# Teaching Food Technology through the Narrative of Food

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## ABSTRACT

This paper takes the position that food technology may be taught in secondary schools (learners aged 11 – 16 years) by a consideration of the narrative of food in the world. This narrative starts with food production mainly through agriculture and moves on to include storage, preservation and processing, sales, and distribution at different levels of scale, complexity, and sophistication dependant on context and concludes with food preparation and consumption. The place of food in society is dependent on the way in which various technologies are deployed throughout this narrative and how these may or may not help in our responses to the two great challenges confronting humanity today: social justice for all and the stewardship of Planet Earth in the face of climate change. It is important that young people learn about this in school in the light of both sustainable food production and nutrition. This paper will discuss how knowledge and understanding of this narrative, the embedded technologies and these challenges might be taught as the basis for a secondary school food technology course.

*Key Words Food Technology, Curriculum, Pedagogy, Social Justice, Stewardship,*

## 1. INTRODUCTION

As young people grow up, they engage with food through the meals they eat at home which depends on the way their families buy, prepare and eat food. This is mainly dependent on the food made available to them in supermarkets and food stores although some people can grow some of their own food. These retail outlets are part of a supply chain that is global in that a variety of food staples are grown in different parts of the world and exported to other countries in which they are processed in various ways to become the food items people buy and eat. This paper adopts the position that this Narrative of Food may be used as the basis for teaching food technology in secondary schools (learners aged 11 – 16 years). This paper is in six parts. Part 1 explores the Narrative of Food in terms of how it might be presented to and then interrogated by learners. Part 2 describes some of the technologies that operate within this Narrative. Part 3 considers the causes of malnutrition. Part 4 identifies the issues to be addressed if food production is not to contribute to global warming. Part 5 describes five ways in which food technology might be used to address the apparently conflicting requirements of feeding the world and reducing global warming. Part 6 presents concluding remarks which consider ways forward for curriculum development.

## 2. EXPLORING THE NARRATIVE OF FOOD

### *2.1. Presenting the narrative to learners*

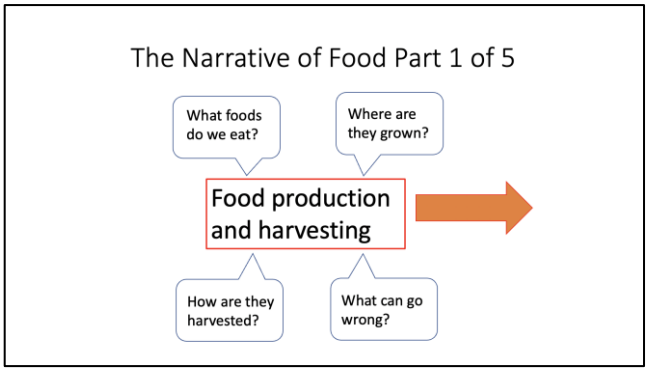
The Narrative of Food is structured in five sections: 1) production and harvesting, 2) storage, 3) preservation and processing, 4) sale and distribution, and 5) preparation and consumption. The technologies deployed in this narrative vary in the extent to which they are food specific in their original intention. Some are directly concerned with the intrinsic nature of food as a material and the way it behaves. Plant breeding to increase crop yields is an example. Others will have a more tangential, but no less significant, relationship within the narrative. The development of tools to aid harvesting is an example. Both types of technology are considered to achieve a holistic view. If learners are to understand the Narrative of Food, then providing them with the 'Big Picture' is important so that they can relate the various stages to their own lives. Such a picture will provide a broad sweep overview with just enough detail to enable learners to grasp the narrative without being overwhelmed by the underlying intricacies. The cognitive load (Willingham 2021) of the details will almost certainly confuse learners.

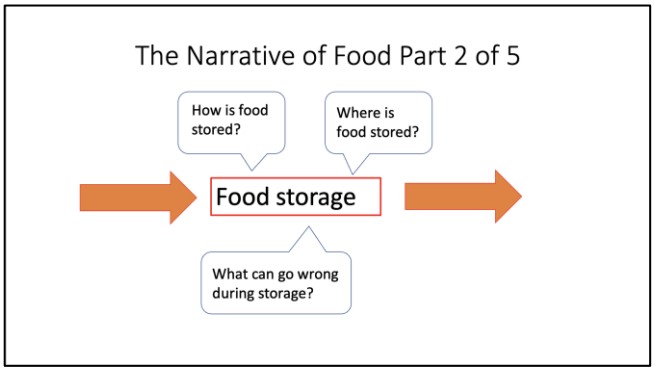
The approach to the Narrative of Food taken in this paper is to see it as a linear sequence involving the five stages listed above. Presenting this sequence all at once, even by means of a mix of diagrams and comments, is likely to overwhelm learners so it will be important to build up the sequence a stage at a time until the entire sequence is complete. In addition to avoiding overloading the learners with information this has the following advantages:

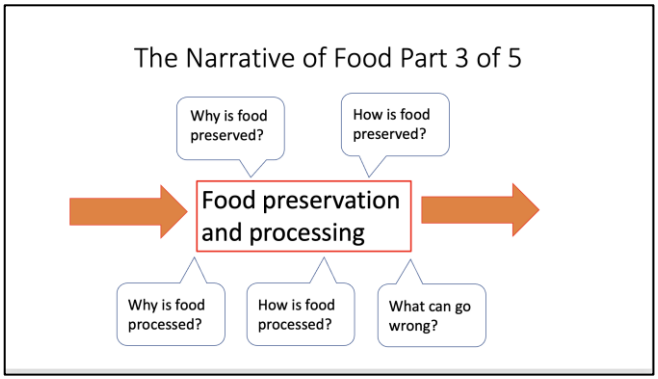
- The teacher can ask the learners about each stage, so he/she has some sense of their existing knowledge and understanding.
- The class can build up a shared appreciation of what they, as a learning community, already know and believe (some of which may well be erroneous as revealed by the ground-breaking work of Rosalind Driver (Driver 1983).
- The teacher can use this to inform the presentation as she/he teaches the class about each stage.
- The teacher can also ask question that provoke the learners to re-evaluate their knowledge and the place of that stage in the sequence in their lives.

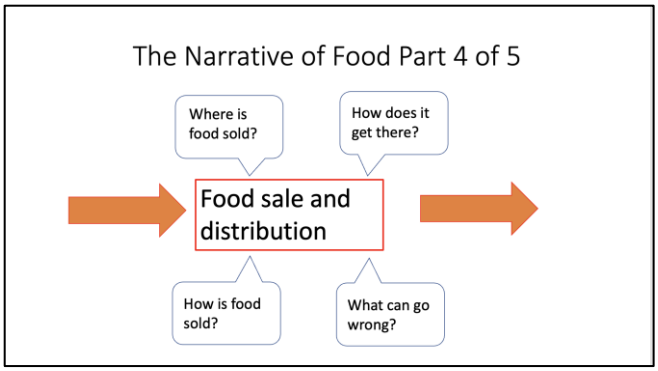
Figure 1, *The Narrative of Food in Five Parts*, shows possible presentation slides, along with possible questions, that might be used to build up a big picture of the narrative of food.

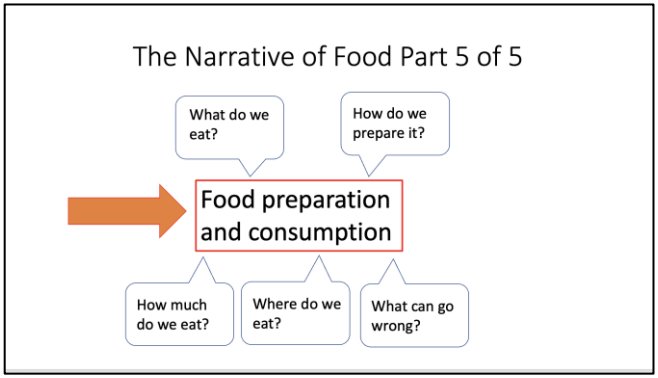
*Figure 1*
*The Narrative of Food in five parts*






***2.2. Interrogating the narrative***

The quality of question-and-answer session accompanying the presentation is crucial to learners' engagement with and understanding of the Narrative of Food. In responding to the learners' comments, it is essential to treat their answers with respect especially those answers that reveal misapprehensions. Many learners, especially those living in cities have little contact with farming and the origins of their food and their ideas will often be incorrect. Only the learners themselves can correct these misconceptions in the light of the information the teacher presents. If they are made to feel foolish it is highly likely they will become resentful and cease paying attention. The questions used by the teacher at each stage all include the question "What can go wrong?" This is an important enquiry as it can be used to highlight issues around food security and nutrition.

## 3. THE TECHNOLOGIES IN THE NARRATIVE

The technological solutions used at the various stages in the narrative will be dependent on the context. Consider the growing of food. The tools used by subsistence farmers (some 25% of the world population (Rapsomanikis, 2015)) are not dissimilar to those used by such farmers many

thousands of years ago, the sickle, scythe, and hoe. The technological response of most recent farming has been ever more mechanisation to increase both capacity and efficiency. Hence the tools available to modern farming now incorporate satellite navigation and robotics into both planting and harvesting. Drones with sensors capture real time data about soil conditions on farms. Satellites are used to accurately predict weather conditions and pest migrations. Autonomous vehicles can now plant and harvest on very large scales with only minimal human oversight. What a paradox – in many parts of the world we have millions of subsistence farmers using indigenous knowledge with tools and methods developed in the distant past to literally scrape a living for themselves and their families whilst at the same time we have modern farming practices elsewhere producing and harvesting vast amounts of crops, informed by sophisticated technology, and implemented through automation requiring minimal human involvement in the activity. The use of driverless tractors to help harvest wheat is already available (Reichenberger 2018). Utilising modern technology can take place in some countries that usually rely on traditional methods. In Kancheepuram district in the southern state of Tamil Nadu, in India, drones are being used to spray crops with fertiliser and pesticides to overcome the shortage of agricultural workers caused by migration to the cities (Mukharj, 2023). Learners will need to appreciate the role of technologies in the different stages of the narrative and consider both the benefits and costs of such applications.

## 4. DEALING WITH MALNUTRITION

### *4.1. Over-nutrition in developed countries*

Being overweight or obese is a major form of malnutrition in developed countries. The government in England, is seriously concerned about the nation's health with particular regard to the impact of poor dietary choices on the cost of the National Health Service (NHS). Foresight is a department within the UK Government Office for Science which is tasked with enabling civil servants to think about the future in terms of the likely impact of new and emerging technologies and societal trends. (See https://www.gov.uk/government/groups/futures-and-foresight#who-we-are ) As early as 2007, Foresight reported that the predicted increase in obesity was a ticking time bomb as far as health service costs were concerned (Department for Innovation, Universities and Skills, (DIUS) 2007a) This extract from the summary of key messages (DIUS, 2007b) indicate the seriousness of the situation:

> By 2050, Foresight modelling indicates that 60% of adult men, 50% of adult women and about 25% of all children under 16 could be obese. Obesity increases the risk of a range of chronic diseases; particularly type 2 diabetes, stroke, and coronary heart disease and also cancer and arthritis. The NHS costs attributable to overweight and obesity are projected to double to £10 billion per year by 2050. The wider costs to society and business are estimated to reach £49.9 billion per year (at today's prices).

Written just over 15 years ago this provided a stark warning. Prescriptions for Type 2 Diabetes caused to a large extent by lifestyle choices leading to being overweight and obese are costing the NHS in England more than £1 billion a year (Ives, 2018). The latest data from the Health Survey for England (2019) paints a similarly bleak picture with these headlines:

- Among adults 16 and over, 68 % of men and 60% 0f women were overweight or obese.
- Among children, 18% of boys and 13 % of girls were obese.
- Children with obese parents were more likely to be obese.
- Adults living in the most deprived areas were the most likely to be obese.

According to Henry Dimbleby (2023), citing the World Health Organisation, one of the contributory causes of poor dietary choice is the ready availability of inexpensive, prepared food that is high in fat, sugar, and salt. At a time when many families are struggling financially, ready meals from the supermarket or from a fast-food outlet provide an affordable, if unhealthy, source of food. Research has indicated that the numbers of fast-food outlets can double the chances of becoming obese (Briggs, 2014) and UK high streets currently have the highest concentration of fast-food outlets since 2010 (Homer, 2018).This is an example of how those who are poor in developed countries find themselves in a situation in which they appear to have little choice but to adopt an unhealthy diet in which there is an overabundance of calories combined with ingredients that are intrinsically unhealthy. The impact of the pandemic made matters worse; according to Keeble, Adams and Burgoine (2023), the number of outlets accessible online in the most deprived areas increased during the pandemic. It is clearly unjust that the poor in the UK and other such countries find themselves in this situation. If one looks at such diets through the lens of stewardship of Planet Earth many of the ingredients used to produce and deliver such food carry a heavy carbon footprint and also deplete the Planet's ability to absorb carbon dioxide. As Foresight acknowledged confronting this issue is a major challenge requiring a coordinated partnership between government, science, business and civil society and it is interwoven with efforts to combat climate change.

### *4.2. Under-nutrition in developing countries*

Under nutrition makes children in particular much more vulnerable to disease and death. According to the WHO (World Health Organisation, 2021) around 45% of deaths among children under 5 years of age are linked to under nutrition. These mostly occur in low- and middle-income countries. Women, infants, children, and adolescents are at particular risk of malnutrition. Optimizing nutrition early in life—including the 1000 days from conception to a child's second birthday—ensures the best possible start in life, with long-term benefits.

Poverty, in both developed and developing nations, amplifies the risk of, and risks from, malnutrition. People who are poor are more likely to be affected by different forms of malnutrition. In addition to lessening opportunities and aspirations, malnutrition increases health care costs, reduces productivity, and slows economic growth, which can perpetuate a cycle of poverty and ill-health. The impact of global warming is intertwined with the impact of poverty and exacerbates the already deleterious effects of malnutrition hence it is to a consideration of sustainable food production we now turn.

### *4.3. Sustainable food production*

The way we produce and consume food and climate change are intertwined. The World Resources Institute's Report (2019) *Creating a Sustainable Food Future* identifies three important 'gaps' that need to be bridged by 2050:

(i) The Food Gap

- The difference between the amount of food produced in 2010 and the amount necessary to meet likely demand in 2050; 56% more crop calories will be needed compared to that produced in 2010.

(ii) The Land Gap

- The difference between global agricultural land area in 2010 and the area that will be required in 2050—even if crop and pasture yields continue to grow at rates achieved in the past. 593 million hectares of extra land will be needed, an area nearly twice the size of India.

(iii) The Greenhouse Gas (GHG) mitigation Gap

- The difference between the level of annual GHG emissions from agriculture and land-use change in 2050, which we estimate to be 15 gigatons (Gt), and a target of 4 Gt that represents agriculture's proportional contribution to holding global warming below 2°C above pre-industrial temperatures. Holding warming below a 1.5°C increase would require meeting this 4 Gt target *plus* freeing up hundreds of millions of hectares for reforestation.

The report identified spurring technological innovation as one possible response to the 'gaps'. Some possible innovations are described in the next section.

## 5. CONFRONTING CONFLICTING REQUIREMENTS THROUGH FOOD TECHNOLOGY

The contribution of farming to global warming juxtaposed to the need for increased food production in the light of population increase creates a situation in which there are conflicting requirements. The following five approaches provide ways in which these conflicts might be addressed through food technology. Learners should be introduced to these and similar approaches in a modern food technology course.

### *5.1. Increasing food production without expanding agricultural land*

Viviano & Locatelli (2017) report that the Netherlands is a country with very little land available for agriculture yet is the second largest global exporter of food by dollar value after the US. It has invested heavily in 'smart' greenhouses which allow farmers to closely control growing conditions and use fewer resources like water and fertilizer. The farming of tomatoes provides a compelling example. The area devoted to growing this crop is only 6.9 square miles but has a yield of 144,352 tons per square mile (greater than anywhere else in the world) with a water footprint 25 times less than the global average. This is achieved through large scale greenhouse cultivation growing plants without soil in nutrient rich solutions.

### *5.2. Developing crops that are resistant to climate extremes*

Gene editing is different from genetic modification in that it does not require the introduction of genes from a different organism. Through such gene editing it is possible to rapidly create plants that are drought resistant, immune to disease and improved in flavour (Niler 2018). And importantly, they need not be labelled as genetically modified (GM) crops and may thus escape the notice of supermarket customers, hence avoiding the backlash suffered by earlier GM crops. This is providing the various food regulation authorities do not classify them as GM crops and insist that they are labelled as such, which would then severely limit their commercial viability and use in combating world hunger.

### *5.3. Growing food in ways that do not contribute to climate change*

Precision fermentation is the use of genetically engineered micro-organisms to produce animal products and this process is being used to produce milk; hence, in addition to milk itself it is possible to develop a range of dairy free milk-based products – ice cream, yoghurt, cheese. Initially these are likely to appeal to those who wish to adopt a diet that does not include food derived from animals but as the prices become more competitive such products will move into the mainstream (Lawton 2021). It is widely acknowledged that production of meat, particularly beef, is bad for the planet and a very inefficient process (Natural History Museum 2022). Hence the idea that we might be able to simply grow meat in bioreactors, using our knowledge of biotechnology is very appealing. Staring with a small sample of cells from an animal the cells are grown in a bioreactor such that they cling to an edible scaffold to create 3D tissue i.e., meat. This meat is then harvested and turned into food products without the need to clear forests for grazing, raise herds of cattle on the cleared land, slaughtering and butchering their carcasses etc. with the attendant environmental damage. This might be described as 'cellular agriculture' (Lawton, 2020).

### *5.4. Utilising foods from unusual sources*

McMillan (2018) claims that whilst eating insects is perfectly acceptable in some cultures, (e.g., Thailand and Mexico), this faces considerable consumer resistance in other countries. However, they are finding a market in the United States as high protein animal feed or ingredients for processed foods. McMillan (ibid) also claims that crickets appeal as a food material because they offer more protein and micronutrients per pound than beef, thrive in dark densely crowded

conditions, thus allowing for factory-scale production on a tiny footprint. And unlike some large hog and cattle farms with their manure lagoons, they produce relatively little waste. Seaweed is also an acceptable food in some parts of the world; particularly Asia but is less so in other jurisdictions. However, this may change as there is a burgeoning kelp industry off the coast in Scotland (Shaw 2021). Kelp is high in vitamins and minerals and there are now many ways to introduce it into our food (Sea Food Nutrition Partnership 2021).

### *5.5. Providing alternatives to ruminant meat consumption*

Niall Firth (2018) cites the advantages of plant-based meat alternatives to meat consumption for the planet: lower caron footprint, lower water consumption, and lower land use compared with beef production and such products are now becoming mainstream. For example, Macdonald's now has on its standard menu in the UK a vegan burger made with a plant-based patty co-developed with Beyond Meat® featuring vegan sandwich sauce, ketchup, mustard, onion, pickles, lettuce, tomato, and a vegan alternative to cheese in a sesame seed bun. (McPlant™ 2022).

## 6. CONCLUDING REMARKS

This paper has described five features that should be considered in developing a food technology curriculum for the secondary school (learners aged 11 – 16 years) based on the Narrative of Food: how the narrative might be presented to and interrogated by learners, some of technologies currently operating within the narrative, malnutrition, sustainable food production and technologies pertinent to this endeavour. There is an elephant in the room: teaching young people to cook. This is a laudable endeavour but not necessarily one that should take place in a food technology curriculum. This issue and others are considered in greater depth in Beaumont (2023) a chapter in Food Futures in Education and Society (Singh, G., Turner, A. & Rutland, M. (eds) 2023). As far as the UK is concerned the recent publication of the National Food Strategy (Dimbleby, 2022) suggests that Ofsted (Office for Standards in Education, Children's Services and Skills, a non-ministerial department of the UK government), should set up a team to create and publish a food and nutrition "research review", as it has started doing with other subjects. If such a research review is set up, it is to be hoped (a) that its terms of reference are wide enough to consider developing a curriculum that teaches across the narrative of food as outlined in this paper and (b) the contributors include stakeholders from academia, education, industry, and government.

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