusing on the 'Eat Well' plate and sometimes on the '5-a-day' campaign. This knowledge was then applied to the development of recipes to make dishes 'more healthy'. Two of the schools in which year 9 pupils were following examination specifications also taught about planning meals to meet the needs of different groups. One school taught about food from different cultures in year 8 and one covered this in year 9.

In terms of the science of food, cooking and nutrition, in year 7 and year 8 this focused on the physical aspect and taste of foods with only three schools looking at the function of ingredients (yeast as a raising agent in bread products). In year 9, two schools looked at the physical properties of foods. In year 8, three schools looked at the function of ingredients in relation to bread-making and in year 9 different schools looked at the function of eggs in food, gelatinisation in a roux sauce and coagulation of meat protein. Some attention was paid to different methods of cooking, to a small extent in years 7 and 8 with more emphasis in year 9, but it was difficult to tell the level at which this was covered, pupils certainly learnt

how to use different cooking methods but there is little evidence that they were taught to understand the scientific differences between these methods. The teaching of nutrition was limited in Year 7 and Year 8, focusing on a limited range of nutrients and basic food commodities. In Year 9 schools covered the macro and micro nutrients and one school taught about Dietary Reference values (DRVs) or current dietary goals.

Incorporating an exploration of both existing and new and emerging food technologies;
There was no evidence of pupils in Year 7 being taught about existing or new food technologies or any aspects of food manufacturing. In year 8, one school taught pupils about mass and batch production, one taught food marketing and two schools taught about Hazard Analysis Critical Points (HACCP). In Year 9, two schools taught about food preservation and one school about manufacturing processes, although only in relation to one-off, batch and mass production methods. One school taught HACCP in Year 9, and another taught about 'quality control'.

The context of sustainable development of food supplies locally, nationally and globally;
Again, in Year 7 there was no evidence for the teaching of sustainable development issues around food. In Year 8, one school taught the issues of food imports, the issues of eating meat and fish, sustainable fish stocks and meat alternatives and another school taught a project on 'ethical food' which covered fair trade, ethical business and the issues of local produce and food miles. In Year 9 one school taught a project based on 'local produce' which looked at food sources and food miles.

An appreciation of the roles of the consumer, the food industry and government agencies in influencing, monitoring, regulating and developing the foods we eat.
In relation to issues of the roles of the consumer, food agencies and the government the focus was on promoting the government healthy eating and 5-a-day campaigns, making informed decisions as consumers. Two schools, one explicitly following the 'Licence to Cook Scheme' [1], taught pupils in Year 8 about 'wise shopping' but it is not known what this covered or to what level. In relation to food safety and health issues, only one school referred to this through salmonella and eggs. There was no teaching about the role of the food industry or government agencies.

Discussion
From this analysis it would appear that there is much more scope in schools to improve pupils' ability to develop food products through using a wider range of design strategies. Teachers were introduced to these through the *Key Stage 3 National Strategy: Design and Technology* (DfES, 2004) so it is disappointing to see that they are not widely used. In addition, it seems that little attention is being given to developing food products using food industry methods, such as target markets, specifications, product development and product testing. Design decisions are focused on aesthetics without consideration of other elements, such as conceptual development, technical or constructional elements. It is also disappointing to see that some schools are still requiring pupils to draw design ideas for food, this is likely to be as a result of external examination specification requirements but it is difficult to see the learning value of such an exercise.

[1] Licence to cook was a programme to support secondary school pupils in learning how to cook and understand the principles of diet, health and safety and wise shopping

It is good to see that pupils are being taught about healthy eating guidelines, although this is not supported by a detailed teaching of nutrition in Key Stage 3. The science of food, cooking and nutrition is very limited in most schools, and this could be developed much more. Perhaps pupils' interest in food science, or their ability in relation to it, is under-estimated but the healthy eating guidelines and understanding of food could be greatly enhanced by developing this aspect of teaching further.

Similarly, there is evidence that pupils are taught little about food technologies, the environmental issues around food or the role of government and food agencies in food matters. These are topics which are likely to be of interest to young people and teachers should be prepared to teach some of these more difficult issues.

There is evidence that pupils are engaging in practical work and developing a range of skills. Though the type of products pupils make in Key Stage 3 are, in some cases, ones that are made in Year 2 and 3 of primary schools, for example fruit salad and fruit smoothie. These skills are limited and this may be the result of constraints of teaching time available, economic constraints as most pupils are required to provide their own ingredients and social constraints as there remains an expectation that pupils will make food products that can be taken home and eaten. Practical work should be developed so that it can support pupils' learning not only of practical skills but also of food science and nutrition, food sustainability issues and food product development. This would be beneficial for pupils' future career prospects and for their future lives as healthy and informed citizens.

Recommendations

- Pupils should be taught to use a wider range of designing skills in food technology to enhance the design decisions they make. It has been common for external examination boards to require pupils to 'sketch' rather than use a range of design strategies to explore the behaviour of food to achieve the required aesthetic, technical and constructional characteristics of a product (Rutland et al, 2005). Food teachers should evaluate the value of such a strategy.

- Thought should be given to the range of food products pupils made in Key Stage 3. Ofsted (2011, p4) noted that pupils' work in D&T was rarely built upon by secondary schools, yet continuity and progression in food technology is essential when building pupils' learning across the key stages. Ofsted (2011) commented that lack of continuity led to weak curriculum planning at Key Stage 3 and projects where the work was too easy and pitched at too low level or duplicated earlier learning. A Key Stage 3 curriculum built on sound primary practice would lead to a demanding, interesting GCSE Food technology courses and rigorous A Level food technology courses.

- Lack of progression is an important issue when considering the teaching of food technology linked with scientific knowledge and understanding. Food technology in the primary curriculum shows evidence of successful and effective practice where children explore the properties of ingredients, where they come from, how and why they can be used and changed in the context of a practical designing and making activity with food in D&T (Rutland & Miles-Pearson, 2009). This should be extended and built on at Key Stage 3 so that pupils can develop new ideas rather than just

modify existing recipes and also understand the concepts underpinning different methods of cooking.

- The recent national emphasis in England on cooking and healthy eating through the 'Licence to Cook' initiative has led to more opportunities for practical work with food and meal preparation, though opportunities to teach practical nutrition as an integral part of learning have been missed in some lessons (DfE, 2011). Pupils should be taught more in-depth nutritional knowledge progressively throughout Key Stage 3 (DfE, 2011, p38) so that they can make sound design decisions related to a range of people's dietary needs.

- The lack of evidence in this research to the teaching of existing and new food technologies, the environmental issues around food or the role of government and food agencies in food matters is disappointing and needs to be addressed. The Key Stage 3 food technology curriculum should be balanced to include the technologically challenging and more modern parts of the subject so that pupils can apply their scientific understanding and develop greater technical rigour in designing and making (DfE, 2011).

The evidence in this study, though of a limited nature, indicates that there is a need for teachers of Key Stage 3 food technology to re-evaluate and modernise their curriculum. This presents a challenge for teachers and a need to keep pace with technological developments to ensure that their curriculum is 'fit for purpose' in the 21st Century.

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